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Let Us Support Our Journal

Edward Nazareth

The very existence of history is to bear witness to everything that passes and teach the willing and comprehending mind, lessons from the successes as well as from the pitfalls. Like a wise man once said “Those who fail to read history are destined to suffer the repetition of its mistakes.” Another wise man said elsewhere, “To preserve history there is no greater means that surpasses the written word.” And in this quest the Orthopaedician and the Academician in us are on the lookout for a medium that provides the means for what we wish to convey.

There seems to be an end to this long wait as the executive committee of KOA under the dynamic leadership of KOA President Dr. Sharath K. Rao and enthusiastic support of Secretary General Dr. V.J. Purushotham, has decided to publish the journal of Karnataka Orthopaedic Association regularly from this year onward. I am grateful to the executive committee for having bestowed upon me the responsibility of editing this journal. As this decision was taken recently I had to urgently request for articles and case reports. At this juncture I am pleased that most of the write ups, if not all are satisfactory. I sincerely thank all the authors for their contributions.

As we had limited options for getting our academic work published, we probably have not developed the habit of documenting our academic work, writing articles and publishing them. When we glance through some of the journals, time and again we exclaim- if this could be published, so could mine! But these feelings never get an appropriate outlet and we ignore our own work and some rare case presentations. Now as we have our own journal, we can surely make some effort to prepare articles/case reports for the journal and showcase our findings. Fortunately the MCI has also made it compulsory for the postgraduate MS candidates to publish/present some academic work. I hope that at least from now on our members will spare some time to get their work documented properly and then published.

As we are yet to begin, the current issue is neither peer reviewed nor indexed. If we regularly publish the journal we will be able to get it indexed. To reach that point there are several requirements and I am sure with the support of our esteemed members, this journal will achieve that milestone soon.

We have several teaching institutions in our state; medical colleges and DNB centers where a good number of enthusiastic postgraduates are pursuing their studies. If our postgraduate teachers insist on every postgraduate student taking up a topic other than the thesis, we can have a good number of papers and if we get enough inputs, the KOA secretariat will publish more than one issue of this journal in a year. I am looking toward that development of this journal. In the meantime this will also inculcate the practice of documenting and reporting the academic work of a particular institution. This primarily depends on the postgraduate teachers.

I need not write about ‘how to write an article/case report’. At present we are following the same format as that of the Indian Journal of Orthopaedics. The guidelines to authors will be available soon on our website www.koaindia.org. I request the authors to refer to the website for guidelines or they can contact me via e-mail.

I anticipate whole hearted support from our members to make our journal a regular feature of the association.
“Why should one publish an article in the journal?”

Sharath K Rao

This is a common question which lingers in the brain of every orthopaedic surgeon but rarely comes out of his mouth. To get ready an article to publish, there would have been some form of research gone on behind it. What is the driving force behind the eagerness to publish an article? Most probably it is the satisfaction of being the part of the advancement of science of orthopaedics. There are basically two types of readers who read articles in the journals of orthopaedics. One type of reader who reads and incorporates this evidence based medicine in his practice. The other type is an avid reader who reads not only to update himself but also uses the data to make changes in his ongoing research. It is important for the writer of an article to know these two types of target readers and make the article help both of them so that the article becomes popular. One way of doing this is to select simple common day today problems.

Which journal to select to publish your article? The first and the foremost factor to consider is the “Peer Review”. The articles need to be properly vetted for its content and presentation and all the data need to be verified. This process when done by the experts in the field tends to filter few of the flaws involved in the publications. If the Peers accept the content that it is suitable to enhance the existing knowledge in the field, the value of the article naturally increases. Articles in peer reviewed journals thus score over the ones without it.

Some of the journals are open access journals like Indian Journal of Orthopaedics, where in any one can down load an article. Some others are limited access in the form of individual payment or membership. This is compared to the sculpture made by an artist which later kept in the museum with tickets to see it (limited access) or the sculpture which is kept for public display (open access). Today open access journals have been popular and preferable over limited access journals. The middle path of late open access has also come into the picture.

Two of the jargon words commonly used in journal publication are the ‘Impact Factor’ & ‘citation Index’. Impact factors are the measures of importance of scientific journals. It is more of a popularity gauge than quality, and also considers quantity rather than quality. Citation Index tells about the number times the article has been cited. But important thing to consider is the quality of the journal in which they are cited. A combination of impact factor of the journal in which the article is published and the citations made in high impact factor journals gives the real value of the article.

The days are gone when article used to be sent by post reviewed and returned by post and publication of the article takes years together. Online manuscript submission, online peer review, has made publication easy and simple. This also has made the process, transparent so that author can track the progress of the manuscript. Now authors prefer the journals which have this process for selection of articles.

What surgeries we were doing as postgraduates 25 years back are no longer done today. Change is the essence of evolution. Yesterdays scientific dogma is considered todays garbage bin. Hugh Oven Thomas makes way for Sir John Charnley and Charnley to Ranawath is the gist of progress. Research is not only finding out new things but also reasoning out existing facts. Apples from trees used to fall to the ground since the time apples started growing on this earth, but we needed Newton to give an explanation to it. Without scientific research, without publication, without evidence based approach to treatment, Orthopaedic Surgery would not have grown and also will not grow. It’s the duty of every orthopaedic surgeon to contribute to the field of orthopaedics which has made him earn his livelihood by way of research & publication.

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French surgeon Nicholas Andry coined this word “Orthopedia” in 1741 meaning ortho ‘straight paedia’ – ‘child’ - to correct the deformities of a child. Much water has flown both over and under the bridge and today orthopedic surgery is one of the most dynamic specialties in the fields of medicine.

Orthopedic knowledge and innovation are virtually exploding and trauma in particular and orthopedic surgery as a whole is much better understood today for the betterment of patient care.

With the bio technological pursuits and in-depth understanding of bone healing, strides have been made in imaging, key whole surgery, nano technology, navigation system, voice controlled robotic arm, variation in hip knee and spine surgery, tissue engineering and stem cell technology. The next 2 decades will be the most fascinating in the history of orthopedics, and we are glad that India orthopedic surgeons are marching ahead in the same pace as rest of the world.

But at the same time we must understand that we are a country with a billion people, 30% are still under the poverty line with 30% uneducated and without access to potable water, proper shelter and sanitation leave alone affording a joint replacement or special instrumentation.

Trauma still remains to be neglected and we see unqualified quacks treating a major fracture with poultices and massage resulting in life long misery to the patient. So it is a paradoxical situation but it is the right of every citizen of this large democracy of the world to be provided the sound basic orthopedic and trauma care. This can be achieved only by restructuring, redefining the medical education at large and orthopedic education in particular.

Though orthopaedic surgery emerged as a separate specialty in our country in the late fifties the Medical council of India still considers it as an allied branch of surgery though specialists like ENT, ophthalmology, and pediatrics are considered separate specialties. Trauma accidents today here are the greatest killer next only to heart disease and unlike it affects a much younger bread earner of the family.

The number of orthopaedic patient seen by a medical practitioner working in a rural area is next only to medical patients. MCI has recommended a minimum of 60 beds for orthopaedics in a medical college compared to 20 beds for ENT and ophthalmology and 100 hours of teaching in orthopedics compared to 70 hours in ENT and ophthalmology.

Through this 100 hours are structured on the preventive aspects of trauma and diseases of bone joints and also the first aid care to an injured patient and the importance of basic resuscitation and prevention of complications. Orthopaedic surgery is allotted only 20 marks out of 160
in theory and 30 out of 200 for practical. So without appearing for orthopaedics, a student can pass in surgery. Naturally with the present system the students are likely to neglect the orthopaedic subject.

**A integrated curriculum: benefits**

The search for need based curriculum is not new. It has been felt for ages, but the curriculum has really not changed. Time has come to restructure the curriculum in orthopaedics to the increasing present needs taking into consideration the increasing trauma. The clinical orthopaedic scenario of our country is different from the western world who mainly treat congenital, traumatic and degenerative diseases where as we face bone infections, trauma of a different nature with late presentations.

Take the post graduate training in our country. We have 306 medial colleges with 176 universities, 14 medial universities and more than 75 DNB centers 50% of the students enter the course with very competitive examinations and another 50% enter through paying very high capitation fees. Many of them are without a good academic track record. It is a 3 years course and each university and college has a different type of training.

Some of the DNB centers are subspecialty centers where the teachers exceed in a certain such subspecialty, hence the student may not be exposed to general orthopaedics. Many of the students may not get hands on experience and we are more likely produce half baked orthopaedics of tomorrow.

Take the examination system at the PG level. In some universities and colleges, the pass percentage is 80-100% and in the recent DNB examination it was 12% and practical of 30%. There is no examination in the world with a success rate in theory examinations of 12%. The examiners assess the candidates in just 90 min of their 3 years training. Lastly in our curriculum, there is nothing to assess the psychomotor, communication skills, social obligations, and the importance of compassion for patients.

*So the time has come to change the curriculum to the present needs of the society and nation with emphasis on prevention of trauma and bone and joint diseases, knowing the basics of trauma care, resuscitation, and when to operate, how to operate and when not to operate.*

Being a teacher on orthopaedics both at under graduate and post graduate levels for the past 38 years, the following are my suggestions for under graduate and post graduate training in orthopaedic surgery.

**For undergraduates**

1. The orthopedic training should start in the first year itself when they learn anatomy, physiology and biochemistry with applied knowledge with a multidisciplinary integrated approach. For examination when they are dissecting median on ulnar nerve, a student should know how palsy will occur or a claw hand will occur and what the solution is. This should continue in a similar manner when they start paraclinical subjects as well.

2. The students should be posted in the casualty for at least a month to learn the concept of trauma care.

3. They should be posted in rural areas where preventive and first aid care is taught and to face the realities of village life in India.

4. Orthopaedics should be given a status of a full subject like pediatrics, ENT and ophthalmology so that students are more enthused in learning the art of orthopaedics.

5. Problem based learning (PBL) to train our doctors to be problem solvers.

**For the post graduate students**

PG .Training should have an aim, objective and the training & evaluation has to be perfectly planned & transparent.

1. The post graduate selection for all the colleges should be strictly merit based with a common all India examination and an interview to look into the aptitude of the candidate. Haphazard selection will result in compromising quality surgeons for the future. Private colleges also should have a merit wise admission.

2. M.S. Orthopedics or DNB should be a 4 year training
course with one year on basic principles, 2nd year the student spends 3 months in General Surgery, 3 months each in Plastic Surgery and in Neuro surgery and 2 months in Cardiac and Vascular surgery and one month in imaging techniques. This should be in the 2d year of training.

3. 1st year he should be taught the basic principles of orthopedics, ethics and philosophy of medial practice, patient care, compassion and how to write and present a paper and communication skill like how talk to a patient, who is in distress.

4. The last 2 years he is on intensive training on trauma and diseases of bone and joint. Emphasis should be on interactive and problem based learning rather than didactic teaching especially with lectures.

5. Each post graduate should maintain a log book and should have fulfilled the perquisite of assisting and performing the different surgeries including manipulation & plaster techniques in fracture management duly certified by the professor in charge, on a weekly basis.

6. He should be made to attend at least 3 conferences and 3 CME programmes of State / National level and should have presented one paper and preferably published one. Research methodology should be inculcated and the thesis work should throw a proof of it.

7. Communication and computer skill, psychomotor skills and social obligations and ethics philosophy should be taught as a part curriculum.

8. The guide and HOD should be responsible for each student and there should be an assessment preferably with an internal assessment examination every 6 months both in theory and clinical and practical and internal assent works should be 40%.

9. The final examination should preferably be at national level with different centers so that uniform perfect standard both in theory & clinical & practical examination is maintained. Examiners of transparency and academic excellence should be on the panel.

10. After passing out at the end of 4 years he should either become a general orthopaedic surgeon or be able to choose a specialty of his choice and undergo 1 or 2 years fellowship training on the specialty of his choice.

11. There should be adequate number of one or 2 year fellowships in different centers through out the country on joint replacements, arthroscopic surgery, spine, hand & pediatric orthopedics and trauma.

12. Time has come where a young orthopaedic surgeon identifies himself as an orthopaedic specialist of a particular field of his interest and always has the option to select his place of work and type of work including general orthopedics.

13. Every orthopaedic surgeon should collect the minimum prescribed credit points of attending CME’s, Workshops and seminars to keep himself up to date through out his life.

Summary

“It is eventually left to each one of us in the desired educational field to move one small step forward towards this transformation of vision towards reorientation of values and objectives of education, as education places an overriding value on products over people, on achievement over synchronization.”

And hope that if these points envisaged are followed by every college and university, then only we can hope to have uniform standard through out the country in orthopaedic P.G. Training to bring out well trained, competitive, compassionate orthopedics surgeons of tomorrow. We should convert knowledge into wisdom, sacrifices into peace of mind, what counts most is ultimate patient care.

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Changing times in orthopaedic clinical examinations?

V. J. Purushotham

“Although the spectrum of human injury & disease changes little over time, our understanding of it continues to improve and with it, the tests that we device to detect the pathologic condition”
- Bruce Reider AB, writes in his second edition of ‘Orthopaedic Physical Examination’

Much has changed in orthopaedics, since my days as a postgraduate in 1986 before I had training for diploma in orthopaedics (D’Ortho). Thomas splints, Bohler Braun splints, and various skeletal tractions are now fast disappearing from the orthopedic wards even in non-corporate setups. I remember having been grilled for half hour for not knowing everything about BB splint. Dressing pin tracts & bed sores were the routine ward work at that time. Conservative management ruled the treatment of most orthopaedic conditions. Orthopaedics was a general specialty dealing with the locomotor systems. For instance, those days you didn’t get to see a designated pediatric orthopaedic or a hand surgeon.

These objects, which were used as an examiner’s weapons once upon a time, are hardly referred by today’s examiners, and today’s post graduates are secretly delighted about it. With the availability of modern equipments & diagnostic modalities today’s postgraduate is more oriented towards the practical side of orthopaedics. With the teachers’ proficiency dwelling in sub-specialties, the post graduate’s learning too becomes more specific than general.

The questions that come to mind then are:
- What happens to the traditional teaching of clinical examinations then?
- How relevant does it become to the post graduate to do a thorough clinical examination?
- With the fading of old generation of teachers, will the methodical clinical examination take a back seat?

For a post graduate, during his routine days, his OPD and ward works are balanced between high-end investigations and high-end surgeries to keep up with the pace of patients’ demands. He believes it to be a waste of time to examine a patient for 30 minutes to ensure a detailed clinical diagnosis, when more sophisticated diagnostic tools and tests reveal a more accurate diagnosis. Ultimately he looks at becoming an orthopedic surgeon than being a good academician.

While post graduates attending PG teaching programmes are questioned as to why they are attending the programme, they hope to pass their exams. Is the notion of learning not an aspiration at all? The irony of the situation is, almost all these attendees are all exam-going post graduates, who hope to gather some basics of orthopaedics in these courses. All these years they were busy learning the practical/ surgical skills!

A few post graduates did want to understand the things which they were not taught, or which they couldn’t understand. Interestingly they are confused with certain ambiguities that are prevalent in some clinical tests. Interpretations from teachers of different school of thoughts have left these post graduates a little confused.

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Here’re some common confusion areas:

1. While doing a Trendlenburg test what should be considered positive?
   - When the opposite hip fails to raise, or
   - When the opposite hip drops?

2. When you refer anterior joint line in hip examination:
   - Some consider it as completely non-existent
   - A few other teachers justify its presence

Some of the standard clinical examination books do not clarify them thus making way to more ambiguities. The most trusted and referred book on clinical examination is not updated since its inception! Some of the books have modified some tests to suit to the needs of patient, and the condition.

This gives rise to one of the most important questions for a post graduate: How is the post graduate evaluated in his exam? In the 30 minutes of his long case presentation, what part of his presentation becomes the key to his successful presentation—history, clinical examination, diagnosis, or management? If you emphasize more on history & clinical examination your assessment on his practical knowledge of management, which is important for his future, leaves you with little time to assess. Does the evaluator expect a post graduate to know all the fundamentals of clinical examination, or would the evaluator want to assess him as a useful orthopedic surgeon of the future? If you agree with the latter, then it is almost impossible for an examiner to assess him in less than one hour with whatever the number of cases he gets to examine. His internal examiners may make better evaluators from that perspective instead.

Ideally, the post graduation period is the period where he is expected to learn from the basics of orthopaedics be it in clinical examination, diagnosis or management. His initial days should be spent on these parameters, exposing him to traditional examination patterns & methods, may be with some modifications or changes. He should be assessed periodically & then gradually promoted to next level of learning, whatever that is possible in the syllabus & the particular institution.

I’m wondering whether it will make a post graduation experience more effective if these things were considered:

- The general perception of exam as his gate pass to his M.S. should be waned off.
- As for the clinical examination methods, the teaching should be oriented in imparting the basics of it without any doubts and ambiguities.
- There should be uniformity in the protocols and methods of examination.
- There needs to be a good reference book that both post graduates and teachers can swear by. That is, the book should provide all information towards orthopedic clinical examination, clarifying doubts with detailed explanation of each & every clinical tests. It might be a good idea to have this book written by a group of senior, reputed teachers than any individual. The IOA PG teaching committee can initiate this & bring it out in the near future.
- Exams should be oriented in assessing a post graduate in total with structured protocol, with due consideration to his internal evaluation over the last 3 years.
- Most importantly, the post graduate’s attitude, aptitude, and approach towards the case, regardless of his competency over the subject should not be ignored at all—particularly when he is stepping into the mainstream of orthopaedics.
Changing trends in acute scaphoid fracture management

Anil K Bhat

Among all the carpal bones, the scaphoid is the most commonly fractured bone accounting for 70% of all carpal fractures. The position of the scaphoid which bridges both the proximal and distal rows makes it vulnerable to continuous shearing and bending forces. The majority of scaphoid fractures occur at the waist due to sparsely distributed thin trabecular bone. Approximately 80% of the surface of the scaphoid is covered by cartilage, which limits its ligamentous attachment and vascular supply. The scaphoid thus is similar to its intracapsular counterparts, the femoral neck and the talus as they all unite by primary bone healing with direct formation of bone across the fracture site without the aid of external callus.

Most acute stable fractures of the scaphoid are treated non-operatively, resulting in a high rate of fracture union. Misdiagnosis and improper treatment can result in potentially devastating complications such as delayed fracture union, pseudoarthrosis, avascular necrosis, and wrist instability, all of which can lead to deformity and osteoarthritis. Approximately 85% of all scaphoid fractures unite with non-operative treatment in a below-elbow thumb spica plaster cast. The remaining 15% may develop a nonunion and may require bone grafts. Although closed treatment of stable fractures of the scaphoid is associated with a high rate of healing, this method requires prolonged cast immobilization, which may lead to muscle atrophy, possible joint contracture, disuse osteopenia, delay in return to work & chance of nonunion. Internal fixation of these fractures is thus becoming popular.

The decision to treat these fractures by conservative or surgical methods rests largely on the stability of these fractures. Assessment of fracture displacement from scaphoid series radiographs is difficult due to the complex anatomy of the scaphoid, its oblique orientation in the wrist and the superimposition of other carpal bones. It is much easier to assess the fracture pattern & degree of displacement from coronal and sagittal CT and MR images. Previous research has indicated that it is impossible to accurately predict whether a scaphoid waist fracture will, or will not, unite by assessment of the scaphoid series of radiographs done immediately after the injury. However magnetic resonance assessment of fracture displacement at first week, or CT assessment at the end of fourth week can be used to predict outcome. Both these studies have demonstrated that undisplaced waist fractures have a union rate of 95–100% with treatment in a below-elbow cast for 4 to 8 weeks.

Unstable fractures are those where the fracture lines run oblique and Type B fractures of Herbert and Fischer classification. Cooney et al further defined unstable fracture patterns as fractures displaced >1 mm, a lateral intrascaphoid angle >35, bone loss or comminution, perilunate-fracture dislocation, dorsal intercalated segmental instability (DISI) alignment, and proximal pole fractures. Such fractures require reduction and internal stabilization.

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Changing trend in methods of treatment:
Conservative

Experience early in the 20th century revealed that if fracture scaphoid was not promptly diagnosed and protected by immobilization for an adequate amount of time, osseous consolidation was considered an exception, and pseudoarthrosis between fragments would occur. For fractures with little displacement, expectant treatment consisting of massage and passive movement was advised. Bohler changed the method of immobilization and included the thumb in his series and this tradition appears to have spread. In 1954 Bohler et al. reported on a large series of scaphoid fractures treated with plaster immobilization with a 96% union rate. Since then the traditional treatment for non-displaced scaphoid fractures has been immobilization, usually involving 8-12 weeks in a cast. Early diagnosis and prompt treatment are mandatory to achieve success, and delay in diagnosing has been reported to increase the rate of nonunion.

Below elbow or above elbow cast

Mac Adams et al. found no significant rotation at the minimally displaced scaphoid waist fracture during pronation and supination in a below elbow cast and in experimental arthroscopic evaluation studies. He concluded that it appears safe to use a below elbow thumb spica cast in the treatment of minimally displaced scaphoid waist fractures. The argument to include the elbow in the plaster cast was initially based on a study by Verdan, who found that supination caused movement at the fracture site in cadavers. Alho and Kankaanpaa conducted a prospective study of 100 individuals and found no difference in required immobilization time between long arm and short arm casts.

Need the thumb to be immobilised?

In a large randomized study, Clay et al. showed that inclusion of the thumb did not affect the union rate and concluded that “the simpler Colles’ cast would appear to be equally effective”. Finally, in a recent systematic review of randomized or quasi-randomized trials Yin et al. concluded that there is insufficient evidence to determine which type of cast should be used in the non-operative treatment of non-displaced scaphoid fractures.

What is not acceptable in today’s scenario is prolonged immobilisation in a cast for unstable fractures where better surgical options are available.

Operative treatment

In 1954, McLaughlin described the use of a Vitallium screw to stabilize fractures of the scaphoid. He had used the screw in 19 patients over nine years and emphasized the early mobilization and early return to work was associated with this technique. A young English orthopaedic registrar, Timothy Herbert, was attracted by this point of view in the mid 1970s. However, he found that the screw fixation of scaphoid fractures was difficult and tackled the problem by designing a jig and a screw that was smaller than the one used previously. In the process of doing so, he came up with the original idea of a screw with two threaded sections of different pitches which would automatically provide compression. After moving to Australia, he collaborated with an engineer, William Fisher, who made the first 100 Herbert screws. The early results were reported by Herbert and Fisher in 1984.

The procedure enabled rigid fixation and early mobilization, usually without a cast and early return to work. On the other hand, this more complicated procedure requires access to operative facilities, is more expensive, technically demanding and necessitates a high level of surgical skill. The technical difficulties associated with this procedure are related to the complex three-dimensional anatomy of the scaphoid bone and by that the procedure requires insertion of the implant through the articulated distal surface of the scaphoid facing the scaphotrapezial joint, a process that theoretically involves a risk for development of secondary osteoarthritis.
What's new in the management of scaphoid fractures over the past two decades is the development of percutaneous and arthroscopic assisted techniques of scaphoid stabilization that minimize surgical morbidity and reduces the complication rate.

**Volar percutaneous technique**

First described by Strel in 1970 and later popularized by Haddad and Goddard, this technique is classically indicated for waist fractures and some proximal pole fractures. The patient is positioned supine with the thumb suspended for traction in a finger trap to allow ulnar deviation of the wrist which improves surgical access to the distal pole of the scaphoid. Under fluoroscopic guidance which is rotated parallel to the floor. Alternatively, the patient’s arm can be kept supine on a radiolucent arm board with rolled sheets under the wrist to extend it. The entry point, the scaphoid tuberosity, is then located using a 12- or 14-gauge intravenous needle introduced on the anteroradial aspect of the wrist, just radial and distal to the scaphoid tuberosity. The needle serves as a trocar to guide the wire and to establish a central path along the scaphoid.

A percutaneous guide wire is inserted into the scaphotrapezial joint and advanced proximally and dorsally across the fracture site with the intent of directing the guide wire into the proximal pole to a point just radial

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**Figure 1:** Headless screw being inserted by Volar percutaneous technique  
**Figure 2:** Wrist position for entry point in dorsal percutaneous technique  
**Figure 3:** The proximal and distal poles of the scaphoid are aligned to form a cylinder or a true ring sign and a 14-gauge needle is placed percutaneously in the center of the ring sign  
**Figure 4:** Headless screw being inserted by mini open dorsal technique
to the scapholunate ligament. The position of the guide wire is easily checked by rotating the forearm under fluoroscopy and if found satisfactory, a longitudinal 0.5-cm-long skin incision is made over the distal radial aspect of the scaphoid and. The length of the guide wire within the scaphoid is determined by placing a second guide wire next to the initial one and measuring the difference between the two. The correct screw size is 4 to 5 mm shorter than the measured length, which will ensure that the screw head is fully buried below the cartilage and the subchondral bone on each end. A drill is then inserted through the soft-tissue protector, the scaphoid is reamed, and a headless cannulated screw is inserted. (Figure 1)

**Dorsal percutaneous approach**

Many surgeons prefer dorsal percutaneous screw fixation popularized by Slade et al² because of its ease of access and the ability to place a screw closer to the central axis of the scaphoid. It has been shown that screws in this position increase the rate of healing of scaphoid fractures and increase the stiffness of fixation. An additional benefit of screws placed in this position is a reduced risk of thread penetration and cartilage injury. This technique is classically indicated for proximal pole fractures.

The wrist is flexed and pronated under fluoroscopy until the proximal and distal poles of the scaphoid are aligned to form a perfect cylinder or a true ring sign. A 14-gauge needle is placed percutaneously in the center of the ring sign and parallel to the fluoroscopic beam. (Figure 2 & 3). A guide wire is inserted through the 14-gauge needle and driven across the central axis of the scaphoid until it comes in contact with the distal cortex of the scaphoid. It is important not to extend the wrist as this may bend the guide wire. A second guide wire is then placed parallel to the first so that it touches the proximal pole of the scaphoid, and the difference in length of the two guide wires is measured to determine the length of the screw. The primary guide wire is then advanced volarly until it is flush with the proximal pole of the scaphoid dorsally and the wrist is extended. The wrist is then flexed and the guide wire is advanced dorsally, exiting the skin. A portion of the guide wire is to be left outside of the volar and dorsal aspects of the wrist in case of wire breakage. Blunt dissection is continued around the guide wire dorsally to minimize the risk of soft-tissue injury to the extensor tendon as the scaphoid is reamed and the screw is inserted.

**Arthroscopic reduction (The Geissler technique)**₁⁴

The goals of arthroscopy-assisted stabilization of scaphoid fractures are to reduce displaced fractures without an open incision and provide secure fixation that will permit early motion until solid union has been achieved. Avoidance of open exposure limits the potential for wrist ligament injury, may help to preserve blood supply, and minimizes postoperative stiffness.

The arthroscope is initially placed in the 3-4 portal (i.e., between the extensor pollicis longus [EPL] and extensor digitorum tendons) to evaluate any associated soft-tissue injuries. The arthroscope is then transferred into the 6-R portal. A 14-gauge needle is inserted through the 3-4 portal and the scapholunate interosseous ligament is palpated at its junction with the proximal pole of the scaphoid. The traction tower may be flexed, extended, and deviated either radially or ulnarly to further reduce the fracture. The reduction of the scaphoid is evaluated with the arthroscope through the midcarpal portals. After the fracture is reduced, the guide wire is aimed proximally into the proximal pole of the scaphoid and out the dorsum
of the wrist. The scaphoid is then reamed, and a headless cannulated screw is placed. It is important to arthroscopically evaluate the radiocarpal space after screw insertion to ensure that the screw is inserted completely within the scaphoid and is not protruding proximally, which would injure the articular cartilage of the distal portion of the radius.

**Mini-open technique** 1,2

The mini-open dorsal technique is a modification of the dorsal percutaneous technique that was popularized by Slade et al. The entry point for the guide wire is identified by an open incision, making this a simpler technique. (Figure 3) The dorsal mini-open technique can be utilized for the fixation of acute non displaced scaphoid waist fractures and proximal pole fractures. Augmented with bone-grafting, the technique can be utilized for treatment of delayed union and scaphoid nonunion without collapse. In displaced fractures, the percutaneous technique can only be employed if the scaphoid can be reduced by percutaneous manipulation with use of Kirschner wires.

To summarise, the trend in treating acute scaphoid fractures is now based primarily on the stability of these fractures and its location. There is also a shift towards using minimally invasive techniques like percutaneous fixation and arthroscopic assisted reduction methods. The goal of early return to work and avoiding complications of both conservative and operative method needs to be balanced by the experience of the treating surgeon.

**References**


Pedicle screw fixation with or without interbody fusion for lumbar spondylolisthesis.

Manoj Kumar H V; Balaji Pai; Prashanth Dhanraj; Somshekhar; Suresh M;

Abstract

Lumbar spine spondylolisthesis has been surgically managed by posterior instrumentation and interbody fusion using pedicle screw and rod fixation. Many surgeons advocate the use of an interbody fusion device (Cage) to assist in fusion and to increase the stability of the construct. The aim of the study is to assess and compare the functional and radiological outcome of patients undergoing surgical fixation with or without interbody cage.

A clinical and radiological prospective non randomised study was performed in 10 patients with spondylolisthesis having posterior lumbar interbody fusion with autogenous bone chips alone and in another 10 patients having posterior lumbar interbody fusion with implantation of artificial cages packed with morselized bone graft. Patients were followed up for at least 2 years. All cases were based on Meyerding classification system.

Clinical follow-up at 6 weeks, 3 months, 6 months, 12 months intervals regarding pain, fusion and the functional outcome was evaluated by visual analog scale (VAS) pain rating, and Oswestry disability index (ODI), SF-36, Modified Benzel Japanese orthopaedic association score and AP, lateral and flexion - extension radiographs.

The mean age of patients at the time of surgery was 46.85 years (28 to 68 years). At a mean follow-up duration of 14 months (range 12-24 months). Bone graft alone had 90% fusion at 1 year & 100% fusion seen with cage incorporation, earliest at 6 months. Average fusion rate in bone grafting and cage group were 10 & 8.5 months respectively Complications included screw loosening 20%, non union 10%, CSF leak 10% and urinary disturbance 10% in bone grafting group. In cage group 10% deep infection, 10% CSF leak were encountered. Patient satisfaction was 80% in bone grafting group and 90% in cage group.

Addition of an interbody fusion device (Cage) helps in greater stability, lower implant failure, higher fusion rate and better functional outcome in surgically treated patient of lumbar spondylolisthesis.

Introduction

Low back pain is the most common cause of work related disability and one of the most common contributors to missed time at work¹. This back pain can be aggravated by activity, which then leads to avoidance of activity and eventually disability. Back pain is also one of the most expensive burdens on the health care system.

Spondylolisthesis is the anterior subluxation of one vertebral body onto another. Because there is a failure of the compensatory mechanisms to maintain an adequate posteriorly directed force vector, the shear forces that exist in the intervertebral disc space cause anterior vertebral slippage. This failure in the isthmic form is caused by a
defect in the pars interarticularis and occurs in up to 8% of the general population in individuals of all ages.

Spondylolisthesis is a condition characterized by a failure of the three-column support with severe complex instability requiring reconstruction of the altered supporting structures. The use of posterior lumbar pedicle screw instrumentation is now the standard for reconstruction of the affected segment; its widespread application introduced the era of segmental spinal fixation.

Biomechanically, pedicle screw system allow three column stabilization that exerts a stronger grip force than other posterior fixation systems; require no intact posterior elements; preserve the adjacent normal motion segment; prevent deformity progression; and reduce mechanical pain syndromes and thus encourage immediate ambulation.

Fusion of the posterior lumbar elements combined with placement of instrumentation represents a valid solution for spinal instability and effect solid fusion in up to 95% of cases. A number of authors, however, have argued that in cases involving anterior-column failure a strong anterior-based support, especially when only one or two vertebral segments are being bridged, is required and, additionally, that an interbody fusion may improve fusion rate and endurance of the posterior construct².

Fusion is defined as “the presence of bridging trabecular bone between the vertebral bodies”. The most reliable radiographic indication of fusion postoperatively is the sentinel sign, or the presence of bridging bone anterior to the fusion cage³.

In current practice, bone grafting and instrumentation are often used concurrently based on the expectation that internal fixation of spine enhances the success of bone fusion while a successful bone fusion eliminates the possibility of hardware failure by reducing the chronic biomechanical stresses on the hardware construct.

While instrumentation increased the fusion rate, this was not necessarily indicative of a more successful outcome. Fusion remains one of the most common surgeries for several spinal pathologies but comes with risks and deficiencies⁴.

Table 1: Data collection schedule.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Pre-op</th>
<th>Post-op</th>
<th>6 weeks</th>
<th>3 months</th>
<th>6 months</th>
<th>1 year</th>
</tr>
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<tbody>
<tr>
<td>Straight A-P &amp; lateral radiographs</td>
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<td>+</td>
<td>+</td>
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<td>+</td>
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<td>T2 weighted MRI/CT</td>
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<td>Lateral extension &amp; flexion</td>
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<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td>Neurological examination</td>
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<td>+</td>
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<td>+</td>
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<td>+</td>
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<td>Data Forms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SF--36</td>
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<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>VAS</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>ODI</td>
<td>+</td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Mod. Benzel's Japanese scale</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
Material and methods

We made a prospective non-randomized study of 20 patients with lumbar spine spondylolisthesis during the period from November 2010 to September 2012. The study was conducted in department of orthopaedics and department of neurosurgery, Bangalore medical college and research institute, Bangalore.

The indication for surgery was spondylolisthesis, as defined by the criteria for which instrumentation was needed to restore spine stability. The indications for fusion were in cases with combined severe low back pain and radicular pain, after failure of conservative treatment.

Adult patients with lumbar spondylolisthesis as per Meyerding classification, secondary to fracture, degeneration and congenital conditions were selected for surgery. All these patients would have received at least 6 months of conservative treatment (minimum) preceding enrolment.

The patient with co-morbid conditions, with spinal deformities, polio and cerebral palsy were not included for the study,

The clinical examination both local and systemic is done to assess the cause of instability. The pain and instability graded clinically and radiologically using scales: SF-36 Bodily Pain Score (SF-36), visual analogue scale (VAS) pain rating, and Oswestry disability index (ODI), Benzel’s modified Japanese orthopaedic association scale.

Surgical technique

We performed the PLIF through a midline posterior approach; the patients underwent wide decompression with removal of the posterior elements, including the

<table>
<thead>
<tr>
<th>Table 2: showing visual analogue scale scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>BG</td>
</tr>
<tr>
<td>Cage</td>
</tr>
<tr>
<td>P value</td>
</tr>
</tbody>
</table>

Figure 1: Bone graft group pre-operative X-ray

Figure 2: Bone graft group 3 months follow up X-ray

Figure 3: Bone graft group 6 months follow up X-ray
Table 3: showing Oswestry disability index scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-op</th>
<th>3 months</th>
<th>6 months</th>
<th>1 year</th>
<th>0 vs 3</th>
<th>0 vs 6</th>
<th>0 vs 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG</td>
<td>53.6</td>
<td>36.2</td>
<td>25.56</td>
<td>19.11</td>
<td>0.002</td>
<td>0.0002</td>
<td>0.0001</td>
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<tr>
<td>Cage</td>
<td>51.4</td>
<td>35.2</td>
<td>21.8</td>
<td>10.6</td>
<td>0.005</td>
<td>&lt;0.0004</td>
<td>&lt;0.0004</td>
</tr>
<tr>
<td>P value</td>
<td>0.305</td>
<td>0.437</td>
<td>0.249</td>
<td>0.1123</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Spinous process, interspinous ligament, lamina, hypertrophic ligamentum flavum, and medial facet joints. We routinely checked the tension of bilateral nerve roots and performed foraminal decompression if there was tightness of the roots. After insertion of pedicle screws, the disc space was gently distracted between the adjacent pedicle screws by a lamina spreader.

The disc space was entered through a posterolateral approach using nerve retractors to displace the theca sac and nerve root medially and inferiorly. After radical discectomy with end-plate preparation by pituitary rongeurs and curettes, graft materials were placed and impacted into the anterior disc space for the interbody fusion.

In the bone grafting group, cancellous autograft taken from resected lamina and articular facet was shaped into chips. We inserted the local morselized bone to fill the disc space followed by firm impaction to avoid retropulsion.

In the cage group, different interbody cages were used. Like titanium cage (Aaxter Corp, Taipei, Taiwan), PEEK cage (Stryker Corp, Kalamazoo, MI), having anterior tilting angles of 0°, 4°, and 8°.

We placed morselized host bone in the anterior aspect of the disc space followed by insertion of artificial cages, which also were packed with morselized local bone graft in the empty space. The cage position was at least 5 mm from the posterior cortical margin and was routinely confirmed by portable radiograph or C-arm fluoroscopy. After the proper position was obtained, gentle compression force was applied over the adjacent screws to achieve firm contact between end plates and grafted materials. Pedicle screw fixation was carried out after inserting the cage to secure the stability and to improve the bony union immediately after surgery. Standard wound closure was performed following haemostasis. The postoperative care and rehabilitation protocols were the same for both groups.

Figure 4: Bone graft group 12 months follow up CT

Table 4: showing Benzel’s Modified Japanese orthopedic association scale scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-op</th>
<th>3 months</th>
<th>6 months</th>
<th>1 year</th>
<th>0 vs 3</th>
<th>0 vs 6</th>
<th>0 vs 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG</td>
<td>14</td>
<td>15</td>
<td>15.67</td>
<td>16.44</td>
<td>0.004</td>
<td>0.001</td>
<td>0.007</td>
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<tr>
<td>Cage</td>
<td>13.8</td>
<td>15</td>
<td>15.8</td>
<td>16.5</td>
<td>0.0001</td>
<td>0.0005</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>P value</td>
<td>0.292</td>
<td>0.5</td>
<td>0.393</td>
<td>0.472</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Post operative treatment

Routine antibiotics and analgesics/anti-inflammatory were used during preoperative, immediate and late postoperative period. The clinical follow-up at 4 week interval and at 6wks, 3 months, 6 months, 12 months intervals was done and the patients were evaluated regarding functional outcome with scores and fusion outcome with use of dynamic radiographs. The CT scan was done at the end of 1 year.

Radiographic assessment of fusion: The following are the criteria were used for radiological evidence of fusion:

i. Lack of any visible motion, or less than 3 degrees of intersegmental change, as seen on flexion and extension radiographs.

ii. Lack of a dark halo around the implant.

iii. Minimum loss of disc-space height, indicating a resistance to collapse of the cancellous vertebral bone.

iv. Lack of visible fracture of the device, graft or vertebrae.

v. Lack of substantial sclerotic changes in the recipient bone bed or the graft.

vi. Visible bone within the fusion cage as seen on A-P or Ferguson radiographs.

Table 5: Comparing clinical scores

<table>
<thead>
<tr>
<th>End points evaluated</th>
<th>BG group (n = 20)</th>
<th>Cage group (n = 20)</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preoperative</td>
<td>Postoperative</td>
<td>Preoperative</td>
</tr>
<tr>
<td>ODI</td>
<td>53.6</td>
<td>19.11</td>
<td>51.4</td>
</tr>
<tr>
<td>VAS (pain)</td>
<td>5.9</td>
<td>1.4</td>
<td>5.3</td>
</tr>
<tr>
<td>Modified Benzel's score</td>
<td>14</td>
<td>16.4</td>
<td>13.8</td>
</tr>
</tbody>
</table>

Statistical analysis:

All quantitative data is expressed as mean ± SD, the significance of difference in means was evaluated by 1 tailed student’s t test. All qualitative data were expressed as percentages and the significance was evaluated by Chi-square test with age correction.

Results

Our study comprise of two groups, depending on the surgeon’s choice: the bone graft (bone graft) group (n = 10) and the artificial cage (Cage) group (n = 10). For patients in the BG group, we used local host bone chips only for PLIF. For patients in the Cage group, we used interbody cages packed with morselized autograft bone chips for PLIF.

1. Age and sex distribution

In our series of 20 patients, 7(35%) were males and 13(65%) were females. In bone graft group (BG), 4(40%) were males and 6(60%) were females. In cage group 3(30%) were males and 7(70%) were females. The average age of patients in bone graft group was 46.3 years and in cage group was 47.4 years respectively. The overall sex ratio males: females was (7:13), the mean age was 46.85 years (28 to 68 years).

2. Level of spondylolisthesis

In our series, we had 1(4.5%) L3-L4 level, 16(72.7%) L4-L5 level, 5(22.7%), L5-S1 level spondylolisthesis. In both the groups, 1 person had (2 level) spondylolisthesis.
3. **Blood loss**: In our study average blood loss is 310 ml in BG group and 355 ml in cage group.

4. **Functional result**

   **A. Visual analogue scale (average)**
   VAS scale (0-10) taken at pre-op, 6 weeks, 3months, 6 months and 1 year showed statistically significant improvement in pain reduction in both the groups after surgery. However there is no significant between the BG and Cage groups.

   **B. Oswestry disability index (ODI)**
   ODI scale (0-100) taken at pre-op, 6 weeks, 3months, 6 months and 1 year showed statistically significant improvement in disability in both the groups after surgery. However there is no significant between the BG and Cage groups.

   **C. Benzel’s modified Japanese orthopaedic association scale**
   Benzel’s Modified Japanese orthopaedic association scale (0-18) taken at pre-op, 6 weeks, 3months, 6 months and 1 year showed statistically significant improvement in daily activities in both the groups after surgery. However there is no significant between the BG and Cage groups.

6. **Clinical evaluation**

   There is a significant decrease in pain, disability and improvement in patients treated with PLIF which was evident by VAS scores (p < 0.001), ODI scores (p < 0.002) and Modified Benzel’s Japanese scores (p < 0.005) taken pre-operatively and 1 year after surgery, which is statistically significant. However there is better clinical outcome in cage group patients in terms of VAS, ODI, SF-36 and modified Benzel’s scores as compared to bone.

Table 6: Showing radiological fusion

<table>
<thead>
<tr>
<th></th>
<th>3 months</th>
<th>X rays</th>
<th>6 months</th>
<th>1 year</th>
<th>CT scan</th>
<th>No fusion</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG</td>
<td>0</td>
<td>3</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>1</td>
<td>10 months</td>
</tr>
<tr>
<td>Cage</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>8.5 months</td>
<td></td>
</tr>
<tr>
<td>P value</td>
<td>0.388</td>
<td>0.331</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pain reduced to a greater level in cage group than BG group as measured by VAS scores, which is statistically not significant.

7. Radiological fusion

In our study, we considered that fusion was complete as per the above defined criteria. In bone graft group 3(30%) of cases achieved radiological fusion at 6 months & 9(90%) of 10 cases at 1 year confirmed by CT scan. In cage group 5(50%) of cases achieved fusion at 6 months and all 10(100%) at 1 year confirmed by CT scan.

1 case in BG group did not achieve fusion even at 1 year, confirmed on CT scan.

Average rate of fusion in BG and Cage group was 10 months and 8.5 months respectively. The fusion rate between BG and Cage groups were not statistically significant at 6 months and at 1 year.

8. Neurological status

Motor: All patients recovered from motor weakness and no motor deficit seen in our study.

Sensory: Sensory disturbance in the form of paraesthesia persisted in 2(20%) of patients in BG group mostly over L4, L5 dermatomes & 1 (10%) patient developed paraesthesia over L5 dermatomes after surgery.

1 (10%) patient had persisted paraesthesia over L4 dermatome in cage group even after surgery. No new deficits seen.

9. Complications

There were no intra-operative complications such as bleeding or nerve root injury. Overall 6(30%) complications occurred in our study. 1(5%) deep infection in cage group which is subsided by intravenous antibiotics. In bone graft group 2(20%) case got implant loosening at 3 month, and 1(5%) of it ended in non-union with exaggeration of a previous urinary stress incontinence after surgery. There was 1(10%) case of CSF leak intra-operatively in both the groups.

Discussion

Since spinal arthrodesis was first reported 90 years ago, various techniques have been developed for lumbar spine arthrodesis. SLRT: Improved in all cases after surgery.

Table 7: Showing complications

<table>
<thead>
<tr>
<th></th>
<th>BG</th>
<th>Cage</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep infection</td>
<td>0</td>
<td>1(10%)</td>
<td>1(5%)</td>
</tr>
<tr>
<td>Screw misplacement</td>
<td>1(10%)</td>
<td>0</td>
<td>1(5%)</td>
</tr>
<tr>
<td>Migration/loosening of implants</td>
<td>2(20%)</td>
<td>0</td>
<td>2(10%)</td>
</tr>
<tr>
<td>Urological</td>
<td>1(10%)</td>
<td>0</td>
<td>1(5%)</td>
</tr>
<tr>
<td>Pseudoarthrosis</td>
<td>1(10%)</td>
<td>0</td>
<td>1(5%)</td>
</tr>
<tr>
<td>CSF leak</td>
<td>1(10%)</td>
<td>1(10%)</td>
<td>2(10%)</td>
</tr>
</tbody>
</table>

Figure 7: Cage group 3 months follow up
fusion. The field has evolved from uninstrumented fusion to use of 1 or more of the following: allograft, autograft, metallic cages, carbon fiber cages, BMP, and supplemental instrumentation. Lumbar fusion has been recommended in some patients who did not improve after an extended, multimodality trial of non surgical therapy.

1. Level of spondylolisthesis

In our study, in BG group 6(60%) at L4-L5 level, 3(30%) at L5-S1 and 1(10%) at two level spondylolisthesis. In Cage group 1(10%) at L3-L4, 9(90%) at L4-L5 level, 1(10%) at L5-S1 and 1 at two level spondylolisthesis. Dong yeob lee et al⁶, in their study found 77% spondylolisthesis at L4-L5, 19 % at L5-S1 level and 4% at L3-L4 level.

2. Clinical outcome

At 12 month follow-up, of 80 % in BG group and 90% in Cage group reported decreased pain and disability as measured by VAS, SF 36 and ODI.

In study by Ching-Hsiao Yu et al⁷, the artificial cages provided better functional improvement in ODI and VAS scales, than Bone chip group.

All patients had uneventful motor recovery with 30% paresthesia in bone graft group and 10% paraesthesia in cage group. All patients returned to previous lifestyle except 1(10%) patient in bone graft group.

Although both bone graft and cage groups showed significant functional improvement in ODI, VAS and Benzels score after PLIF; the Cage group had greater improvement than the bone graft group, which is statistically not significant.

Satisfactory outcomes were obtained in cage group because there is better maintenance of disc space, vertebral height and no collapse. In bone graft group, bone graft alone is used, which is less rigid and lead to collapse before the fusion occurs. This was attributed to increase pain, disability and less satisfaction even after surgery.

3. Radiological outcomes

In our study at 3, 6 months and 1 year in bone graft group fusion rates were 0, 30% and 90% as compared to Cage group were 0, 50% and 100% respectively. Ching-Hsiao Yu et al⁷ reported average fusion rate ranges from 90% to 95.7% in patients with non-cage PLIF and from 90% to 100% in patients with cage PLIF. Our fusion result was comparable to those of other published studies. Paul M. Arnold et al⁴ reported in their study that unilateral PLIF, with local morselized bone graft fusion was 98% at 12 and 24 months.

Fusion was assessed by the operative surgeon and not by the radiologist. Better fusion outcome in cage group is attributed to a rigid spacer, which maintained disc space and prevents abnormal mobility till fusion occurs. Also the design of cage prevents any further slip and loss of reduction. There is no collapse of vertebral bodies and no complications of screw loosening or implant failures.

4. Complications

In our study, in bone graft group we found 2 screw loosening (20%) and 1(10%) of them had non–union at end of 1 year, same patient developed urinary stress incontinence which exaggerated after surgery. In Cage group we encountered post-op deep infection (10%) which subsided with IV antibiotics. Both group had 10% CSF

<table>
<thead>
<tr>
<th>Level</th>
<th>Our study</th>
<th>Dong yeob lee et al⁶</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BG group(10)</td>
<td>BG group(34)</td>
</tr>
<tr>
<td></td>
<td>Cage group (10)</td>
<td>Cage Group(42)</td>
</tr>
<tr>
<td>L3-L4</td>
<td>0</td>
<td>2 (6%)</td>
</tr>
<tr>
<td>L4-L5</td>
<td>7 (70%)</td>
<td>20 (59%)</td>
</tr>
<tr>
<td></td>
<td>1 (10%)</td>
<td>32 (76%)</td>
</tr>
<tr>
<td>L5-S1</td>
<td>4 (40%)</td>
<td>11 (33%)</td>
</tr>
<tr>
<td></td>
<td>1 (10%)</td>
<td>3 (7%)</td>
</tr>
</tbody>
</table>
leak intra-op which was uneventful. Our results are comparable with Ching-Hsiao Yu et al\textsuperscript{7} as they reported 6% screw breakage in bone graft group and high intra-op and post–op complications with Cage group. Noboru Hosono et al\textsuperscript{8}, reported a 0.4% deep infection, 6.7% screw misplacement and 8.8% CSF leak.

5. Follow up

All patients were followed up for an average of 14 months one patient in bone graft group, which was lost to follow up after 1 year.

Limitations

- Pre-operative assessment of slip angles, height of disc spaces and other parameters were not taken into consideration.
- Study was not randomised and selection of cage was at sole discretion of the operative surgeon.
- There were no specific indications for the usage of interbody cage.
- Imaging was not done at 4 week interval but evaluated at specific intervals.
- CT imaging was done only at end of 1 year of follow up.
- The size of sample was smaller.
- Our duration of follow up was limited for assessing long term outcome and complications associated with the procedure over a period of time.

Conclusion

This study was conducted to assess the functional and radiological outcome of PLIF with cage or bone graft alone in lumbar spine spondylolisthesis.

Table 9: Comparing clinical outcome.

<table>
<thead>
<tr>
<th></th>
<th>Our study</th>
<th>Ching-Hsiao Yu et al\textsuperscript{7}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bone graft group(10)</td>
<td>Cage group(10)</td>
</tr>
<tr>
<td>Sensory disturbance</td>
<td>3 (30%)</td>
<td>1 (10%)</td>
</tr>
<tr>
<td>Patient satisfaction (SF-36 scores)</td>
<td>8 (80%)</td>
<td>9 (90%)</td>
</tr>
<tr>
<td>Return to previous life style</td>
<td>9 (90%)</td>
<td>10 (100%)</td>
</tr>
</tbody>
</table>
Lumbar spine spondylolisthesis is more common in 4th & 5th decade of life with female predominance, commonest level of instability being L4-L5.

Patients with PLIF + Cage had better neurological improvement, pain reduction, reduced disability, generalised well being and satisfaction as evident by Modified Benzel’s Japanese scales, VAS, ODI, and SF-36 scores respectively, which is statistically not significant.

PLIF with cage is associated with decreased post operative morbidity, motor improvement, reduced paraesthesia and improved SLRT.

Addition of an interbody fusion device (Cage) helps in greater stability, lower implant failure, higher fusion rate and better functional outcome in patient treated with PLIF for lumbar spine instability.

We conclude solid fusion would correlate with good functional outcomes and minimal complications in patients with unstable lumbar segments.

### Table 10: Comparing complication among other studies

<table>
<thead>
<tr>
<th></th>
<th>Bone graft</th>
<th>Cage</th>
<th>Total</th>
<th>Noboru Hosono et al⁸</th>
<th>Harri Pihlajamaki et al⁹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep infection</td>
<td>0</td>
<td>1(10%)</td>
<td>1(5%)</td>
<td>1 (0.4%)</td>
<td>2%</td>
</tr>
<tr>
<td>Screw misplacement</td>
<td>1(10%)</td>
<td>0</td>
<td>1(5%)</td>
<td>16(6.7%)</td>
<td>9%</td>
</tr>
<tr>
<td>Migration/loosening</td>
<td>2(20%)</td>
<td>0</td>
<td>2(10%)</td>
<td></td>
<td>18%</td>
</tr>
<tr>
<td>Urological</td>
<td>1(10%)</td>
<td>0</td>
<td>1(5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudoarthrosis</td>
<td>1(10%)</td>
<td>0</td>
<td>1(5%)</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>CSF leak</td>
<td>1(10%)</td>
<td>1(10%)</td>
<td>2(10%)</td>
<td>21(8.8%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6(60%)</td>
<td>2(20%)</td>
<td>8(40%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 11: Comparing radiological outcome

<table>
<thead>
<tr>
<th></th>
<th>Our study</th>
<th>Ching-Hsiao Yu et al⁷</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bone graft group</td>
<td>Cage group</td>
</tr>
<tr>
<td>Fusion rate</td>
<td>90%</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Table 12: Showing end results

<table>
<thead>
<tr>
<th>End results</th>
<th>Bone graft group (n = 20)</th>
<th>Cage group (n = 20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusion rate</td>
<td>90%</td>
<td>100%</td>
<td>0.30</td>
</tr>
<tr>
<td>Patient satisfaction</td>
<td>80%</td>
<td>90%</td>
<td>0.53</td>
</tr>
<tr>
<td>Radiculopathy improvement</td>
<td>70%</td>
<td>90%</td>
<td>0.26</td>
</tr>
</tbody>
</table>
References:


In these days of surgical activism, conservative treatment for fracture shaft humerus!

John Ebnezar

Abstract

Humerus fractures were one of those fractures that were treated successfully by non-operative treatment. Many experts considered this as the gold standard and was the first choice treatment not long ago, it has been considered as ‘old fashion’ due to the sudden spurt of newer surgical options. Even though there are clear cut indications for the operative interventions osteosynthesis has emerged as the first choice of all orthopedic surgeons in all varieties of fracture shaft so much so that conservative treatment is almost on the verge of extinction. In this surgical activism we had treated fracture shaft humerus with as simple a conservative treatment as a U Splint in 4 patients between 2009 to 2012. In all these cases, conservative treatment was opted by the patients for various reasons all these fractures united well within the stipulated time frame with no deformity or functional limitations.

Introduction

Fracture shaft humerus accounts for only 3% of all fractures. Humeral shaft fractures have been reported to be more common in males with a peak incidence in the third decade. Road traffic accident was a common cause for such fractures in our and other similar studies. Treatment methods for these injuries continue to evolve as advances are made in both non-operative and operative management.

Though conservative treatment due to the evidence based pioneering work of Sarmiento and others was considered the gold standard and was the first choice treatment not long ago, it has been pushed to the back burner due to the sudden spurt of newer surgical options. Even though there are clear cut indications for the operative interventions, osteosynthesis has emerged as the new gold standard and is the choice of all orthopedic surgeons in all varieties of fracture shaft so much so that conservative treatment is almost on the verge of extinction. Plate osteosynthesis, interlocking nails, and locked nails are increasingly being tried in the present days with good results. There is a constant debate as to which is better, plating or nailing with each one advocating their arguments strongly in favor of their choice. The fact is each one has its own specific indications and works best when the selection criteria’s are strictly adhered to and done by those well versed with the technique. Strangely these recent spate of surgical indications which is being preferred over conservative treatment in all varieties of humerus shaft fractures and not the select ones, are not being supported by enough EBM, but for a greater comfort factor following surgery, still almost all surgeons suggest osteosynthesis with impunity. We are guilty of overselling the surgery and undermining the role of conservative treatment.

Material and methods

In this surgical activism we had the rare opportunity of treating fracture shaft humerus with as simple a conservative treatment as a U Splint in 4 patients between 2009 to 2012. Curiously in all these cases, conservative treatment was opted by the patients for various reasons and they said a strict no to any sort of surgical intervention. Out of these four cases, three cases were due to pathological fractures. To our surprise all these fractures...
united well within the stipulated time frame with no deformity or functional limitations. Most importantly patients were satisfied with the final outcome.

**Case no 1**

The male patient, 77 years of age, had multiple co-morbidities and was a known patient of diabetes, hypertension, IHD and was on dialysis for kidney failure. He suffered fracture of the right humerus due to a trivial fall at his home. He had spiral fracture of the mid-shaft with minimal displacement. It was an osteoporotic fracture and we advised immediate open reduction and osteosynthesis with locking plates as is the norm of late. But the patient firmly refused and said that his condition is too critical to undergo any major surgical procedure and opted for conservative treatment. We explained the pros and cons of the various treatment options including surgery. We told him that he could be mobilized early if undergoes locking plate and if treated conservatively it may be longer for him to move the shoulder. There was an additional possibility of mal-union too. But the patient was very firm and refused surgery and his relatives were unwilling to undergo the procedure. So patient was treated with the old time tested U-cast. We decided against the hanging cast as the fracture was in the middle shaft and the patient had IV Cannula on his left forearm for dialysis. He was advised to come for follow up every week and changed the u-cast once in fifteen days. I was hoping to convert the cast to a functional cast brace after 3 weeks. At the end of the third week when I removed the cast, I was pleasantly surprised to find that the fracture had united clinically and the check x-rays too showed sufficiently good callus. There was no tenderness at the fracture site and the upper limb could be moved without pain. So I did not find the necessity to use a functional cast brace and just reapplied the cast. After 4 weeks the fracture was completely united both clinically and radio logically. There as was no limitation in external rotation as is normally said and the shoulder movements also recovered within two months to near normal range.
Needless to say the patient was happy and so were the relatives. The outcome with a simple u-cast was very good.

**Case no 2**

A man aged 44 years, a first division clerk in a major government hospital in Bangalore had the rare both left upper and lower limb polio. He suffered fracture of the left humerus due to a road traffic accident when his car overturned on a highway. He had a closed short oblique fracture of the middle shaft of left humerus. Since he was young and in active service, we advised him surgery with locking plates. But he refused surgery despite telling him the advantages of surgery and fixation with locking plates. He volunteered for conservative treatment and was not unduly concerned with the pros and cons. So we treated with him u-cast and changed it periodically once in 2 weeks. He showed a good progress and at the end of the 2nd week there was no tenderness at the fracture site and the cast was reapplied. At the end of the 4th week the pain and tenderness at the fracture site had totally disappeared and the x-rays showed union in progress. We advised him to use the functional cast brace. At the end of 6 weeks there was complete recovery and the fracture showed good clinical evidence of union and the x-rays also showed adequate union. We mobilized him and within w2 weeks he regained complete movement of the shoulder. Interestingly he was back to work immediately the next day after application of the u-cast and did not remain absent from his work. It suited him that the fracture was in the left humerus and he could manage his personal and professional work with the right hand. He was happy with the outcome and did not feel the 6 weeks of immobilization a big impediment in the course of his life.

**Case no 3**

This was a 55 year old female patient. She was a hemiplegic patient with right side involvement. She was undergoing treatment for some psychiatric ailments and was hypertensive, diabetic and osteoporotic. She had a trivial fall while getting up from bed and sustained injury to the right arm resulting in a transverse fracture of the mid shaft of the right humerus. Surgery was advised and her family was told that since it was an osteoporotic fracture locking plates would be the ideal choice of fixation. But the husband and the patient both refused surgery and strongly requested for conservative line of treatment despite the shortcomings. This patient was also treated with a u-cast and the cast was changed periodically as in other cases once in 2 weeks. By the end of the fourth week, the fracture showed clinical signs of union though the x-rays showed good progress in callus formation. Since there was no pain, tenderness and the fracture was reasonable stable clinically.
the patient was advised mobilization and by the end of 6 weeks as in earlier cases, she could lift her right shoulder completely but with support from her left hand or when the right limb was lifted passively by her husband. Both husband and wife were extremely satisfied with the outcome.

**Case no 4**

A man of 86 years, sustained a fracture of the left humerus at the junction of the upper and middle third due to a trivial fall at home. He was a known case of hypertension, diabetes, and IHD. He too was an ideal candidate for locking plate but refused surgery. Since the fracture was undisplaced, a cuff and collar sling was given as the patient refused even a plaster. But at the end of the first week, the fracture showed significant displacement and a cast had to be applied after closed reduction. The fracture as periodically monitored every week and by the end of 4 weeks the fracture showed good clinical and radiological union. The shoulder was mobilized for fear of developing periarthritis shoulder. Like in earlier cases patient has regained full movements and is back to doing his regular day to day activities at the end of 6 weeks.

**Discussion**

Our case series show that fracture shaft humerus if managed conservatively will deliver good clinical and radiological outcome in a comparable period of time. For fracture shaft humerus Sarmiento and other authors recommended conservative line of treatment as the first option. His concept of functional cast brace revolutionized the way the fracture shaft of humerus was treated. Their study showed significantly good results, acceptable rate of reduction and good return of movements. The only problem they found was the limitation of a few degrees of external rotation which was not very significant. Even the malunion which was seen in few cases was in acceptable limits due to thick musculature around the humerus and the shoulder joint above. In 2000, Sarmiento published a series of 922 patients with humeral shaft fractures treated conservatively, of which 620 were available for follow-up. There were 465 closed and 155 open fractures. In the group with the closed fractures there were less than 2 % non-unions, in the open fracture group he found 6 % nonunion. There were less than 16 % of anterior angulations in 81 % and less than 16 % of varus angulations in 87 % of patients. These angular deformities are considered by the author as usually functionally and aesthetically acceptable. Our case series did not show any anterior or varus angulations as in sarmiento’s series but however ours was a small series of cases.

Several other reports about non-operative treatment of humeral shaft fractures have been published. In 1988, Zagorski et al reported about a series of 170 patients with a non-union rate of 1.8 %. Angulations in varus and valgus averaged 5 degrees, while anteroposterior angulations averaged 3 degrees. Toivanen et al reported on 93 patients and found 23 % consolidation problems, most of them in fractures of the proximal third. In our series we did not find any consolidation problems.

In a series of 67 patients, Koch et al had 87 % of clinical healing at 10 weeks; of the 9 cases that failed to heal there were 6 transverse fractures. Functionally, 95 % had an excellent or good result and 3 patients reported a slight limitation of active range of motion. Wallny et al found 95 % of good results based on subjective criteria in 87 patients, with no objective restriction in shoulder and elbow motion in 86 % of cases. In their group there was a 12.6 % rate of angulations greater than 10°, but functional outcome however was good to excellent in two thirds of cases followed up. An interesting report is the one published by Fjalestad et al, who found a 91 % healing rate in a total of 67 patients, but a loss of external rotation in the shoulder in 38 %. Compared CT-scan evaluation between a group with normal motion and a group with a deficit of external rotation showed fracture healing in malrotation as a frequent finding, although no statistical correlation could be proved between CT findings of mal-rotation and clinical loss of external rotation. In our series we did not encounter any problems with the healing and restriction of external rotations.

Some comparative studies between functional and surgical management have been reported. The biggest series is reported in 1984 by Andre et al, who treated 252 cases, half of which conservatively and half surgically, whether it was by nailing, plating, intramedullary pinning.
or external fixation. They had 8 non-unions in the conservatively treated patients, with however significant limitation of motion in almost half of the cases. The best results of surgical treatment were found with intramedullary nailing or pinning in the upper and middle third, while plating is recommended in unstable fractures of the lower third. Bleeker et al used either bracing, skeletal traction or operative stabilization according to the severity of associated lesions. In the single injury group (humeral fracture as an isolated lesion) the best results were obtained by bracing and there were no cases of delayed union. Wallny compared a group of 44 fractures conservatively treated to 45 patients treated with intramedullary nailing. There were 2 pseudarthroses in the conservatively treated patients and 2 surgical revisions in the other group, one for hematoma and one for infection. The functional end results were somewhat better in the non-operative group and these authors recommend conservative management as the treatment of choice. Recently, Jawa et al reported about their comparative results in distal third fractures, treated either conservatively or with plate and screw fixation. They found excellent range of motion and function in the conservatively treated group, but angular deformity and skin breakdown are a reason for concern. Contrary to this, operative treatment achieved more predicable alignment, but iatrogenic radial nerve injury was found in 3 out of 19 patients, as well as one infection and one loss of fixation.  

The findings of the studies of other authors mentioned above and our own findings in a small series of cases suggest that if opted conservative treatment for shaft humerus still delivers thus vindicating strongly the recommendations of Sarmiento. But the million dollar question in these days of surgical activism is, are the surgeons willing to bite the bait?

In summary, the vast majority of the authors state that conservative management is the treatment of choice for humeral shaft fractures, although Schittko stated in 2004 that nowadays operative treatment is the gold standard because of the development of new intramedullary and rotational stable implants. the advent of locking plates has revolutionised the treatment of osteoporotic fractures of humerus. In our series all the patients were osteoporotic and as per the latest recommendations the ideal choice for them would have been locking plates. But to our surprise we found that all the fractures in the age group of 44 to 86 years united well with no angulations and functional limitations within 6 weeks. So this brings us to a realization that conservative treatment still is a good choice when in the present scenario all humerus shaft fractures are operated irrespective of the indications. Earlier recommendations that surgical treatment should be reserved only for a few select indications like open fractures, segmental fractures, ipsilateral fractures, bilateral humeral fractures, polytrauma and fractures with neurovascular injuries are give a go by in the present scenario by all surgeons across the globe. Surgeons prefer to operate even in undisplaced fractures of the humerus and everyone is loath to try the conservative treatment option in fracture humerus. The factors could be patient driven due to the current fast paced life or surgeon driven who does not want to be seen as old fashioned and be on par with rest of their colleagues. And many senior surgeons are of the opinion that the excellent results shown by Sarmiento are only in his hands and is hard to replicate by other surgeons. But our success in this small series of cases belies this theory and has reinforced Sarmento’s theory of conservative management as first line of treatment that is capable of delivering the goods of good clinical and functional outcome.

Although it is generally accepted that conservative management is the treatment of choice for humeral shaft fractures, in specific situations surgical therapy should be considered. If fracture alignment cannot be maintained by closed methods, the fracture should be treated surgically, although it is difficult to define what acceptable alignment is. The skeletal deformity of malunion is better concealed in the humerus by the thick soft tissue envelop and shortening does not cause significant functional disability. The most frequent type of angular deformity is varus, and it is accepted by several authors that up to 15° of variation do not result in clinically detectable deformity.
Angulations of up to 20° have been reported without giving loss of function. Gregory recommends not accepting greater than 15° of varus angulation unless the patient is willing to accept the aesthetical deformity. Alignment with bracing typically is difficult to maintain in obese patients and tendency is towards surgical treatment of humeral shaft fractures in this population.

Humeral shaft fractures in polytraumatized patients should be operated to facilitate comfort, mobility, and nursing care. The same is true for bilateral humeral fractures. Surgical therapy is also indicated in humeral fractures associated with both forearm fractures (floating elbow). If a repair of vascular or neurological injuries is necessary, the fracture should be surgically stabilized as well to protect the repairs.

Barring these special situations, it is recommended that conservative methods of treating fracture shaft humerus will give comparable results if the patient is willing and motivated to undergo this line of treatment. A surgeon should always make suggest this option to the patient before unilaterally deciding to operate on all cases of fracture humerus so often done in the present times.

**Conclusion**

Conservative treatment for fracture shaft humerus can still deliver the goods as effectively as it did during the days of Sarmiento. Instead of overselling the concept of surgery, we need to give the conservative option to the patient during the initial stage unless there are specific indications for surgery as a primary procedure.

**Limitations of study**

Short series of patients, shorter length of follow-up are the serious limitations of this study. But however as most patients are operated of late, it is difficult to find patients who accept conservative line of management in fracture shaft humers.

**References**


Minimally invasive plate osteosynthesis of distal tibial periarticular fractures

Hariprasad.C.; Mayur Rai; K.Ghanashyam Kamath; Premjit Sujir; Vivek Nahar

Abstract

Background: Treatment of distal tibial fractures using minimally invasive plate osteosynthesis (MIPO) technique may minimise damage to soft tissues and the vascular integrity of bony fragments. This is a study to assess the outcome of patients treated with MIPO technique for distal tibial fractures. This study was aimed to study the efficacy of minimally invasive plate osteosynthesis in treating distal periarticular fractures of tibia in terms of time required for the union of fracture, mobility at the ankle joint and to evaluate the complications.

Methods: A Prospective study of 30 patients treated for distal tibial fractures using a distal tibial locking plate through the MIPO technique.

Results: There were 24 males and 6 females of mean age 40 years. The mean follow-up period was 14 months. According to the AO classification system, there were 12 patients with 43A type fractures, 10 patients with 43B, and 8 patients with 43C type fractures. Mean time to union was 18 months. All patients were fully weight bearing at 8 weeks. There were 5 cases with superficial infections treated successfully using oral antibiotics and no failures of fixation. There were no cases of non-union/delayed union or rotational mal-alignment.

Conclusion: MIPO is an effective method of treatment for distal tibial fractures. The use of indirect reduction techniques and small incisions is technically demanding but decreases surgical trauma to soft tissues.

Key words: Distal tibial fractures, MIPO

Introduction

Of all tibia fractures, 7%-34% occur in the distal tibial region. Management of distal tibial fractures remains challenging due to the poor soft tissue envelope, decreased vascularity of the region and accompanying soft tissue injury have challenged orthopaedicians with problems of infection, delayed union, non-union, and wound problems. They are usually the result of high energy axial compression and rotational forces. Soft tissue compromise is often severe. Several methods of treatment are implemented including non-operative treatment, external fixation, intramedullary nailing, and internal fixation with traditional implants. However, each of these treatment options is associated with certain challenges. Non-operative treatment requires prolonged immobilisation and may be complicated by loss of reduction and subsequent malunion. External fixation may lead to pin-track infections, septic arthritis, malalignment, and delayed union. Intramedullary nails on metaphyseal fractures are technically hard to perform and must be addressed with care. Failures in controlling distal fragments may lead to deformities and malunion. Conventional open reduction and internal fixation of such injuries results in extensive soft tissue dissection and periosteal injury, compromising the blood supply, and

Dr. Hariprasad.C, Post Graduate resident, hariprasad1475@gmail.com; Dr.Mayur Rai, Associate Professor; Dr.Ghanashyam Kamath, Professor; Dr.Premjit Sujir, Assistant Professor; Dr.Vivek P Nahar, Senior Resident, Department Of Orthopaedics, Kasturba Medical College Mangalore Manipal University, Karnataka.
may be associated with high rates of infection, delayed union, and non-union.\textsuperscript{3} 

Minimally invasive plate osteosynthesis (MIPO) offers biological advantages. Reduced soft tissue dissection and exposition results in low surgical trauma and thus preservation of the blood supply is one of the main advantages of MIPO. Biological fixation is achieved with lesser evacuation of osteogenic fracture hematoma.\textsuperscript{6} 

The aims of this study were to assess the outcome of patients treated with MIPO technique for open or closed distal tibial fractures with specific reference to fracture union, implant failure or other surgical complications. 

**Materials and methods**

We conducted a multicentred; retrospective study of 30 consecutive patients from two institutions treated with MIPO using the distal tibial locking plate for closed distal tibial fractures and followed them up a period of 14 months. Case notes were analysed for patient’s demographic parameters, follow-up reviews and complications. Radiographs were

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<thead>
<tr>
<th>Table 1: Age Incidence</th>
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<tr>
<td>Age</td>
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<tr>
<td>30 and below</td>
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<tr>
<td>31 - 50</td>
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<td>Above 50</td>
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<tr>
<td>Total</td>
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<table>
<thead>
<tr>
<th>Table 2: Mode of injury</th>
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<tr>
<td>Mode of injury</td>
</tr>
<tr>
<td>Fall</td>
</tr>
<tr>
<td>RTA</td>
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<td>Total</td>
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<table>
<thead>
<tr>
<th>Table 3: Fracture classification</th>
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</thead>
<tbody>
<tr>
<td>Fracture</td>
</tr>
<tr>
<td>A1</td>
</tr>
<tr>
<td>A2</td>
</tr>
<tr>
<td>A3</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Figure 1:** (Case 1) a. Pre operative x-ray, b. Immediate post operative, c. 2 months post operative X-ray
Table 4: Complications

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
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<tbody>
<tr>
<td>Absent</td>
<td>25</td>
<td>83.3</td>
</tr>
<tr>
<td>Present</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100.0</td>
</tr>
</tbody>
</table>

assessed for classification of fractures and evidence of union. Fractures were classified according to the AO classification system. Open fractures were excluded from the study.

The surgeries were performed by six different orthopaedic surgeons. However, all patients received parenteral antibiotic till 48 hrs post operative period. Physical therapy was commenced first day postoperatively. Fracture union was defined as radiological evidence of bridging mature callus combined with clinical union as evidenced by pain free full weight bearing. Delayed union was defined as healing of the fracture between 5-9 months and non-union was considered when no evidence of healing was detected after 9 months from the operation. Patients with a clinical rotation difference of >15° and a clear rotation difference between both legs as assessed on the radiographs by a senior orthopaedic trauma surgeon were considered to have rotational malalignment.

Figure 1: (Case 1) d. 4 months post operative X-ray showing good union

Figure 2: (Case 2) a) Pre operative, b) Intra operative clinical picture, c) Post op 3rd month AP, d) post op 3rd month lateral
Results
Thirty patients who had 30 fractures were available for evaluation. The duration of follow-up ranged from 9 to 22 months (average 14.1 months). There were 24 men and 6 women, ranging in age from 19 to 65 years old, with an average age of 40.43 years. 19 right and 11 left tibia were fractured. According to OTA/AO classification of the distal tibia fractures, majority were of A1 type (40%) A2 type (33.3%) A3 type (26.7%). Most of the fractures were caused by high energy trauma, 18 of the fractures were caused by motor vehicle accidents (RTA). Most of the patients in our study were operated average at 5th day (4 - 10 days) after trauma. All patients were weight bearing at a period of 8 weeks after surgery. The mean time to union was 18 weeks (16-20 weeks). There was 5 cases with superficial wound infections which were treated with oral antibiotics and dressings, and they progressed to union. There were no delayed union/non-union, failures of fixation or implants and no rotational malalignment on clinical and radiographic evaluation of the patients.

Discussion
Metaphyseal fractures of the tibia are often associated with significant soft tissue injury. The key point in management of this injury is to recognize the importance of the soft tissue component.

Table 5: Functional outcome

<table>
<thead>
<tr>
<th>Functional outcome</th>
<th>No of patients</th>
</tr>
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<tbody>
<tr>
<td>Excellent</td>
<td>5</td>
</tr>
<tr>
<td>Good</td>
<td>17</td>
</tr>
<tr>
<td>Fair</td>
<td>8</td>
</tr>
</tbody>
</table>

MIPO technique has become widely practised in the operative management of articular, metaphyseal and transitional zone fractures over the last few years. It has the advantages of respecting soft tissue via small skin incisions, minimal surgical dissection, indirect fracture reduction and minimal hardware application. As a result, healing time is accelerated, and complication rates are low. MIPO is easy to insert and gives better results with respect to alignment correction. However, there is a learning curve. Adequate preoperative planning is mandatory, as well as accurate surgical timing in secondary skin compromise. Mechanism of action depends on principles of “biological internal fixation” where the aim is to produce the best biological conditions for healing rather than absolute stability of fixation which usually requires a fairly extensive surgical approach to the bone. This takes advantage of indirect reduction of the fracture and application of a bridging plate with minimal screw insertion through stab incisions to fix the plate. The plate functions purely as a splint rather than causing compression of the fracture. The resulting flexible stabilisation has been shown to give early solid union by callus formation. Our study supports this finding with all patients achieving union at an average period of 18 weeks after surgery. This is consistent with results from other studies where union was achieved at 22.4 and 23 weeks follow-up respectively. In this study, we had five cases of superficial wound infection, which were treated with oral antibiotics, and no cases of deep infection or revision fixation.

Conclusion
MIPO technique is an effective method of treatment for fractures of the distal tibia. The procedure is technically demanding and has a learning curve. In our series we found that minimally invasive plating of metaphyseal fractures of distal tibia showed excellent and good results in 73% of patients without complications.

Table 6: Functional outcome and age

<table>
<thead>
<tr>
<th>Age</th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>31-50</td>
<td>6</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>&gt;50</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 7: Functional outcome and fracture type (classification) AO/OTA

<table>
<thead>
<tr>
<th></th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>A2</td>
<td>1</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>A3</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

References


An analysis of reconstruction of traumatic soft tissue defects of leg and foot

S. P. Sivakumar; B. Jagannath Kamath; Ankush Bansal; Harshvardhan; Deepak M Naik

Abstract
One of the important goals in the management of traumatic soft tissue defects of leg is early coverage, to promote vascularity and assist union of associated fractures. Hence enreconstructive flap coverage should be a part of the therapeutic arsenal of an orthopaedic surgeon, facilitating the treatment of open injuries.

Forty five patients (study period 2010-2012) with traumatic defects of leg and foot which required flap coverage were included in the study. 31 patients were treated with debridement, fracture fixation and flap coverage within 10 days. 9 patients were treated between 10 days to 6 weeks. 5 patients were treated after 6 weeks.

All 45 patients were followed up till the soft tissue coverage was achieved. 31 patients having tibia fractures, 17 patients achieved primary acceptable union (55 percent) and 14 patients went into delayed union/non-union for which they required secondary procedures. Average union time for tibia fracture was 9.6 months (6-17 months). 5 patients had fracture of the metatarsal bones, all of them achieved acceptable union with average union time of 4.8 months (4-5.3 months). 3 patients had no bony injuries. 4 patients were lost to follow up after the flap coverage. No patient required secondary flap coverage.

Traumatic soft tissue defects should be treated with radical debridement, rigid fixation and early flap coverage using an orthoplastic approach.

Introduction
Management of lower extremity trauma with bone and soft tissue injury remains a formidable problem. Road traffic accidents, fall from height, sporting injuries and gunshot injuries are the common causes for traumatic defects of leg and foot. Treatment of lower extremity trauma has evolved over the last two decades to the point that many extremities that would have required amputation are now routinely salvaged.

Soft-tissue coverage procedures are performed to provide a closed wound, to promote revascularization of the injured bone and soft tissue, and to prevent infection and nonunion that may occur secondary to persistent bone ischemia. This is possible only when there is a collective osteoplastic approach to the problem rather than conventional orthopedic approach alone. Soft tissue management has improved over the recent years with a better understanding of local fasciocutaneous flaps, local muscle flaps and micro vascular free tissue transfers and also, the technique of vascular and nerve repair which have been further refined. The aims of this study are to study the various flap reconstructive options for open injuries of leg and versality of various flap.

Material and methods
Between 2011 September to 2012 October, 45 cases of open injuries of leg which needed flap cover for soft tissue injury are included in the study. Case notes were analysed for patients’ demographic parameters, type of flap
Case 1: Cross leg flap

Figure 1: Pre operative clinical picture

Figure 2: Followup at 4 months

Figure 3 & 4: Pre operative & post operative radiographs

coverage done, follow-up reviews and complications. Radiographs were assessed for classification of fractures and evidence of union.

Discussion

Age and sex: Out of the 45 patients who underwent flap coverage, 7 were females (16%) and 38 were males (84%). In this study age of the study population ranged from 9 yrs to 72 yrs with a mean age of 39.7 yrs. Mean age of the patients who underwent flap coverage was 35.6yrs. The mean age is between 25 to 35 yrs in most of the literature studies.

Mode of injury: In this study the most common mode of injury was road traffic accident which was the cause in 30 (66.7%) patients. On analysing the pattern in different age groups, it was observed that road traffic accident was again the most common mode in each age group. Farm injuries and falls were more common in the 31-40 years population than among others. All modes were common in males than females, except domestic injuries which were seen more among females, and this observation was found to be statistically significant.

Table 1: Age distribution

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 20</td>
<td>5</td>
</tr>
<tr>
<td>21-30</td>
<td>11</td>
</tr>
<tr>
<td>31-40</td>
<td>12</td>
</tr>
<tr>
<td>41-50</td>
<td>10</td>
</tr>
<tr>
<td>51-60</td>
<td>6</td>
</tr>
<tr>
<td>61 and above</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
</tr>
</tbody>
</table>
Observation was similar. Among males, a majority of patients needed (56.9%) and among females, a majority did not need (54.1%) secondary procedures. The secondary procedures that were done for fracture union in the flap surgery groups were bone grafting (18.2%), dynamisation (27.3%), Ilizarov (27.3%) and IMIL.

### Table 2: Site of defect

<table>
<thead>
<tr>
<th>Site of defect</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximal 1/3rd of leg</td>
<td>3 (6.7%)</td>
</tr>
<tr>
<td>Middle 1/3rd of leg</td>
<td>24 (53.3%)</td>
</tr>
<tr>
<td>Distal 1/3rd of leg</td>
<td>10 (22.2%)</td>
</tr>
<tr>
<td>Foot</td>
<td>8 (17.8%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

### Table 3: Mode of injury

<table>
<thead>
<tr>
<th>Mode of injury</th>
<th>Flap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>4 (8.9%)</td>
</tr>
<tr>
<td>Fall</td>
<td>6 (13.3%)</td>
</tr>
<tr>
<td>Farm injuries</td>
<td>5 (11.1%)</td>
</tr>
<tr>
<td>Road traffic accidents</td>
<td>30 (66.7%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

### Table 4: Secondary procedures for union

<table>
<thead>
<tr>
<th>Secondary procedures</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone grafting</td>
<td>2</td>
<td>18.20%</td>
</tr>
<tr>
<td>Dynamisation</td>
<td>3</td>
<td>27.30%</td>
</tr>
<tr>
<td>Ilizarov</td>
<td>3</td>
<td>27.30%</td>
</tr>
<tr>
<td>Intramedullary nail</td>
<td>3</td>
<td>27.30%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

### Table 5: Type of flap

<table>
<thead>
<tr>
<th>Type of flap</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal based flap</td>
<td>28</td>
<td>62.20%</td>
</tr>
<tr>
<td>Proximal based flap</td>
<td>2</td>
<td>4.40%</td>
</tr>
<tr>
<td>Free flap</td>
<td>4</td>
<td>8.90%</td>
</tr>
<tr>
<td>Soleus flap</td>
<td>6</td>
<td>13.30%</td>
</tr>
<tr>
<td>Cross leg</td>
<td>5</td>
<td>11.10%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>45</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

**Side of injury:** In cases which required flap coverage, right was the more involved side with 23 (51.1%) patients. However, in the less than 20 and more than 50 yrs age group, left was more involved. Analysing the sex pattern, it was found that females had more of right sided defect whereas there was no side preleddiction in males.

**Site in the limb:** In this study majority of cases (i.e.) 24 (53.3 %%) patients defect in middle 1/3 rd. All the age groups reflected a similar picture except in the below 20 yrs group which had proximal third leg and foot defects in equal incidence. Both among males and females middle third defects were the commonest. In literature distal 1/3 rd and ankle defects were predominant.

**Defect:** Majority of the cases had defects more than 5cm 36 (80%) patients. The majority patients in each age group and both sex categories of either group also had defects more than 5 cm.

**Rate of union:** Average time taken for was 8 months 1 week (4 months - 17 months) is also comparable with the previous reported series.

**Types of flaps:** The most common flap used was the distal based flap, in 48.9% (n=22) patients. The other types of flaps used were soleus and sural artery flaps in 6 patients each, cross leg flap in 5, proximal based flap in 4 and free flap in 2 patients.

**Secondary procedures:** Only 24.4% (n=11) of patients requiring secondary procedures. The results were similar in all age groups and among males and females. In all age groups except in 31-50 yrs and above 60yrs, the observation was similar. Among males, a majority of patients needed (56.9%) and among females, a majority did not need (54.1%) secondary procedures. The secondary procedures that were done for fracture union in the flap surgery groups were bone grafting (18.2%), dynamisation (27.3%), Ilizarov (27.3%) and IMIL.
Case 2: Soleus flap

Figure 5: Stabilisation done with external fixator

Figure 6: Pre operative x-ray

Figure 7: Intramedullary nailing done at 6 weeks

Figure 8: Post operative clinical picture day 14 after flap coverage

Figure 9: Follow up clinical picture at 3rd month

Figure 10: Follow up x-ray at 4th month
Table 6: Timing of flap coverage

<table>
<thead>
<tr>
<th>Timing of coverage</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-7 days</td>
<td>30</td>
<td>66.70%</td>
</tr>
<tr>
<td>7 days-6 weeks</td>
<td>10</td>
<td>22.20%</td>
</tr>
<tr>
<td>&gt;6 weeks</td>
<td>5</td>
<td>11.10%</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

(22.2%) within 6 weeks and 5 patients (11.1%) after 6 weeks of injury. The mean time required for healing of a flap cover was 23.64 days with a minimum and maximum of 14 and 39 days respectively.

**Complication:** Complication were seen in 26 patients, the most common being infection (n=21) (46.9%) which is comparatively higher compared to previous series of 22.7%6, and the other being flap necrosis in 5 patients (11.1%).

**Conclusion**

Males accounted for majority of the patients and Road Traffic Accident (RTA) was the commonest cause. The

**Case 3 : Distal perforator based flap**

**Figure 11 & 12 :** Pre-operative clinical picture & pre-operative X-ray  
**Figure 13 & 14 :** Followup at 4 months, clinical picture & post-operative X-ray
The number of injuries due to RTA is on the increase every year. So awareness should be created among the general public to reduce the incidence of RTA.

Perforator flaps (i.e.) Island fascio cutaneous flaps have negated the need for cross leg and free flaps. Of course there is a necessity for cross leg flap in some extreme situations, but their numbers have been drastically reduced.

The referral for reconstruction is not done early enough sometimes, and so the residual morbidity of the skeleton makes the reconstruction redundant.

Infection is still the most common complication of soft tissue coverage. Antibiotic coverage and anti microbial needs are not standardized yet.

Early intervention in delayed union gives good results in fracture union after soft tissue healing.

Table 7: Complications of flap coverage

<table>
<thead>
<tr>
<th>Complications</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flap necrosis</td>
<td>5</td>
</tr>
<tr>
<td>Graft rejection</td>
<td>11.1%</td>
</tr>
<tr>
<td>Infection</td>
<td>2146.7%</td>
</tr>
</tbody>
</table>

References
Non operative treatment of congenital club foot

Surendra U. Kamath

Abstract

The first three months after birth offer golden opportunity to correct the deformity by repeated manipulation. The Ponseti and the French methods of nonsurgical management of idiopathic clubfoot are in stark contrast to the extensive surgical releases that have been more commonly used. The Ponseti method consists of manipulation and casting of idiopathic clubfeet; the French method consists of physiotherapy, taping, and continuous passive motion. These methods may seem laborious, especially for physicians who are used to correcting deformity in one surgical setting. However, these techniques have the potential to decrease not only the rates of surgical intervention but also the extent of surgery required.

Proper manipulative techniques followed by applications of well moulded plaster casts offer the best and safest correction of most congenital club feet in infants. Long term function and results of patients treated in infancy indicate that well treated club foot is not a handicap and is compatible with normal active life.

Key words: Club foot, Conservative method, Ponseti technique, French method

Introduction

Majority of orthopaedic surgeons agree that the initial treatment of congenital club foot should be nonoperative, beginning in the first days of life so as to utilise the fibro elastic properties of the ligaments, tendons and joint capsules. The first three months after birth offer golden opportunity to correct the deformity by repeated manipulation.

In 1939, J. Hiram Kite presented his management method of and experience with congenital clubfoot as a” plea for conservative treatment.”. However, because some patients did not achieve full correction of the deformity with nonsurgical management, interest in surgical approaches increased, and non-operative methods were largely ignored during subsequent decades. Surgical treatment predominated because it was thought to predictably obtain full and lasting correction.

In the early 1940s, Ignacio Ponseti developed a nonsurgical approach for the management of Clubfoot3,4. Like Kite, he wanted to investigate a less aggressive method of correction that would decrease the high rates of complications, stiffness, and overcorrection seen with surgery. Careful anatomic dissections of the idiopathic clubfeet in stillborn babies were critical for Ponseti to be able to define the pertinent pathoanatomy and to rationalize a mechanism for correction.

The French method for nonsurgical correction of clubfoot was developed in the 1970s by Masse6 and Bensahel et al.10. Also known as the functional method, it consisted of daily manipulation of the new-born’s clubfoot, stimulation of the muscles around the foot (particularly the peroneal muscles)

Kite method

Kite’s nonsurgical approach to managing idiopathic clubfoot, consisting of manipulation and serial casting in a prescribed manner, was developed in response to the stiffness and pain that occurred in feet treated with forceful manipulation (e.g., Thomas wrench) and extensive surgical
release\textsuperscript{1}. Kite’s method was derived from the concept of three-point pressure, such as might be used to correct a bent wire. The technique consisted of grasping and distracting the forefoot with one hand while holding the heel from the back with the other hand. After elongating the foot, a laterally placed thumb pushed the talus in a medial direction, and the medially placed index finger pushed the navicular in a lateral direction. The heel was everted as the forefoot was abducted. This manipulation was followed by application of a slipper cast with abduction of the forefoot against a fulcrum over the calcaneocuboid joint. When the slipper cast hardened, the cast was extended to below the knee, with the foot everted with gentle external rotation. After correction of the forefoot adduction and hindfoot varus, the foot was gradually dorsiflexed to correct the equinus.

Casts often had to be changed two times per week. After full correction, a Phelps night splint was applied to prevent relapse. One of the major drawbacks suggested was by abducting the foot against pressure at calcaneocuboid joint the abduction of calcaneum is blocked. Although this method was effective in most cases, treatment required an average of 20.4 months in casts. Thus, the practice changed and surgical management was recommended for those patients with residual deformity after 3 months of manipulation and casting.

**Ponseti method**

Ponseti’s method of weekly manipulations and cast application to hold correction allowed for relaxation of the collagen and atraumatic remodelling of joint surfaces without the fibrosis and scarring resulting from surgical release.

At birth, the idiopathic clubfoot is severely supinated, but the forefoot is still adducted and pronated relative to the hind foot, which is in varus and in equinus. The four basic clubfoot deformities are cavus, adductus, varus, and equinus.

To stretch the ligaments and gradually correct the deformity, the foot is manipulated for 1 to 3 minutes. The correction is maintained for 5 to 7 days with a plaster cast extending from the toes to the upper third of the thigh with the knee at

---

**Figure 1**: Cavus correction

**Figure 2**: Varus and adduction correction
90° of flexion. Five or six cast changes are sufficient to correct most clubfeet. Casting is usually timed to coincide with routine feedings; after manipulation, the baby is fed a bottle, which tends to relax the infant, allowing easier cast application.

The first management goal is correction of the cavus deformity by forefoot supination relative to the hind foot. This manipulation seems counterintuitive because it tends to exaggerate the appearance of overall foot inversion. Elevation of the first metatarsal and supination of the forefoot is in contradistinction to other methods of manipulation that propose correction of the cavus by pronation of the first metatarsal. At the first session, the forefoot is simultaneously supinated and abducted. The cavus is almost always corrected with the first cast. At successive manipulation and casting sessions, metatarsus adductus and hindfoot varus are simultaneously corrected by abducting the foot while applying counter pressure laterally over the head of the talus. The calcaneus, navicular, and cuboid are gradually displaced laterally. This key manoeuvre corrects most of the clubfoot deformity and must be done at each session with attention to three points. First, forefoot abduction should be done with the foot in slight supination. Doing so preserves correction of the cavus deformity and maintains colinearity of the metatarsals, thereby producing an efficient lever arm for abduction. Second, the heel should not be constrained by premature dorsiflexion. It is important that abduction be accomplished with the foot in equinus, which allows the calcaneust to abduct freely under the talus and evert to a neutral position (without pressure on the heel). It also is important to avoid forceful dorsiflexion before correction of hind foot varus because a rocker-bottom deformity could develop. Finally, care must be taken to locate the fulcrum for counter pressure on the lateral head of the talus. Equinus is corrected last and should be attempted when the hind foot is in neutral to slight valgus and the foot is abducted 70° relative to the leg. This degree of abduction may seem excessive, but it is needed to prevent recurrence of deformity. Equinus may be corrected by progressively dorsiflexing the foot after the varus and adduction has been corrected. The foot is dorsiflexed by applying pressure under the entire sole of the foot, not just under the metatarsal heads, to avoid a rocker-bottom deformity. Equinus may be completely corrected through further progressive stretching and casting.

However, to facilitate more rapid correction, a subcutaneous heel cord tenotomy is done in 70% to 75% of patients. Heel cord tenotomy, a procedure in which the entire Achilles tendon is transected, has been done in children as old as 1 year without incidence of overlengthening or weakness. Tenotomy may be done with a thin cataract knife followed by application of a long leg cast in maximal dorsiflexion with abduction to 70°. Most infants require immobilization for 3 weeks, but 4 weeks is reasonable in children older than 6 months. After removal of the last cast, a foot abduction orthosis (i.e., Denis Browne bar) is prescribed to prevent recurrence of the deformity, to favour remodelling of the joints with the bones in proper alignment, and to increase leg and foot muscle strength. The orthosis consists of two straight last open-toe shoes connected by a bar that allows the shoes to be placed at shoulder width. The bar should hold the shoes at 70° of external rotation and 10° of dorsiflexion. In unilateral cases, the normal foot should be in 40° of outward rotation.

Figure 3: Corrective casts
Maintaining the feet at shoulder width facilitates foot abduction. The orthosis is worn full time for at least 2 to 3 months, after which it is worn during naps and overnight for 2 to 4 years.

**French method**

The French method for nonsurgical correction of clubfoot was developed in the 1970s by Masse and Bensahel et al.\(^5\,^6\) Also known as the functional method, it consisted of daily manipulation of the new-born's clubfoot, stimulation of the muscles around the foot (particularly the peroneal muscles) to maintain the reduction achieved by the passive manipulation, and temporary immobilization of the foot with non-elastic adhesive strapping.

The daily treatments were continued for approximately 2 months and then were progressively reduced to three sessions per week for an additional 6 months, after which taping was continued until the children became ambulatory. Night time splinting was used for an additional 2 to 3 years.

Although results were encouraging, this method raised some concerns\(^6\,^7\). It required considerable time and expertise, with success dependent on the skills of the physical therapist\(^7\,^8\). Cooperation and availability of families were essential for this program to be effective; successful outcomes were less likely when the family lived far from the treatment centre. In addition, economic concerns were a factor because the daily specialized care was not covered by all health care systems.

**Summary**

The Ponseti and the French methods of nonsurgical management of idiopathic clubfoot are in stark contrast to the extensive surgical releases that have been more commonly used\(^9\). These methods may seem laborious, especially for physicians who are used to correcting deformity in one surgical setting. However, these techniques have the potential to decrease not only the rates of surgical intervention but also the extent of surgery required. Although no long-term randomized studies exist that compare extensive surgical release with either of these methods; initial results suggest that better foot function is inevitable with less surgical management.

**References**

Evidence based orthopedics

John Ebnezar

Introduction

Evidence and judiciary are two inseparable units. They are inconsequential without each other. Pronouncing a person guilty or not guilty is based on foolproof evidence and not mere evidence. In front of a judge, in an open court, two gentlemen in black coats, one for and against dissect the available evidences against an accused threadbare and each one wants to find out a loophole in the evidence to either support or discard an argument. Listening dispassionately with an analytical mind is the judge who is going to pronounce the judgment based on the veracity of the evidences placed before him. Law is blind but does not buy any argument without proper evidences even though convinced that the accused is guilty.

Real life incidences

To quote a popular and recent example in the sensational Aarushi’s murder case everyone including the CBI, Court and the public knows that the heinous crime was conducted by her servants. Ironically everyone is a mute spectator as the criminals roam free in the society, reasons lack of evidences. This is travesty of justice that the perpetuators of crime make a mockery of justice. But it is a hard fact. Or on the positive side, take the example of Cine Star Shiney Ahuja’s case. That he raped his servant is backed by foolproof DNA evidence that has resulted him remaining confined within the jail. So this is how the judicial systems function and Evidence Based Judiciary (EBJ) is a well accepted fact.

If judiciary keeps the society healthy, medicine keeps the people healthy. Principles, practice, drugs used on humans being to keep them healthy also needs to be evidence based as human life is a treasure. Jeopardizing the human life by unproven, unscientific, and unfit treatment methods is a crime for one may be deprived of the best treatment options that could make a difference in the morbidity, mortality, or recovery. Hitherto the patient was at the mercy of the treating doctor’s opinion but now patients are seeking evidences of the diagnostic and treatment methodologies practiced on them. So evidence based medicine is fast gaining ground and is here to stay in the near future. The God like status enjoyed by doctors is a thing of the past for they need to back their actions and deeds with evidences. When all the branches of medicine are brought under the gambit of EBM, orthopedics cannot be far behind and thus EBO has emerged. It is a new paradigm that places less emphasis on expert opinion (authoritarian) but more emphasis to evidences from well conducted and published clinical research (authoritative).

What is EBM?

All these days in our practice two things were involved, patient and the treating doctor. Insinuat-ing between the two now is the clinical research evidence. Thus EBM is a healthy integration of all the three namely patient with his illness, doctor with his clinical expertise and credible evidences based on sound clinical research.1 Now the expert opinion is backed by expert research evidences for expert medical care. This is EBM for you.

History

Unlike many medical events and practice that has rich history, EBM is a new discovery credited to the recent times. The term was coined by Gordon Guyatt in 1991.
and was described by the evidence based medicine group by Mcmaster University. However EBM has still a colorful history starting from an era before Christ.

- 2600 years ago Prophet Daniel conducted a trial on King Nebuchadnezzar’s order to the Israelite children to eat a diet of the King’s meats and wines.2
- Sir James Lind’s work on the prevention of Scurvy in 1747.3
- May have origins in China BC.
- May have been coined by Dr David Eddy of Kauser Permanente.
- Xavier Bichet, Pierre Louis, Francoid Magendie of post revolutionary France are credited for the philosophical base.
- Discovery of cowpox vaccine for immunization against small pox by William Jenner.4
- First Cohort trial by Cotton Mather in 1720 about the use of cowpox vaccine against small pox.5
- First RCT was reported in 1931 by J Burns Amberson regarding the treatment of TB.5
- In the 1950’s another RCT was carried out on the effect of Streptomycin in TB trials.7
- In 1954 a clinical trial on Salk Polio Vaccine was conducted. This is the largest single clinical trial of the 20th century.7
- Practiced at McMaster University in the late 1970’s.8
- In 1980, David Sackett coined the term Critical Appraisal.9
- Advances in meta-analysis and systematic Reviews started taking place in mid 1980’s.10
- Prof Gordon Guyatt coined the term EBM in 1991.1
- In 1992, first Cochrane center was established by Ian Chambers at Oxford University.11
- Second Cochrane center was established in McMaster University in 1994.
- Cochrane collaboration and library was born in 1996.
- JBJS in 2000 introduced a new section Evidence based Orthopedics.12
- Earliest article to be published about EBO in JBJS was a series of four user’s guides to the ortho-pedic literature by Bhandari, Guyatt et al.13
- To classify the quality of study, JBJS introduced 5 levels of evidence rating for all articles submitted for publication.14
- In 2002, a study recommending discontinuation of hormone replacement therapy (HRT) in the prevention and treatment of osteoporosis.15
- Osteoarthritis Research International (OARSI) group for the first time published an article in 2008, combining expert opinion, with clinical trials and systematic overviews as the highest level of evidence.16

**Why is EBM necessary?**

Change is the way of life. Right from our evolution nothing has remained static. Due to continuing evolitional changes over centuries we are what we are today. Then how can the treatment and diagnosis of our patients remain the same. It also has to follow the path of change. Earlier medical treatment and decisions were taken on the following grounds:

- Guess work
- Unsystematic observation
- Common sense
- Expert opinion
- Standard and accepted practice.

During this era doctors enjoyed the status of Gods. Everyone followed the advices of doctors as divine and did not question their judgment. If something went wrong they blamed their luck but not the doctor. Such was the implicit faith on doctors in those days. But slowly as people started getting more educated and aware they realized that this method was fraught with lots of dangers and pitfalls.
Pitfalls of this method:

- Improper.
- Inadequate.
- Faulty treatment.
- Legal complications.

EBM is necessary to overcome all the above pitfalls of the earlier medical treatment methods and give quality treatment to the patients.¹⁷ This can be done by systematic reviews of medical literature that include:

- **Randomized controlled trials**: Here patients are allocated randomly to either a treatment or control group and followed over a period of time for an outcome of interest. They help avoid selection or confounding biases and provide an objective basis for quantifying study outcomes.

- **Observational studies**: These include large prospective studies followed up over a period of time. Based on the exposure to certain variables, they draw the inferences from groups of patients. Implementation of therapies are not involved in these studies but rather follow groups of patients that have been exposed or analyze patients retrospectively for an exposure that have experienced the outcome of interest. These studies can have bias because the preferences of the patients or the physicians can determine whether patients receive a treatment or control therapy. While the insight and expertise of experienced clinicians cannot be questioned regarding the diagnosis or treatment but they are affected by a small sample size and human errors of making inferences.¹⁸

All this will be discussed in greater detail is sections to follow.

**When to practice EBM?**

The need to practice EBM is now. In complex clinical situations when decision taking is difficult it is best to practice EBM. If you are reluctant to practice EBM your patients will not shy away from quoting you the EBM and embarrass you. Patients are well informed of late due to the internet boom and easy availability of knowledge over the net, TV, media, and other sources. They will not hesitate to question or demand EBM and put you in the dock if you fail to exercise your options well. Let me illustrate with an incident that happened not so recently to my friend who is a very senior and well known Obstetrician in a corporate hospital in Bangalore.

**How to practice EBM?**

The standard medical teaching is when encountered with a patient take proper history, do a clinical examination, order relevant investigations and based on your previous experience institute the treatment what you think is warranted. We were heavily inclined to rely on our past experiences and expert opinions of our teachers and professors under whom we had received our previous medical training. This was OK few decades ago. Now the expectations of the patients are rising and there is very little room for error as patients demand and expect the latest available treatment methods. So the earlier method no longer works. Now the approach should be to assess the patient, formulate your clinical questions by asking the patient, then do a extensive literature survey while the patient is being investigated or planning to be treated, critically examine the studies, now integrate the evidence gathered to the patient in question and later evaluate the outcome and the prognosis.¹⁹ The knowledge gained by all this experience will help you to take decision in future when encountered with a similar case.²⁰ All these steps are summarized in the box below.

**Who should practice EBM?**

In recent times all practicing clinicians and investigators need to practice EBM. It is beneficial for both the clinicians and the patients to adapt to EBM methods. It gives the best option to the patient and for the clinicians it gives the satisfaction of executing the best available options supported by strong and good evidence and also provides him immunity from litigation and other problems that may arise due to poor judgments and complications.
Quality of research: Is it good or bad?

Evidence is all right, research analysis is alright, but you need to keep in mind that not all evidences and not all research analysis are good and are of standard quality. It is ok if you do not practice EBM but it is not ok if you practice improper EBM based on poor literature and evidences.

Note: Only a small proportion of the available research is relevant and is good, interesting, and important.

E.g.: 60,000 articles are published every year in 120 journals. Only 3500 articles every year meet critical appraisal. 25 articles per year available for clinicians. Only 5-10 articles for authors of evidence based clinical topic reviews.

What is the hierarchy of evidence?

To rate the quality of research evidences available the concept of rating the quality of evidences has been introduced. This alerts the clinician and the patient about the quality of literature they are referring to. Evidences based on good quality randomized controlled trials occupy the top position in the hierarchy while the expert opinion is at the bottom. The following are the hierarchy of evidences currently followed:

1. Systematic reviews.
2. Critically appraised topics (Evidence syntheses).
3. Critically appraised individual articles (Article synopsis).
4. Randomized controlled trials.
5. Cohort studies.
6. Case Control Studies (Case series/Case reports).
7. Background information/Expert opinion.

What is the type of study?

You have now understood what a good study is and a bad study, what is the level of literature evidences. Now you need to know what the various types of literature studies available are. There are three types described:

1. Therapeutic study: Aims to determine efficacy or adversity of a treatment method. This is the commonest study encountered in orthopedic practice.
2. Diagnostic study: This helps to detect the presence or absence of specific condition by an inter-vention.
3. Prognostic study: This predicts the outcome of the patient’s condition.

EBM triad

This triad puts the entire EBM in a nutshell (Fig. 1).

User’s guide

How to Critically Appraise a Level 1 (RCT) Research Article and what is the role of the user’s guide?

You have come across a literature pertaining to the diagnosis or treatment of your patient. You have also ascertained that the said literature is good and is rated high. Is that enough? No, not all literature is good and trustworthy. You now need to critically assess the research and not just assess it. It is advised to observe the following guidelines in critically judging an article based on RCT study. To give an effective care to our patients, EBM helps to amalgamate experience and education with relevant literature. According to the User’s guide21 to the medical literature a therapeutic study should answer three important questions:

1. Are the results valid or is the study believable?
2. What are the results? Is the result big and precise?
3. How can the results apply to patient care? Is it applicable to my patient?

Now let us evaluate each one in greater details.

1. Are the Results valid? This can be done by analyzing whether the study results support a cause effect relationship between the treatment and the observed outcome. This is called the Internal Validity and the results are said to be valid if the following conditions or criteria’s are fulfilled:
Randomization: Here some method of chance (E.g. flip of a coin) is used to assign patients to treatment groups, study or control groups to eliminate bias. The box ahead shows types of randomization.

Concealment: Whether this randomization was concealed from the investigator, patient, observer, and analyst (See box).

Intention to treat analysis: Here the patients are followed and evaluated within the group to which they were initially allocated, regardless of whether they received or completed the intended treatment.

Blinding: To minimize any differences in patient care other than the intervention under investigation it is necessary to keep the patient, clinicians, outcome assessors and statisticians unaware of the group to which the patient was allocated. In double blind study, both the patient, the clinician or the researcher are blind to the treatment allocation. Unlike in drug trials where in the physicians can be blinded, it is difficult to blind a surgeon during surgical trials.

Note: Blinding a patient helps eliminate psychological or placebo effect.

Follow up: Adequate follow-up is a must, to consider the study as valid. Remember the 5 and 20 rule. If less than 5 percent of the patients are lost to follow up then the effect on the outcome is considered minimal and if 20 percent or more of the patients are lost to follow up, the validity of the study is poor.

2. What are the results? To know what are the results two values need to be looked into, namely its magnitude and precision.

Magnitude: It is important to find out the magnitude of the treatment effect to know what impact the intervention has had on the subjects under study. It is easy to interpret the outcome if the patient’s response is either a definite yes or no eliminating the gray are in between. To know the magnitude of the treatment effect two measures need to be followed:

(a) Summary measures: This measures central tendency along with the dispersions (Standard deviation, standard error, variance, range).
(b) Outcome measures: This includes incidence, prevalence and various risk parameters like:
- Absolute risk (AR).
- Absolute risk reduction (ARR).
- Number needed to treat (NNT).
- Relative risk (RR).
- Relative risk reduction (RRR).
- Hazard ratio (HR).

Precision: After ascertaining the magnitude of the treatment effect it is imperative to find out the precision of the study. The estimate of the magnitude of a treatment effect is called a point estimate. But it is extremely unlikely that this estimate will be precise but may lie between ranges of values called the confidence interval. Two methods are employed to achieve this namely the p-value and the confidence interval.

1. P-Value: It is the probability that the treatment effect has happened by chance alone in a long trial is depicted by the p-value. It tells us whether the results obtained by the study are due to chance or by choice of the intervention. In other words is the study statistically significant. This is answered by observing the p-values which is normally set at 5 percent (p<0.05). If the p value is less than this level then the study results are actual and not due to chance. If it is above this value then the results are not statistically significant and could be due to chance.

Limitations

The p-value does not tell how important this actual difference is. Even a small difference that is clinically
insignificant can be shown as statistically significant. This is revealed by the minimally important difference (MID).

- It does not tell us the range over which the effect can possibly happen. This is taken care by the Confidence interval

**Minimally important difference (MID):** It represents the smallest difference in this actual difference. Even a small difference that is clinically insignificant can be shown as statistically significant.

2. **Confidence interval (CI):** This depicts the range of values within which we can be confident that the true value for the whole population lies. Normally a confidence interval of 95 percent is accepted as a standard by statisticians who mean that if a study is repeated 100 times the point estimate will remain within this interval 95 times. CI is related to the sample size. Bigger the sample size narrower will be the CI and greater will be the precision of the study.

   **Note:** More the sample size more will be the CI.

**Outcome of the studies:** This could be positive, indeterminate, or negative.

- **Positive study:** Here the CI is above and not overlapping the MID in statistically significant studies (p<0.05).
- **Indeterminate study:** Here the CI crosses the MID in statistically significant studies (p<0.05) and in statistically significant results (p>0.05) the upper limit of CI overlaps the MID.
- **Negative study:** Here the results are statistically insignificant (p>0.05) and the CI lies below MID.

   **Note:** Statistically significance, MID and CI is necessary to identify whether a study is positive, indeterminate or negative.

**Sample size:** A bigger sample size makes a study more authentic than a study with a smaller sample size. To either support or refute the use of intervention it is important to know whether the sample size was large enough or the CI was narrow enough. To achieve these following steps needs to be fulfilled:

- State the upper and lower limits of the stated range.
- Introduce the concept of **minimally important treatment effect** which means the smallest amount of benefit that would justify the initiation of the therapy under investigation. If the study is statistically significant but fails to surpass the MITF then it would be deemed as inappropriate as no benefit is conferred.

**How to assess the adequacy of the sample size based on the results?**

- **Positive study:** If the CI is positive, the adequacy of the sample size is determined by looking at the lower limit of the interval and ascertaining if it lies above the MITF. If true then the adequacy of the sample size is sufficient.

- **Negative study:** Here the treatment group is no better than the control group and the CI is negative. Now inspect the upper limit of the range, if found below zero, then the sample is adequate and the treatment can be ruled out. On the other hand if the upper limit is above zero, the trial does not have an adequate sample size to dismiss the treatment.23

**3. Is the study applicable to my patient?** Every clinician is interested to know how effective and relevant is the study to this patient? To do this the following things needs to be done:

1. **Compare** the characteristics of study participants in your clinical patients? This can be done by determining the research question which involves the following criteria’s (PICOT):
   - **P - Patient**
   - **I - Intervention**
   - **C - Control**
   - **O - Outcome of interest**
   - **T - Time frame**

2. **Know the types of trial:** Was it explanatory or pragmatic?
In explanatory trial, the trial is conducted in an ideal situation and by expert clinicians and in highly compliant patients.

In Pragmatic trial: Here the trial is completed under usual situations in usual circumstances. Most of the studies lies in between the two.

3. Applicability: Can be further determined by looking at the inclusion and exclusion criteria’s and other criteria’s of a study.

4. Cost effectiveness (CE): Any treatment to be effective has to be cost effective and affordable to your patients and answer the question is it really worth the increased cost, apart from knowing the benefits and risks of the treatment in question. Now let us deal with the CE analysis.

Cost effectiveness analysis

It is alright to have procedures and treatment methods that are far superior to the available treatment options. But it is not alright if the same comes with a prohibitive higher treatment costs that will pinch the pockets of your patients. Hence it is imperative that a full economic analysis must consider both the costs and outcomes of the alternative treatment methods. Thus it is imperative that CEA be carried out along with the RCT’s where both the efficacy and cost data are collected prospectively.24 The ideal scenario that is desirable from a new treatment option that it should be both less costly and more effective

Studies other than RCT

EBM is not only about RCT’s. In fact RCT’s unfortunately form a very small percentage of all scientific studies (Only 3%). This implies that there are other studies which are being advocated with greater frequencies though they are not in the same pedestal as RCT’s. Let us now know about these other studies.

Cohort study

A group of individuals that share similar characteristics is called a Cohort. Cohort studies identify equal sized groups with or without an exposure of interest and follow them forward in time to determine outcomes.25

Types

1. Prospective cohort study: Here before the onset of the study, the exposures are identified and then followed forward.

2. Retrospective cohort study: Here the outcomes have already happened even before the study was initiated.

Advantages: Where randomization is not feasible these studies help to identify infrequent and harmful outcomes of intervention.

Disadvantages: It is affected by confounding variables and surveillance bias.

Case control study: These are entirely retrospective studies. Identify a group of people with a specific outcome and label them as the case group. Then a control group is selected based on a similar group of individuals with the same demographics but without the outcome of interests. Now analyze these groups for previous exposures to suspected harmful agents and determine if they influence the target outcome.

Advantages: It helps to investigate outcomes that are rare or slow to develop since the outcome here has already occurred.

Disadvantages: They are affected by confounding variables and recall bias.

Case series

This could be multiple patients (Case series) or single patient (Case report). These simply report on variables thought to be causally linked with the outcome of interest. They do not provide a comparison with the control group.

Though placed on the lower level of the hierarchy of evidence it serves the following beneficial purposes:

- It helps the clinicians to generate clinical questions and hypothesis for future or further studies.
- It helps to identify substantial adverse events that have changed the standard of treatment.
Diagnostic study

Using a reference standard or gold standard as comparison, the efficacy of the diagnostic tests under question must be studied. A test that is well accepted and accurate diagnostic tool in the medical community is called the gold standard. To describe the performance of a diagnostic test, two indices are used:

1. **Sensitivity:** This is the proportion of diseased individuals with a positive test result or the true positives.
2. **Specificity:** This is the proportion of non-diseased persons with a negative test result or the true negatives.

Decision analysis study

Is it not true that our whole life is based on the choices we make? Right choices or decisions make our life successful and the wrong ones make our life miserable. It is said that when we pick up a stick we pick up the other end too. God has given us the great capacity to make our own choices in all spheres of life and it is fully under our control but once we make a choice the consequences is not under our control.

Now apply the same logic to the clinical trials. Faced with a clinical situation you have done a painstaking research analysis of the various treatment options and now you are faced with taking decision as to which treatment options is the best for your patient. This decision making is extremely vital in achieving the best possible outcome. This can be achieved by rigorous and objective analysis of the outcomes and probabilities and is known as the decision analysis.

Decision analysis is an objective, explicit method to represent specific decision problems using models and allows the user to apply EBM to a particular clinical scenario. This requires the construction of a decision tree that illustrates all plausible relationships, alternatives, and outcomes involved with a given decision. By incorporating both probabilities and outcome values, a decision analysis model expresses its conclusion in terms of average expected results.

Components of decision analysis

1. **Probabilities:** This is a quantities estimate of the chance or likelihood that a given outcome will occur and is derived from a systematic and rigorous analysis of available literature particularly the RCT’s. To help in the decision making processes these estimated probabilities are then incorporated into the decision tree.

2. **Outcome variables:** These are summary measurements of a particular outcome and are expressed in the form of:
   - Life years
   - Quality adjusted life years (QALY’s)
   - Costs
   - Utilities.

These are derived from the literature or from expert opinion or patient’s choice. The next step is to multiply outcome values by their respective probabilities and obtain the calculation. The model then expresses its conclusion in terms of an average expected results interpreted as life years, days of treatment, cost or other variables depending on the clinical context. These final values represent the baseline values that can undergo further analysis in a decision tree and is called the sensitivity analysis.

Sensitivity analysis

Due to biologic variations, differing techniques and expertise, discrepancies in literature baseline probabilities and outcome values are often associated with some uncertainties. Moreover the difference between the options may be quite small though they may show one method is preferred over the other. In such situations a sensitivity analysis is performed by varying probabilities and outcome values. This helps to explore the uncertainty of data and to examine what are the effects of variability or probabilities and outcome values in an expected outcome.

This allows a clinician to choose a preferred method of treatment and explores the various variables that may influence the final decision. Thus decision analysis has developed into a powerful and effective technique for
variety of clinical application. It thus helps in determining the best course of action.

**Quality reporting**

Evidence based decision hinges not just on available literature but on good literature. How to ascertain that the available literature is good and reliable. Well this can be done by subjecting each level of evidence through their own quality control check lists. Let us first begin with the mother all evidences, the RCT. Therapeutic studies are the most common class of study found in orthopedic literature.

1. **RCT’s:** These occupy the top level of hierarchy of evidence simply because these studies eliminates bias by ensuring that both the treatment and control groups are balanced for both the known and unknown prognostic factors. Here the subjects have an equal chance of being either in the study or control group by chance and not by choice. However the quality of reporting in orthopedic RCT is of poor quality and needs effort to improve it.27,28 RCT’s to be of top standard it should meet other criteria’s apart from mere randomization namely:

- Concealment of randomization.
- Blinding.
- Loss to follow-up.
- Sample size calculation.
- Following the intention to treat principle.

To improve the quality of orthopedic RCT’s reporting the following quality checklists needs to be applied:

a. *Detsky quality index:* This includes 14 items and a score of >75 percent is deemed a high quality RCT’s. Only 68 percent of the reported RCT’s meet these criteria’s.

b. *CONSORT criteria:* It is a 22 item checklist and a flow diagram first published in journal of American Medical Association (JAMA) in 1996. This criterion focuses on reporting of trial design, analysis, interpretation, and participant progress. So poor is the quality of reporting, that more than 70 percent of the RCT studies did not meet even half of the CONSORT criteria.29

It is appalling to note that only 11.3 percent of published articles are considered to be of level 1 evidence and even among these the reporting quality is considered to be poor causing concern and hence the value of these checklists. RCT’S in particular constitute only 3 percent of these orthopedic literatures.

2. **Systematic reviews:** Unlike unsystematic literature reviews, systematic reviews are more likely to be quoted as evidences30 and they follow the 8 step process:

- a. Formulating a hypothesis.
- b. Identifying the inclusion and exclusion criteria’s.
- c. Searching for the studies.
- d. Selecting the studies.
- e. Checking the study quality.
- f. Extracting data.
- g. Result of the analysis.
- h. Interpretation of the results.

But like RCT’s, the quality of rigorous methodological reporting of the systematic reviews is found to be only 15 percent and is a cause of concern.31

**Meta-analysis:** One of the most beneficial aspects of following a systematic review is meta-analysis. This is a quantitative analysis of results across many studies to arrive at the single best estimate of treatment effect. This helps eliminate bias and is an important tool for practitioners while making treatment decisions.

For methodological consideration of systematic reviews the quality of reporting of meta-analysis (QUOROM) was developed.32 This helps the readers to critically appraise the meta-analysis. Based on these criteria it is observed that only 15 percent of the systematic reviews is correct while a whopping 85 percent gives biased results.

By improving the quality of RCT’s and over-coming
its shortcomings will help overcome the shortcomings of systematic reviews. But on the flip side it is observed that the majority of published orthopedic systematic reviews are non-randomized trials due to apparent lack of RCT studies.

**Publication bias**

Another factor that affects systematic reviews is the *publication bias* where positive trials are published more frequently than negative trials. This tilts the balance heavily towards positive affects and creates bias even in the most rigorously followed systematic analysis. This is known as positive outcome bias. In a trial it has been noted that nearly 70 percent of the positive studies were published against the 10 percent of the neutral studies. This is a serious problem and can result in severe bias.

These checklists provide invaluable source guidance to authors, journals, editorial, and readers to critically appraise the published reports.

**Developing evidence based balance sheet**

After all this painstaking procedures of research analysis it is now time to prepare a balance sheet of the evidence based procedure by adopting the following four procedures:

1. Identification of alternative treatments available to the patients.
2. Identification of the health outcomes that are affected by treatment.
3. Estimation of the probabilities or magnitudes of each of the health outcomes for each of the treatment methods and finally,
4. Displaying the information in a table.

**Communication to a patient**

Once you have zeroed on the best possible treatment options after careful analysis, communicating the same to the patients effectively and convincingly poses a bigger challenge to the clinicians. As in life so in EBM lack of proper communication skills can give rise to lots of confusion and sometimes may be reason for litigations. Hence due care need to be exercised while communicating facts and figures to the patients. Some of the better ways of doing this are:

1. *Paternalistic method*: Here the clinician makes the decisions.
2. *Patient independent model*: Here the patient makes the decision based on the facts presented by the clinician.
3. *Relationship centered model*: This is the best model. Here the physicians establish a relationship with the patient and their families and both participate in the decision making process with mutual trust. This two way process seems to be ideal.

**Tools for communication**

You have decided to communicate and you have chosen your method of doing so. But you need to know the different tools available for effective communications. One cannot follow a set pattern as each patient is different and hence different tools and strategies need to be used to communicate namely:

- Verbal, written or video information presented in a structured format.
- To use aids like illustrations and graphs, bar charts and pictographs, etc.

**Appliances for communication**

The following five approaches may be used to communicate to your patients the results of an orthopedic study:

- Relative risk.
- Relative risk reduction.
- Odds ratio.
- Absolute risk reduction.
- Number needed to treat.

Detailed descriptions about these approaches are outside the scope of this book and the students are advised to refer bigger books on this subject.
Note: It is important to note that the same rules do not apply to each patient and different yardstick needs to be used to convince the patients better.

Problems in EBM

EBM is not without problems. But however the benefits far outweigh the problems and should not come in the way of putting EBM into use.

References


Safe surgical dislocation: Its usefulness in traumatic situations around the hip - report of 3 cases

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Abstract
Most of the fractures around the hip such as acetabular fractures, fracture of the femoral head require femoral head dislocation for fixation of Pipkin’s fractures and for clearing of intra-articular fracture fragments from the acetabulum risking damage to the vascular supply of the femoral head. GANZ et al has described safe surgical dislocation of hip with trochanteric osteotomy which preserves the blood supply to femoral head for conditions for intracapsular pathologies of hip joint. Three cases of hip fractures (2 cases of Pipkin’s fracture dislocation and one case of acetabular fracture with loose fragments in the joint) treated using Ganz’s trochanteric osteotomy for definitive management of the fracture situations are reported. All the three cases operated were young patients. So preservation of blood supply to the femoral head was of paramount importance. All the three patients recovered well.

Introduction
Most of the fractures around the hip such as acetabular fractures, fracture of the femoral head have been treated either with anterior approach or posterior approach. Most of the times, these fractures require femoral head dislocation for fixation of Pipkin’s fractures and for clearing of intra-articular fracture fragments from the acetabulum risking damage to the vascular supply of the femoral head. GANZ et al has described safe surgical dislocation of hip with trochanteric osteotomy which preserves the blood supply to femoral head for conditions for intracapsular pathologies of hip joint. We report 3 cases of hip fractures (2 cases of Pipkin’s fracture dislocation and one case of acetabular fracture with loose fragments in the joint) treated using Ganz’s trochanteric osteotomy for definitive management of the fracture situations.

Technique
In the lateral decubitus position, a Kocher-Langenbeck incision is made and the fascia lata split accordingly. The leg is then internally rotated and the posterior border of gluteus medius identified. No attempt is made to mobilise gluteus medius or to visualise the tendon of piriformis. An incision is made from the posterosuperior edge of the greater trochanter extending distally to the posterior border of the ridge of vastus lateralis. A trochanteric osteotomy with a maximal thickness of about 1.5 cm is made along this line with an oscillating saw [Fig 13]. At its proximal limit, the osteotomy should exit just anterior to the most posterior insertion of gluteus medius. This preserves and protects the profundus branch of the medial femoral circumflex artery [MCFA], which becomes intracapsular at the level of the superior gemellus muscle.

The greater trochanteric fragment is mobilised anteriorly with its attached vastus lateralis after releasing it along its posterior border to about the middle of the tendon of gluteus maximus. The most posterior fibres of gluteus medius are also released from the remaining trochanteric base. With the leg flexed and slightly rotated externally, vastus lateralis and intermedius are elevated from the lateral and anterior aspects of the proximal femur. The tendon of piriformis becomes visible by careful anterosuperior retraction of the posterior border of gluteus medius. The inferior border of gluteus minimus is separated from the relaxed piriformis and underlying...
The constant anastomosis between the inferior gluteal artery and MFCA, which runs along the distal border of the piriformis muscle and tendon, is preserved. The entire flap, including gluteus minimus, is retracted anteriorly and superiorly to expose the superior capsule. This is facilitated by further flexion and external rotation of the hip. The anterior, superior and posterosuperior capsule can now be visualised.

The capsule is first incised anterolaterally along the long axis of the femoral neck since incision in this area avoids injury to the deep branch of the MFCA. An anteroinferior capsular incision is made [Fig 2]. The capsulotomy must remain anterior to the lesser trochanter in order to avoid damage to the main branch of the MFCA, which lies just superior and posterior to the lesser trochanter. Elevation of the anteroinferior flap allows visualisation of the labrum. The first capsular incision is then extended towards the acetabular rim where it is sharply turned posteriorly parallel to the labrum reaching the retracted tendon of piriformis. Care must be taken not to damage the labrum.

The hip can now be dislocated; the leg is flexed, externally rotated, brought over the front of the operating table, and placed in a sterile bag allowing inspection of most of the acetabulum. Therapeutic procedures to the acetabulum are difficult and, if required, the anterior dislocation is completed after the ligamentum teres is either torn by further external rotation, or incised. The stump of the ligament remaining on the femoral head may be resected. The foveolar artery, which is frequently patent in the ligamentum teres, is not an important source of blood supply to the femoral head. By manipulating the leg, the surgeon now has 360° access to the acetabulum and of nearly 360° to the femoral head.
**Brief report of cases**

**Case 1**

A young man aged 28 years old male patient presented to the casualty with two days’ old unreduced posterior fracture dislocation of right hip for which he underwent immediate closed reduction and put on skeletal traction. Post reduction check radiograph showed fracture of the femoral head. CT scan confirmed a Type 2 Pipkin’s fracture of femoral head.

He was taken up for surgery after 5 days. Lateral incision was made with the patient in supine position. A trochanteric osteotomy as outlined by Ganz et al was performed and the osteotomy fragment was flipped anteriorly [Fig 4] and the capsule was incised. Care was taken not to go to posteriosuperior part of capsule so that Medial Circumflex Femoral Artery is not damaged. The joint was dislocated anteriorly by adduction and external rotation of the hip and the fracture visualized. Fracture fragment of femoral head was fixed with 2 Herbert screws [Fig 5] and joint was reduced and the greater trochanter osteotomy fragment fixed with 2 cancellous screws [Fig 6] and wound was closed in layers and patient was mobilized non weight bearing from 2\textsuperscript{nd} post operative day after drain removal with the support of crutches.

**Figure 4:** (Case 1) Ganz osteotomy of the greater trochanter was done and the osteotomy fragment flipped anteriorly.

**Figure 5:** (Case 1) Fracture fragment of femoral head fixed with 2 Herbert screws

**Case 2**

A man aged 45 years presented to the casualty with history of road traffic accident and diagnosed with type 3c fracture both bones right leg with severe crushing and Pipkin’s fracture right femoral head [Fig 7, 8]. He underwent Below Knee Amputation on the day of admission and on the 6\textsuperscript{th} day was taken up for surgery for femoral head fracture. His CT SCAN showed type 1 Pipkin’s fracture with comminution.

**Figure 6:** (Case 1) the greater trochanter osteotomy fragment fixed with 2 cancellous screws
Patient was positioned in lateral decubitus position and through a Kocher Langenback approach, trochanteric flip osteotomy was done and joint was dislocated anteriorly. The intra-articular fragments were excised and the joint thoroughly lavaged and reduced and trochanteric osteotomy fixed with cancellous screws [Fig 9] and the wound was closed over a drain.

Case 3
A 25 year old male patient presented to the Casualty with Comminuted fracture posterior wall of right acetabulum and fracture both bones right leg. His CT Scan of acetabulum showed comminuted fracture of the posterior wall of acetabulum with intra-articular fracture fragments lying anterior to the femoral head also. [Fig 10, 11, 12]. Patient was put on skeletal traction initially and taken up for surgery after 5 days of trauma to allow the soft tissue bruising to settle down.

Patient was initially positioned on fracture table and Intramedullary interlocking nailing of tibia was performed and then the patient was repositioned in lateral decubitus position for acetabular fracture fixation.

Through a Kocher- Langenback approach posterior aspect of hip was approached. The short external rotators were disrupted by the injury. The hip joint was dislocated posteriorly and some of the fragments were excised, but the large anterior fragment could not be accessed despite meticulous attempts. Hence greater trochanteric osteotomy was performed and the hip dislocated anteriorly and the large intra articular fragment was removed and joint was reduced and the posterior wall acetabular fracture reconstruction done with 2 contoured AO Recon plates and trochanteric osteotomy was fixed with cancellous screws [Fig 13] and wound was closed in layers. Patient was mobilized non weight bearing with crutches from 2nd postoperative day after drain removal.

Discussion
All the three cases operated by us are of young patients. So preservation of blood supply to the femoral head was of paramount importance. The first case presented was a 2 day old unreduced Pipkin’s fracture dislocation. Since the ligamentum teres was already ruptured due to trauma,
it was essential to preserve the remaining blood supply to femoral head via the MCFA. The safe surgical dislocation preserves the vascularity of femoral head, gives us clear visualization of the fracture site and allows an anatomical reduction of the fracture fragment and easy internal fixation. Further, intraoperatively the vascularity of femoral head can be confirmed with drilling of femoral head with K-Wires which will show active bleeding. 

The second case was with vascular injury to right leg with severe crushing which required Below Knee amputation on an emergency basis. Later upon evaluation of his hip joint, his CT SCAN revealed type 1 Pipkin’s fracture of right femoral head with comminution, hence it was decided to excise the fragments.

In the third case, there was extensive posterior disruption of the short external rotators and blood supply to the femoral head in all probability would have been disrupted. We had to resort to anterior dislocation of the hip since we could not retrieve the anterior fragments inspite of dislocating the hip posteriorly and making all attempts to retrieve the fragments. This case gave us the opportunity to combine the anterior dislocation with posterior wall reconstruction.

**Conclusion**

Although conventionally Pipkin’s fractures and intra-articular fragments are operated either with anterior or posterior approaches, both these approaches carry a significant amount of risk to the vascularity of femoral head. Since most of these are high velocity injuries and occur mostly in young individuals, conservation of the vascularity of femoral head is of paramount importance. Hence conventional approaches which carry a risk to the vascularity of femoral head may not be ideal for the fixation of femoral head. The safe surgical dislocation of the hip described by Ganz et al is a versatile approach and has revolutionised the management of various pathologies around the hip including paediatric, degenerative as well as trauma situations.
References


Total hip arthroplasty in a Girdlestone hip

Ranganath B.T., Purushotham V.J., Pawan Kumar M.,

Abstract
An improperly implanted bipolar prosthesis creates more problems with one of the options being a Girdlestone arthroplasty. And the decision of reconstruction of girdle stone hip is a tough one to make. An adult male aged 60 years had sustained fracture neck of femur following fall about one and half years ago. He had undergone cemented bipolar hemiarthroplasty with prosthesis and extravasated cement causing stiff and painful hip. Girdlestone arthroplasty was done as a treatment for painful stiff hip joint. We successfully converted the Girdlestone arthroplasty to a total hip arthroplasty.

Introduction
Hemiarthroplasty (unipolar or bipolar) of the hip is a commonly performed procedure in elderly patients with intracapsular displaced fractures of the neck of the femur with good short-term results with regard to pain relief, return to activity, morbidity and mortality. An improperly implanted bipolar prosthesis creates more problems with one of the options being a Girdlestone arthroplasty. And the decision of reconstruction of girdle stone hip is a tough one to make. Adequate relief is usually achieved with Girdlestone pseudoarthrosis. Most of the patients do not achieve more than a reasonable result. With the following treatment option we report this case of reimplantation with total hip arthroplasty in Girdlestone hip.

Case report
An adult male aged 60 years reported to the outpatient department with complaints of limp and shortening of the right lower limb for the previous one year. The patient had sustained fracture neck of femur following fall while working one and half years ago [Figure 1]. He had undergone cemented bipolar hemiarthroplasty for the same [Figure 2]. The old post operative x-rays showed a bipolar prosthesis with extravasation of cement from proximal femoral aspect.

The patient gave history of lengthening of the operated limb, which he noticed on day one. He had continuous dull aching pain in the right hip with stiffness for a period of six months from the day of surgery. He was advised removal of bipolar prosthesis for pain relief. Patient underwent the procedure [Figure 3]. Since one year he has been walking with pain, limp, shortening and instability.

The recent X-ray of the hip [Figure 4] showed gross proximal migration of femur with porotic greater trochanter and cement mantle without any signs of loosening.

The patient was thoroughly investigated to rule out any signs underlying infection. The markers of infection: CRP was negative and ESR was around 25mm at the end of one hour. The hip joint aspiration was done under C-arm guidance was done and sent to microbiology to rule out any infective collection; the tap was negative. Later an MRI scan of the hip was also done which showed gross proximal migration of the trochanter which was porotic; the cement mantle was seen in the MRI.
With operative plan of removal of cement mantle and total hip arthroplasty with or without extended trochanteric osteotomy, patient was posted for surgery. The standard posterior approach was used to expose the hip joint. The acetabulum was filled with hard fibrous tissue which was completely cleared and acetabular floor was prepared. Once the preparation of acetabulum was done the proximal femur was exposed without trochanteric osteotomy. The cement mantle in the proximal part of shaft was removed with some effort enblock, but the distal mantle was impacted in the shaft. The mantle was drilled with 3.2mm drill bit, to remove it in piece meal. But the peripheral part was integrated very well with the canal. The K-nail reamers of 6.0mm, 7.0mm and 8.0mm were used to gradually remove the mantle, in the attempt the antero-lateral wall of the femur was breached. The breach in the wall, which was about 6mm in diameter was identified immediately and the exposure was further extended to visualize it. The break in the cortex was used to remove the distal part of the cement mantle. Once the cement was completely removed the femoral canal was prepared. Long cemented stem was planned to bypass the cortical breach by atleast 2 cortical diameters. An undisplaced split in the trochanter was stabilized using a cable.

The trial prosthesis was placed and reduction was attempted. It was noted that inspite of adequate soft tissue release the reduction was not achievable, unless the vertical offset was decreased. Hence an on table decision
of placing the stem deeper in the shaft, accepting the shortening was made. Uncemented acetabular cup with cemented revision stem total hip arthroplasty was done [Figure 5].

The immediate post operative period was uneventful and he was made to walk with support on the third day. The patient was doing well at present with shortening of the limb of about 2.5cms compensated by a heal rise.

**Discussion:**

Better results with total hip arthroplasty in Girdlestone hips can be expected in cases where more bone on the proximal femur can be preserved. In this case where the proximal femur was completely intact was ideal for conversion into total hip arthroplasty. However the muscle strength around the hip in such cases which are operated multiple times is difficult to assess. It is important to explain guarded prognosis of the procedure beforehand to the patient.

**References**

Neurological outcome following early spine stabilization and decompression in thoraco-lumbar fractures.

Bakul Arora, Edward Nazareth

Abstract

Background: Vertebral column injuries are reported to occur in approximately 6% of trauma patients, with half of these patients (2.6%) sustaining spinal cord or nerve root level neurologic injury. A sub optimally managed spine injury with a neurologic deficit may permanently impair a patient’s function and quality of life. The timing of treatment of unstable fractures and fracture-dislocations of the thoracic and lumbar spine has long been controversial. Hence we conducted a study to evaluate the benefits of early stabilization of fractured thoraco-lumbar vertebral column and its effect on neurological functions.

Material and methods: This prospective study includes twenty adult patients who sustained thoraco-lumbar fracture with neurological deficit and underwent spine stabilization and decompression within 24 to 48 hours at the department of orthopaedics in Father Muller Medical College, Mangalore from April 2009 to April 2011. Patients were evaluated and assessed post-operatively at 1 month, 3 months and 6 months for neurological improvement. A posterior midline incision was used with the patient in prone position. Stabilization using pedicle screw fixation system and decompression were done. Patient’s immediate post operative neurological status was documented. At the time of discharge neurological status was documented again. Patient advised follow up at 1 month, 3 months and 6 months. Neurological assessment was done and data recorded. The Frankel’s system was used for grading neurological status.

Results: Mean time since injury at presentation to hospital was 10 hours (range 4 – 15 hours). Mean interval between injury and surgery was 15 hours (range 6 – 23 hours). Neurological improvement was seen in 16 patients (80%) which is statistically significant (P value < 0.005). None of the patients had postoperative worsening of the neurological status. All patients (20%) who did not improve were complete paraplegics and had translational injury with complete transection of cord. Correlation coefficient between neurological improvement and time interval of injury and surgery is a minus figure (-0.15) which means that when the time interval increases, the neurological improvement decreases.

Conclusion: Early spine stabilization and decompression will improve the neurological outcome provided the pre-op MRI rules out cord transection.

Introduction

Vertebral column injuries are reported to occur in approximately 6% of trauma patients, with half of these patients (2.6%) sustaining spinal cord or nerve root level neurologic injury. Fractures of thoracolumbar spine are commonly due to fall from height, road traffic accidents, and sports injuries. These fractures are commonly associated with neurological sequel like motor and sensory disturbances, bladder and bowel disturbances, erectile dysfunctions, deformities like kyphosis and scoliosis. Many of them are also prone for bed sores, pulmonary infections as late complications. Indeed, a sub optimally managed spine injury with a neurologic deficit may permanently impair a patient’s function and quality of life. The timing of treatment of unstable fractures and fracture-dislocations of the thoracic...
Material and methods

Source of data:

This prospective study includes twenty adult patients who sustained thoraco-lumbar fracture with neurological deficit and underwent spine stabilization and decompression within 24 to 48 hours at the Department of Orthopaedics in Father Muller Medical College, Mangalore from April 2009 to April 2011. Patients were evaluated and assessed post-operatively at 1 month, 3 months and 6 months for neurological improvement. Patients with polytrauma and pathological fractures were excluded from the study.

Patients were stabilized and resuscitation methods given when needed in the casualty. Primary survey was done to identify site of fracture and associated injuries. Level of neurological involvement was identified and recorded. Neurological grading was done using Frankel’s system. Associated injuries were ruled out. Radiographic diagnosis was established using x-rays in two planes of the thoracolumbar spine. Fractures were classified according to Denis classification system. Pre-op MRI and was done to assess the nature of cord injury. Patients were kept nil per oral from the time of admission until 24 hours after surgery and during this period steroid treatment was started. Patients received intravenous fluids and pain management treatment. Surgery was done within 24 to 48 hours of injury.

and lumbar spine has long been controversial. Many authors, such as Guttman and Bedbrook, advised nonoperative treatment, but later reports, such as those by Levine and Edwards; Bohlman; Bradford et al.; McAfee, Bohlman, and Yuan; Luque, Cassis, and Ramirez-Wiella; Eismont et al.; and Cotrel Dubousset & Guillaumat, have emphasized the advantages of open reduction and rigid internal fixation with posterior instrumentation. Among posterior instrumentations pedicle screw instrumentation is now preferred because of easy surgical exposure and less risk of injuring cord. Even pedicle screw instrumentation is associated with complications like inappropriate positioning of screws, failure of synthesis material, damage to nerve roots, spinal cord, cauda equina, dural tear, blood loss, infections, pseudoarthrosis.

Various studies have mixed opinion regarding neurological improvement and restoration of vertebral body height and spinal canal diameter and also regarding complication rates following pedicle screw instrumentation. Marvin R Leventhal writes that “these instruments are still the subject of considerable controversy.”

This study is to evaluate the benefits of early stabilization of fractured thoraco-lumbar vertebral column and its effect on neurological functions.

Figure 1 & 2 : (Case 1) Pre-operative & post-operative X-rays

Figure 3 & 4 : (Case 2) Pre-operative & post-operative X-rays
A posterior midline incision was used with the patient in prone position. Stabilization using pedicle screw fixation system and decompression were done. Patient’s immediate post operative neurological status was documented.

Pre operative anti-biotic coverage was given and wound inspected on third and sixth day. Sutures were removed on the twelfth day if the wound had healed. Patients were taught deep breathing exercises and mobilisation of lower limbs. Patient was made to sit using thoraco-lumbar orthosis (Knight Taylor brace or spinal jacket).

At the time of discharge neurological status was documented again. Patient advised follow up at 1 month, 3 months and 6 months. Neurological assessment was done and data recorded. Frankel’s system was used for grading neurological status.

**Results**

Twenty four patients matched the inclusion criteria for the study; however, 4 were lost to follow up. Of the 20 patients included in the study group, 19 (95%) were males and 1 female with a mean age of 33 years (range 18 – 66 years). Except the female patient who was a student, all were either manual labourers, agriculturist or construction site workers. The most common mode of injury was fall from height (85%).

Two patients (10%) had road traffic accident and 1 patient (5%) had a direct trauma to the back when a log of wood fell on his back. Thoraco-lumbar junction was found to be most common site of injury with 9 patients (45%) sustaining injury at T11, 5 patients (25%) at L1 and 4 patients (20%) at L2. One patient (5%) had injury at T4 and T9 each.

Thoraco-lumbar junction was found to be most common site of injury with 9 patients (45%) sustaining injury at T11, 5 patients (25%) at L1 and 4 patients (20%) at L2. One patient (5%) had injury at T4 and T9 each.

Eight of the patients (40%) had stable burst fracture with cord edema, 5 patients (25%) had wedge compression fracture with cord edema, 3 patients (15%) had unstable burst fracture with a retropulsed fragment causing cord compression and 4 patients (20%) had translational injury with complete cord transection.

In the study group, patients with stable fractures were found to be associated with only cord edema – 13 patients (65%). Unstable fractures were found to cause cord compression or transection. Eleven patients (55%) had incomplete paraplegia and 9 patients (45%) had complete paraplegia.

Mean time since injury at presentation to hospital was 10 hours (range 4 – 15 hours). All patients underwent early spine stabilization and decompression within 24 hours of presentation. Mean interval between injury and surgery was 15 hours (range 6 – 23 hours).

Neurological improvement was seen in 16 patients (80%) which is statistically significant (P value < 0.005). None of the patients had postoperative worsening of the neurological status.

Of the 9 patients with complete paraplegia, 5 showed neurological improvement. Two patients improved to grade B and 2 to grade C and 1 to grade D. The mean improvement of 0.8 Frankel grade.

Among the 11 patients with incomplete paraplegia, all had neurological improvement. Only 1 patient had Frankel grade C at the end of 6 months study period, rest 10 patients improved to Frankel grade D or E. Mean improvement of 1.8 Frankel grades.

All patients (20%) who did not improve were complete paraplegics and had translational injury with complete transection of cord.

Correlation coefficient between neurological improvement and time interval of injury and surgery is a minus figure (-0.15) which means that when the time interval increases, the neurological improvement decreases.
Discussion

Fractures of thoracolumbar spine occur following major trauma such as fall from height, road traffic accidents, or blow from heavy object. It usually affects young male individuals.

In this study it was found that most of the patients were males with the mean age of 33 years. The mechanisms of injury being fall from height due to occupation hazard.

Harrington\(^4\) in his study found that thoracolumbar fractures most commonly occurred in T12 and L1 levels. McAfee\(^5\) observed wedge compression fractures in 12%, stable burst fractures in 18%, unstable burst fractures in 30%, chance fractures in 4% flexion distraction in 4% translation injuries in 11%.

Out of 20 patients included in this study, 11 patients (55%) had incomplete paraplegia and 9 patients (45%) had complete paraplegia. Thoraco-lumbar junction was found to be the most common site of injury with 9 patients (45%) sustaining injury at T11, 5 patients (25%) at L1 and 4 patients (20%) at L2. One patient (5%) had injury at T4 and T9 each.

Eight patients (40%) had stable burst fracture with cord edema, 5 patients (25%) had wedge compression fracture with cord edema, 3 patients (15%) had unstable burst fracture with a retropulsed fragment causing cord compression and 4 patients (20%) had translational injury with complete cord transection. There were no flexion distraction and chance fractures in this series.

In the study group, patients with stable fractures were found to be associated with only cord edema – 13 patients (65%). Unstable fractures were found to cause cord compression or transection.

The effect of the timing of spinal fixation on neurologic outcome has been extensively debated in the literature.\(^6\)\(^-\)\(^{13}\) The timing of the surgical stabilization of spinal column injuries, whether early or late, continues to be controversial, especially since major traumatic spinal injury is usually associated with polytrauma.\(^14\)

Trauma surgeons have espoused the belief that early stabilization of spinal fractures produces better results as it allows for prompt mobilization of patients. This in turn will reduce complications and decrease length of stay. There has been a limited amount of work in this area and the concept remains controversial.\(^15\)

The timing of surgery is usually classified as early, less than 72 hours, or late, greater than 72 hours. The basis of this time delineation was likely based on pre-clinical studies that showed that early decompression of acute spinal cord injury led to improved neurologic recovery.\(^14\)

McLain and Benson\(^16\) prospectively looked at the safety of urgent spinal stabilization (<24 hours) as compared with those that had early spinal stabilization (between 24 and 72 hours) in patients with severe injury. Unexpectedly, they noted better neurologic outcome in patients undergoing urgent stabilization. Although the study was small (27 patients), and did not analyze the influence of spinal cord injury, it suggests that urgent stabilization (<24 hours) in severely injured patients is at least as safe as delaying surgery more than 24 hours.

Cengiz\(^17\) et. al. reported in a recent quasi-randomized prospective study of 27 spinal fractures that patients who underwent early surgery had a trend toward better neurologic outcomes, shorter hospital stays, shorter intensive care unit stays and lower complication rates.

There is evidence within the literature that early surgical stabilization leads to shorter hospital stays, shorter intensive care unit stays, less days on mechanical ventilation and lower pulmonary complications. This effect is more evident in patients who have more severe injuries. This benefit is seen in both cord injured and non-cord injured patients. There is also some evidence that early stabilization does not increase the complication rates compared to late surgery. Even so, any reduction in these non-neurologic outcomes may result in significant clinical and financial benefits to the patient and the health care system.
Unfortunately, in clinical trials, there is no clear evidence to support early surgical decompression in improving neurologic outcomes. Prospective randomized clinical trial by Vaccaro\textsuperscript{10} \textit{et. al.} showed no benefit with early surgery compared to late surgery.

McKinley\textsuperscript{18} \textit{et. al.} noted no significant differences in neurological or functional changes between surgical groups managed early versus late.

Experimental studies have suggested that early fracture stabilization may be advantageous for outcome of neurologic deficits.\textsuperscript{18,19} Similarly, a meta-analysis recently performed by La Rosa\textsuperscript{21} demonstrated a benefit from early decompression compared to late decompression or conservative treatment.

In this study, all patients underwent early spine stabilization and decompression within 24 hours of presentation. Mean interval between injury and surgery was 15 hours (range 6 – 23 hours). Neurological improvement was seen in 16 patients (80%) which is statistically significant (P value < 0.005). None of the patients had postoperative worsening of the neurological status.

Table 1: Neurological improvement

<table>
<thead>
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<td>A - 4</td>
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<td></td>
<td>B - 2</td>
<td>B - 3</td>
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<tr>
<td></td>
<td>C - 1</td>
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<td>D - 1</td>
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<td>E - 0</td>
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<th>Preop Frankel A</th>
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<th>@3 months</th>
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<tbody>
<tr>
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<td>B - 2</td>
<td>B - 1</td>
<td>B - 0</td>
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<tr>
<td></td>
<td>C - 2</td>
<td>C - 2</td>
<td>C - 1</td>
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<tr>
<td></td>
<td>D - 1</td>
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<td>E - 1</td>
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<th>Preop Frankel A</th>
<th>@1 month</th>
<th>@3 months</th>
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<td>C - 1</td>
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<tr>
<td></td>
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<th>Preop Frankel A</th>
<th>@1 month</th>
<th>@3 months</th>
<th>@6 months</th>
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<td>Total no. of patients - 6</td>
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<td></td>
<td>E - 0</td>
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</table>
Mean improvement of 0.8 Frankel grade was noted following complete paraplegia and 1.8 Frankel grades following incomplete paraplegia. All patients who did not improve were complete paraplegics and had translational injury with complete transection of cord.

Correlation coefficient between neurological improvement and time interval of injury and surgery is a minus figure (-0.15) which means that when the time interval increases, the neurological improvement decreases.

The use of methylprednisolone in the immediate postinjury phase has been shown to improve outcomes in the National Acute Spinal Cord Injury Study (NASCIS)22, but this improvement has not been substantiated in their studies and its role remains controversial. All patients in this study received some form of steroid therapy, depending upon their affordability.

Surgery is typically employed in patients with unstable injuries and significant neurological deficits. Laminectomy alone is not recommended for decompression of spinal column injuries in that it can further destabilize the spine23.

Primary goals in thoracolumbar trauma patients are preservation of remaining spinal cord function, restoration of spinal alignment, achievement of pain-free fracture site, maximum neurological recovery, and early rehabilitation. This can be achieved by optimizing neural decompression while providing stable internal fixation over the least number of spinal segments24. The pedicle screw rod systems, by virtue of direct fixation through middle and anterior columns, are able to reduce fractures of these columns by ligamentotaxis25-29.

Transpedicular screw rod construct is currently the standard in segmental fixation of thoracolumbar spine28,31,32. Posterior surgery with pedicle screw constructs over a short segment stabilizes the fracture and allows early mobilization.

All patients in this study underwent spine stabilization using pedicle instrumentation and posterior decompression, via posterior midline approach. Postoperatively, patients were taught deep breathing exercises and mobilisation of lower limbs. Patient was made to sit using thoraco-lumbar orthosis (Knight Taylor brace or spinal jacket). Frankle’s grading system was used in determining the neurological outcome.

**Summary**

In this study it was found that most of the patients were males with the mean age of 33 years. The mechanisms of injury being fall from height due to occupation hazard. Eleven patients (55%) had incomplete paraplegia and 9 patients (45%) had complete paraplegia. Thoraco-lumbar junction was found to be most common site of injury. Stable burst fracture with cord edema being the commonest presentation.

All patients underwent early spine stabilization and decompression within 24 hours of presentation. Mean interval between injury and surgery was 15 hours (range 6 – 23 hours). All patients received some form of steroid therapy, depending upon their affordability. Pedicle instrumentation and posterior decompression were done via posterior midline approach. Postoperatively, patients were taught deep breathing exercises, mobilisation of lower limbs and made to sit using thoraco-lumbar orthosis. Frankle’s grading system was used in determining the neurological outcome.

Statistically significant improvement in neurological status was noted. Mean improvement of 0.8 Frankle’s grade following complete paraplegia and 1.8 Frankle’s grades following incomplete paraplegia.

All patients who did not improve were complete paraplegics and had translational injury with complete transection of cord. Correlation coefficient between neurological improvement and time interval of injury and surgery is a minus figure (-0.15) which means that when the time interval increases, the neurological improvement decreases.
Conclusion

At the end of this study, it is worth highlighting the importance of ascertaining the extent of spinal cord injury by MRI on an urgent basis. Complete cord transection has a grave prognosis on the neurological outcome and the surgical stabilization must be aimed to improve rehabilitation. In the back drop of cord edema or severe cord compression, early stabilization and decompression will improve the neurological outcome.

However, it is prudent to individualize the timing decision to make sure that the patients are appropriately resuscitated, and that their medical condition is optimized before operative spinal stabilization.34

Regardless of the timing of spinal fixation, it is also important to promptly mobilize these patients postoperatively and to provide appropriate critical care, physical therapy, pulmonary toilet, and rehabilitation to reduce length of stay and resource utilization.15

References

18. Mckinley et. al. Outcomes of Early Surgical Management Versus Late or No Surgical Intervention After Acute Spinal


Conservative treatment of cervical spine injury - An analysis

Mohammad Sharjeel Rasheed, B. Seetharama Rao

Abstract

Background: Cervical spine injury is common and difficult to manage. The present study aims to find ways to decrease the incidence and to analyse the neurological pattern of recovery after conservative treatment.

Materials and Methods: 43 patients who presented with acute injury to cervical spine were examined clinically and radiologically and treated with skeletal traction immobilization and neurological recovery was assessed by Frankel grading system.

Results: Most common mode of injury was fall from height. Most common dislocation occurred at C6-C7. Mortality rate was 14%. 75% patients showed neurological recovery with best prognosis seen in C6-C7 dislocation and with MRI suggesting cord oedema.

Conclusion: As fall from tree forms commonest mode of injury, steps should be taken to provide appropriate safety measures. Cause of death in majority is complication of bedridden state, so proper care is required to prevent it.

Introduction

Cervical spine injury is a life threatening condition that requires a coordinated multidisciplinary approach to manage the injury itself and the potential secondary complications satisfactorily. Yet acute management of the cervical spine injury and more so long term management is inadequate due to financial constraints and account for a major cause of death and disability and have become a growing challenge and public catastrophe for the health care system. Moreover, this injury has always been a grey area regarding management, prognosis and outcome. Surgical treatment is available at tertiary care centres and often due to lack of expertise and financial constraints these injuries are treated conservatively. The purpose of this study is to analyse epidemiology in order to set preventive measures and to analyse pattern of neurological recovery.

Material and methods

This prospective study included 43 patients with cervical spine injury between June 2010 and September 2012. Patients with closed injury to cervical spine with or without neurological deficit were included and patients who reported after 48 hrs of injury were excluded. Holdsworth classification was used to classify mechanism of injury. Sensory level was determined based on the appreciation of pin prick and light touch in all dermatomes of the body. Motor level was determined based on testing of muscles in all myotomes in a rostral-caudal sequence. For evaluating the progress of neurological injury Frankel grading was employed at the time of admission and at every subsequent follow up. At the time of admission roentgenograms Antero-Posterior and Lateral views were taken to evaluate the site and type of injury. CT scan and MRI were done in selected cases.

Cervical traction was applied with Crutchfield tongs. In patients with dislocation weight was increased at one hour interval and portable lateral x-ray was taken to assess reduction. If reduction was not achieved gentle
manipulation was done. After an average duration of 6 weeks traction was removed and Lateral roentgenogram in flexion and extension was taken to determine the stability of vertebra. The patient was then fitted with a Philadelphia collar and mobilised and followed up for an average period of 1 year.

**Results**

A series of 43 patients were analysed. Among them 14% (6) patients died during the study and 3 patients could not be followed upto 1 year. 88% patients were male. 58% of patients were in the age group 31-50 years with average age being 43 years. The commonest mode of injury in this study was Fall from height (40%), followed by slip and fall (30%) and motor vehicle accidents (30%). About half of the lesions were incomplete (49%) and 37% were complete, while in 14% cases these was no neurological deficit despite having bony injury. Majority of the lesion were caused by flexion rotation injury, among which 46% had complete and 66% had incomplete lesion.

In majority of patients the mechanism of injury was flexion-rotation (63%), least common being axial compression (9%). 53% of patients had dislocation with 45% dislocating at C6 –C7 level and 29% at C5 – C6 level. Frankel grade C was the commonest (35%) neurological status at admission and in 14% patients there was no neurological deficit. 75% patients with flexion-rotation mechanism had grade A, B or C at admission reflecting greater morbidity in these injuries. 55% of patients with fracture dislocation had grade A at admission, while 83% of the patients with no radiological abnormality had grade C or better. Dislocation at C6 – C7 level had least deficit with 35% patients in grade E and 85% had incomplete injury, while in C3 – C4 dislocation 75% had grade A injury.

**Table 1** Showing distribution of patients among various bony level of injury

<table>
<thead>
<tr>
<th>Level of injury</th>
<th>C4</th>
<th>C5</th>
<th>C3-C4</th>
<th>C4-C5</th>
<th>C5-C6</th>
<th>C6-C7</th>
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<tr>
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<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Neurological recovery by Frankel grade at follow up</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>By 1</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>6</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>By 2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>By 3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

80
There were 6 deaths (14%) during the study period. One patient died after 7 months, while others died within 3 weeks. All patients had grade A injury. 2 patients died due to respiratory failure after 1 day and 4 days respectively as a result of fracture dislocation at C3-C4 level. Rest of them died due to complications of bed ridden state.

MRI was done in 15 cases and cord contusion was found in 40% (6 cases), while in 33% (5 cases) cord compression and another 46% (7 cases) cord oedema was found. In 53% (8 cases) of cases disc osteophyte complex was found. In 4 cases there was no radiological abnormality and disc osteophyte complex was the only finding on MRI causing compression of cord. So, traumatic disc protrusion can be a major cause of neurological lesion despite normal bony elements.

In 75% of patients there was neurological improvement. Among which 54% showed improvement by grade 1 and 18% showed improvement by grade 2, while 12 % cases showed full recovery. Improvement was least in axial compression injuries as 75% did not show improvement, while 100% of Flexion injuries showed improvement. Chance of improvement was least in higher lesions, while in C5-C6 dislocation 87% improved and in C6-C7 dislocation all patients showed improvement.

**Discussion**

The management of cervical spine injuries has always been debatable regarding surgical and conservative management\(^4\,5\,6\). A detailed understanding of the epidemiological, demographic and pathological features of cervical spine injuries is vital to directing further system development, identifying the greatest potential for injury prevention and setting priorities for resource management which is a limiting factor in a developing country. Males were most commonly affected probably due to the greater time spent outdoors. Commonest mode of injury in this study was fall from height (40%) which is different from

<p>| Table 2: Neurological improvement by Frankel grades. No. Of patients |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|</p>
<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>At admission (Column)</td>
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<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>-------</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>B</td>
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<td>-</td>
<td>6</td>
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<td>C</td>
<td>4</td>
<td>9</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

...
other series where motor vehicle accidents contribute for majority of cases. In the region where this study was conducted climbing to coconut tree is a common profession and fall contributed to majority of cases. This can very well be avoided if there is awareness and proper precautionary measures are taken while climbing the tree. Paramedical as well as primary health care givers should be trained properly to suspect cervical spine injuries and take proper care in handling and shifting the patients and arranging quick transfer of such patients to tertiary care centers. About half (49%) the lesions were incomplete which is similar to series by Kiwerski (1991)

Among 6 deaths, only two were due to respiratory failure as a result of cervical cord injury, while rest 4 died due to complications of bedridden state. Mortality in cervical spine injuries is mostly due to non ambulatory status and not due to cord injury especially in low cervical cord injury. So, there is need for better patient care and to make patients ambulant with support as soon as possible. High mortality due to immobilization perhaps make early stabilization and mobilization a better option. In

incomplete cervical spine injuries in which initial neurological assessment shows Frankel grade B or C, prognosis is often good and aggressive treatment should always be given either conservatively or surgically so that spinal cord can get a proper environment for its recovery. Equally important is the medical management of the complications, which in most of the cases is the cause of death rather than spinal injury per se. Similarly if the level of lesion is lower cervical spine, especially C6-C7, or if MRI shows cord edema, the prognosis is usually good and treatment should be aggressive.
References

Perioperative complications associated with total joint replacement surgery

Mukartihal Ravikumar, P Harish, Anvekar Praveen, Patil Sharan

Abstract

Background

Globally numbers of total joint replacement done are increasing every day. The fastest growth, occurring in Asian Countries especially India. Recent improvements in surgical and anesthesia technique mean that TJR is being offered to sicker patients with multiple co-morbidities. With growing emphasis on shorter hospital stay and early discharges the duration of hospital stay has been reduced to 3-5 days as compared to much longer periods of hospital stay in the olden days so much so that talks of TKR as day care surgery is already surfacing. Hence we undertook this study to recognize the changing dynamics of the incidence, timing and severity of these complications while ensuring that early patient discharge is a safe practice. Also trying to determine the risk group which may additionally need proper optimization before and after surgery.

Methods

We evaluated the systemic and local complications associated with primary elective total hip and knee arthroplasty at our institution from January 2010 to December 2010. During this period a total of 315 hip and Knee Arthroplasties had been performed in 255 patients. All the patients who underwent TJR were evaluated with strict pre operative evaluation forms in terms of general health checkup. The hospital course of the patients was followed very closely and any complications identified by treating surgeon were recorded. The details of the intervention were also noted. Sutures were removed on 14th POD and were followed at 6 weeks, 3 months, 6 months and one year respectively. Patients were followed with telephonic questionnaires from the day of discharge till 6th week to closely monitor systemic complications.

Results

There were a total of 85 complications in 57 patients. These included 72 systemic complications and 13 orthopaedic complications. The major systemic complication included non fatal MI, acute renal failure and two pulmonary embolisms. All the patients who had complications were associated with one or more co-morbidities. The peak incidence of complications was seen at 24-48hrs after the surgery. 15% of the complications were orthopedic related in terms of hip dislocation, delayed wound healing and nerve palsies.

Introduction

Total joint arthroplasty represents one of the greatest advances in modern orthopaedic surgery and continues to be one of the safest and the most effective surgical procedures. Globally numbers of total joint replacement done are increasing every day. The fastest growth, occurring in Asian countries especially India. Nevertheless, hip and knee arthroplasty have been associated with several serious potential complications and occasionally even with death.

Improvements in surgical and anesthesia techniques has contributed to a marked reduction in mortality after elective joint arthroplasty. However longer life expectancy in general and better survival of patients with cardiac and other systemic illnesses in particular has meant that joint arthroplasties are being catered to a population who are at a higher risk for complications. This would mean better
optimization of patients before surgery and close monitoring in the immediate postoperative period, perhaps even longer duration of stay especially in countries like India where medical surveillance at the place of residence as well as patients understanding of medical conditions is not at par with the west. In contrast to this, there is a growing trend for shorter hospital stays so much so that talks of joint replacement surgeries as a day care surgery are also being contemplated, in part because of patients’ expectation for faster recovery and also the ever growing need for cost control. Hence we undertook this study to recognize the changing dynamics of the incidence, timing and severity of these complications and its impact on the growing trend for early discharge. It is also an attempt to determine the risk group which may need additional proper optimization before and after surgery.

Materials and methods

All patients undergoing elective primary total hip or knee arthroplasty at our institution from January 2010 to December 2012 were recruited into the study. Institutional review board approval was obtained for the study. During this period, a total of 315 consecutive primary total joint replacements performed in 255 patients. This included 273 knee replacements and 42 hip replacements. The primary joint arthroplasties had been performed in 110 male patients with a mean age of sixty-four years (range, 28 to 88).

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Number of patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30</td>
<td>4</td>
<td>1.6</td>
</tr>
<tr>
<td>31-40</td>
<td>6</td>
<td>2.4</td>
</tr>
<tr>
<td>41-50</td>
<td>36</td>
<td>14.1</td>
</tr>
<tr>
<td>51-60</td>
<td>60</td>
<td>23.5</td>
</tr>
<tr>
<td>61-70</td>
<td>107</td>
<td>42.0</td>
</tr>
<tr>
<td>71-80</td>
<td>40</td>
<td>15.7</td>
</tr>
<tr>
<td>81-90</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Total</td>
<td>255</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Mean ± SD: 61.22 ± 10.64
Table 2: Gender distribution of patients studied

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number of patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>110</td>
<td>43.1</td>
</tr>
<tr>
<td>Female</td>
<td>145</td>
<td>56.9</td>
</tr>
<tr>
<td>Total</td>
<td>255</td>
<td>100.0</td>
</tr>
</tbody>
</table>

80 years) and 145 female patients with a mean age of sixty-six years (range, 30-70 years). This study included only patients undergoing primary total joint arthroplasty.

All patients who underwent elective joint arthroplasty at our institution underwent detailed preoperative evaluation that captured detailed data including demographic information, past medical and surgical history, medication history, and the functional status.

In-hospital course

A standardized and detailed form intended to capture all medical and orthopaedic complications was devised. This form was completed on a daily basis for every patient who underwent elective joint arthroplasty. The hospital course of the patients was followed very closely, and any complications identified by the treating doctor or evident on a laboratory test or other investigations were recorded. The details of any medical or surgical intervention were also noted.

Table 3: Complications

<table>
<thead>
<tr>
<th>Major complications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Myocardial infarction:</td>
<td>1</td>
</tr>
<tr>
<td>2. Renal failure:</td>
<td>1</td>
</tr>
<tr>
<td>3. Pulmonary embolism:</td>
<td>- 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other general complications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Deep venous thrombous</td>
<td>2</td>
</tr>
<tr>
<td>2. Electrolyte imbalance</td>
<td>18</td>
</tr>
<tr>
<td>3. Exacerbation of COPD</td>
<td>07</td>
</tr>
<tr>
<td>4. Nausea, vomiting, itching</td>
<td>11</td>
</tr>
<tr>
<td>5. Gastrointestinal problems</td>
<td>03</td>
</tr>
<tr>
<td>6. Urinary tract infections</td>
<td>27</td>
</tr>
</tbody>
</table>

Surgical data

Regional anesthesia, unless it was contraindicated, was used for all patients who had elective arthroplasty. All total knee arthroplasties were performed through a medial parapatellar arthrotony. All hip arthroplasties were performed through an anterolateral approach with the patient in the supine position. All operations were performed by or under the close supervision of one orthopaedic surgeon. Joint replacements were carried out in a laminar flow room with standardized aseptic practices. All patients in the cohort who underwent TKR / THR were treated with the standardized postoperative protocols as described.

Postoperative care

All patients were followed closely by an internist. All Patients were routinely admitted to the intensive care unit or a step-down unit with continuous electrocardiogram

Table 4: Incidence of complications

<table>
<thead>
<tr>
<th>Incidence of complications</th>
<th>No.of patients (n=255)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>198</td>
<td>77.6</td>
</tr>
<tr>
<td>Present</td>
<td>57</td>
<td>22.4</td>
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<tr>
<td>· Electrolyte imbalance</td>
<td>18</td>
<td>7.1</td>
</tr>
<tr>
<td>· UTI</td>
<td>27</td>
<td>10.6</td>
</tr>
<tr>
<td>· Vomiting/Itching/Nausea</td>
<td>11</td>
<td>4.3</td>
</tr>
<tr>
<td>· Diarrhoea</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td>· Exacerbation of COPD</td>
<td>7</td>
<td>2.7</td>
</tr>
<tr>
<td>· Others</td>
<td>8</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Table 5: Orthopaedic complication

<table>
<thead>
<tr>
<th>Orthopaedic complication</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Delayed wound healing</td>
<td>- 06</td>
</tr>
<tr>
<td>2. Superficial wound infection</td>
<td>- 03</td>
</tr>
<tr>
<td>3. Nerve palsy</td>
<td>- 02</td>
</tr>
<tr>
<td>4. Post op dislocation</td>
<td>- 02</td>
</tr>
</tbody>
</table>
monitoring and dedicated nursing care (two days for bilateral and one day for unilateral cases), monitoring of the respiratory rate, heart rate, blood pressure, and pulse oximetry was carried out at frequent intervals by the nursing staff. Any changes in these parameters that were deemed to be clinically important were investigated.

Daily laboratory tests, including complete blood-cell count, renal function tests, blood chemistry, were performed. Additional tests, such as liver function tests, troponin levels, chest radiographs, electrocardiograms, and computerized tomography, were also ordered as deemed necessary for some patients.

Thromboembolic prophylaxis was given in the form of injlexane 5000 units was given for bilateral cases or in those who were at risk for developing DVT. Intravenous antibiotics, usually a second-generation cephalosporin, were administered preoperatively and for twenty-four hours following the surgery.

Table 6: Association of age with incidence of complications

<table>
<thead>
<tr>
<th>Age in years</th>
<th>No. of patients</th>
<th>No. of complications</th>
<th>Incidence</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30</td>
<td>4</td>
<td>1</td>
<td>25.0</td>
<td>0.901</td>
</tr>
<tr>
<td>31-40</td>
<td>6</td>
<td>2</td>
<td>33.3</td>
<td>0.522</td>
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<td>41-50</td>
<td>36</td>
<td>11</td>
<td>30.6</td>
<td>0.238</td>
</tr>
<tr>
<td>51-60</td>
<td>60</td>
<td>13</td>
<td>21.7</td>
<td>0.896</td>
</tr>
<tr>
<td>61-70</td>
<td>107</td>
<td>20</td>
<td>18.7</td>
<td>0.358</td>
</tr>
<tr>
<td>71-80</td>
<td>40</td>
<td>9</td>
<td>22.5</td>
<td>0.988</td>
</tr>
<tr>
<td>81-90</td>
<td>2</td>
<td>1</td>
<td>50.0</td>
<td>0.349</td>
</tr>
<tr>
<td>Total</td>
<td>255</td>
<td>57</td>
<td>22.4</td>
<td></td>
</tr>
</tbody>
</table>

Age is statistically associated with incidence of complications with P=0.02

Table 7: Association of gender with incidence of complications

<table>
<thead>
<tr>
<th>Gender</th>
<th>No. of patients</th>
<th>No. of complications</th>
<th>Incidence</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>110</td>
<td>23</td>
<td>20.9</td>
<td>0.706</td>
</tr>
<tr>
<td>Female</td>
<td>145</td>
<td>34</td>
<td>23.4</td>
<td>0.773</td>
</tr>
<tr>
<td>Total</td>
<td>255</td>
<td>57</td>
<td>22.4</td>
<td></td>
</tr>
</tbody>
</table>

Gender is not statistically associated with incidence of complications with p=0.630

Course after discharge

During the first postoperative visit, occurring usually at six weeks, the postoperative evaluation forms completed by the patient were collected. A form for capturing any complications that may have happened following discharge was also completed by the examining physician. The circumstances leading to the complications, if any and the details of the therapeutic intervention for each complication were recorded. As part of routine surveillance, patients who did not
Contacted by means of a detailed questionnaire sent by mail and then by a telephone call, if necessary.

**Definition of complications**

The complications were categorized into systemic and local. Furthermore, the complications were subcategorized as major systemic if they were deemed to be life-threatening and required complex medical intervention, or as major local if the complication necessitated additional surgical intervention or was deemed to result in temporary or permanent functional impairment. Minor complications were those that resulted in a prolonged hospital stay, necessitated additional observation such as monitoring of the wound, or required additional medical treatment such as blood transfusion or antibiotics.

Myocardial infarction was determined on the basis of an increase in the troponin level and/or electrocardiographic changes. Acute renal failure was defined as an abrupt decline in renal function parameters (increasing creatinine) with reduced urine output. Pulmonary embolus was diagnosed on the basis of the presence of emboli in the pulmonary vasculature as determined by multidetector computerized tomography. Anemia was thought to exist if the postoperative hemoglobin level of the patient, regardless of the preoperative hemoglobin level, had declined to <9 mg/dL. Persistent wound drainage was defined as more than 100ml of drainage from the wound more than forty-eight hours after the index surgery. Deep venous thrombosis was diagnosed with use of Doppler ultrasound and was categorized into distal and proximal clots.

**Statistical analysis**

Descriptive statistics and the Fisher exact test were used for analysis of categorical data. Continuous data were analyzed with use of descriptive statistics and the non-paired t test. Univariate regression analysis was performed on all risk factors for complications. Multiple logistic regression analysis was performed on all variables that were significant in univariate analyses. For the univariate analysis, a p value of < 0.1 was considered significant. For all other tests, a p value of < 0.05 was considered significant.
Incidence of medical complications

There were a total of 72 systemic complications. These included 4 major complications and 68 minor complications.

Myocardial infarction was seen in a 62 years old female on the 6th POD when she complained of chest pain. She was a known case of DM and HTN and was treated conservatively. Renal failure was seen in a 68 year male who was a known case of DM/HTN/Hypothyroidism and was detected with a high RFT on the second post op day. He recovered well after dialysis. Pulmonary embolism was seen in two patients on the second postoperative day and was treated conservatively with good recovery

Orthopaedic complications

There were a total of 13 orthopaedic complications.

Table 2: Orthopaedic complications

<table>
<thead>
<tr>
<th>No.</th>
<th>Delayed wound healing</th>
<th>Superficial wound infection</th>
<th>Nerve palsy</th>
<th>Post of dislocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>06</td>
<td></td>
<td></td>
<td>02</td>
<td>02</td>
</tr>
</tbody>
</table>

Table 10: Association of basic variables with incidence of complications

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. of patients</th>
<th>No. of complications (UTI)</th>
<th>Incidence</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>4</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>31-40</td>
<td>6</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
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<td>41-50</td>
<td>36</td>
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<td>11.7</td>
<td>0.782</td>
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<td>11.2</td>
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<td>12.5</td>
<td>0.696</td>
</tr>
<tr>
<td>81-90</td>
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<td>0</td>
<td>0.0</td>
<td>-</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>110</td>
<td>10</td>
<td>9.1</td>
<td>0.609</td>
</tr>
<tr>
<td>Female</td>
<td>145</td>
<td>17</td>
<td>11.7</td>
<td>0.667</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
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<td></td>
<td></td>
</tr>
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<td>18.0-25.0</td>
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<td>10.0</td>
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<td>0.793</td>
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<tr>
<td>30 &amp; above</td>
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<td>3</td>
<td>9.4</td>
<td>0.825</td>
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<tr>
<td>Co morbid conditions</td>
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<td></td>
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<td>DM only</td>
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<td>13.6</td>
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<tr>
<td>HTN only</td>
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<td>16.7</td>
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<td>Others</td>
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<td>14.3</td>
<td>0.653</td>
</tr>
<tr>
<td>Total</td>
<td>255</td>
<td>27</td>
<td>10.6</td>
<td>-</td>
</tr>
</tbody>
</table>
The maximum incidence of complications was seen from the second to fourth postoperative day.

**Risk factors for major complications**

A number of factors were analyzed with respect to their potential influence on the development of major medical complications. All the patients who had one or more associated co-morbidities

The risk of urinary tract infection did not show significant association with comorbid conditions.

Univariate analysis identified older age; a higher body-mass index; general anesthesia; and medical comorbidities, as measured by the American Society of Anesthesiology (ASA) score, to be important predictors of postoperative major complications. When these factors were subjected to multiple logistic regression analysis, age (odds ratio, 1.21; 95% confidence interval, 1.02 to 1.19), body mass index (odds ratio, 1.01; 95% confidence interval, 0.99 to 1.09), and ASA score (odds ratio, 0.76; 95% confidence interval, 0.55 to 1.2) were found to be important predictors of major complications.

**Discussion**

Substantial and parallel advances in the medical fields over the recent years have enabled a large number of patients with severe illnesses to enjoy longer life expectancy and to seek orthopedic care for their degenerative joints. Hence, total joint arthroplasty is currently being offered to some patients with severe comorbidities who may have been deemed inappropriate candidates during the early years of joint replacement. Despite the availability of this surgical procedure to sick and frail patients, the mortality and morbidity following total joint arthroplasty remains very low. Deaths and complications following joint arthroplasty, however, can and do occur. In recent years, minimally invasive surgery has become more popular. The advocates of minimally invasive surgery have cited reduced intraoperative blood loss; less perioperative pain; faster recovery; better incision cosmesis; and, more importantly, a shorter hospital stay as potential benefits. The mean length of stay following minimally invasive total hip arthroplasty was reported to be 1.9 days compared with 3.5 days for a standard hip arthroplasty. Berger and Duwelius proposed a “same day” discharge pathway for patients undergoing two-incision total hip arthroplasty. The minimally invasive arthroplasty, with the exception of some inherent differences in soft-tissue dissection, still involves surgical violation of the medullary canal with the potential for fat and marrow embolization. Furthermore, patients require the same degree of anesthesia as that needed for conventional joint replacement to allow the surgeon to perform the same bone cuts and insert the same implants as in conventional joint arthroplasty. Hence, any complications associated with a standard joint arthroplasty can conceivably occur after minimally invasive joint replacement. This raises a critical and worrisome concern: what influence does a shorter hospital stay have on the management of life-threatening complications if they were to occur outside the hospital? This study, which was designed with the intention of identifying in-hospital complications that may occur after elective joint arthroplasty, highlights some important findings. First, it demonstrated that a considerable number of life-threatening medical complications occur in 6% of the patients who have an elective joint arthroplasty. All of these complications were deemed to be life-threatening, as the lack of emergent medical intervention in the form of the administration of drugs and close monitoring could have resulted in catastrophic consequences. Even if one assumes that emergent medical care could have been provided for most of these patients if they were outside the hospital, one cannot overlook the relatively high incidence of cardiac complications in general and near-fatal arrhythmias (ventricular tachycardia) in particular that occurred in these patients. On the basis of the analysis of detailed data, we can confidently say that major complications, if they occurred outside the hospital, would have resulted in the death of twenty to twenty-five patients in this cohort. Another important finding of this study was
that for more than half (58%) of the patients who had a major complication, the complication could not have been predicted on the basis of the medical history. Hence, strategies such as close surveillance of so-called at risk patients may not identify other patients who may have life-threatening complications develop for the first time. Furthermore, all of these life-threatening complications occurred despite intensive and rigorous medical evaluation of all patients in this cohort. Finally, the present study demonstrated that the majority (>90%) of the fatal and near-fatal complications occurred during the early days and within the expected typical four-day hospital stay of a standard elective joint replacement (Fig. 1). The incidence of in-hospital mortality and major complications such as myocardial infarction in our cohort is similar to that in previous reports10,11. Furthermore, the risk factors identified in our study, namely old age and the history of coexistent diseases, also agree with the findings of previous studies10. An additional factor, increased body mass index, was identified as a possible etiological factor for an increased rate of complications. Although one may have intuitively selected any of the aforementioned as possible predisposing factors to systemic complications after total joint arthroplasty, it is important to recall that not all patients with near-fatal complications possessed these risk factors. As far as we know, none of these risk factors have been cited as contraindications for minimally invasive total hip arthroplasty. We deliberately excluded patients who had a revision or bilateral joint arthroplasty since, by strict criteria, they may not be considered as candidates for minimally invasive joint arthroplasty. Hence, any of the complications that were encountered in this cohort could occur in patients undergoing minimally invasive joint replacement. We invested extensive efforts to ensure that every complication occurring in the hospital and following discharge was captured. Despite the prospective nature of this study, it is possible, although unlikely, that some complications may have escaped detection particularly if they occurred following discharge. The latter, if true, would imply that the actual incidence of complications is higher than what is reported. We believe that the incidence of complications reported in the present study is likely to be affected by other factors. One important fact to consider is that this study was performed in a single, high-volume institution where standardized protocols are in place and patients receive a thorough preoperative medical evaluation and are followed diligently by internists postoperatively. Hence, it is plausible that the incidence of complications would be higher in centers if the aforementioned protocols were not in place. Conversely, the implementation of these protocols, in particular the routine measurement of pulse oximetry and the availability of modern imaging modalities such as multidetector computed tomography scanning, may have resulted in the detection of complications that might have otherwise gone unnoticed. We were also stringent with the definition of some complications such as anemia and wound drainage. The majority of the patients diagnosed as having anemia in this study did not receive a blood transfusion and were asymptomatic. A large number of patients with chronic disease who had a low preoperative hemoglobin level, and despite experiencing a small decrease in the hemoglobin level, were categorized as anemic. Similarly, a large number of patients in this cohort who were classified as having a draining wound would not have been classified as such in other centers. We had selected any drainage from the wound beyond forty-eight hours as the cut-off beyond which drainage was considered abnormal. Our findings raise concern and caution against the current strategies to reduce hospital length of stay after total reconstruction of a major joint in the lower extremity.

**Conclusion**

Although this study was not a randomized control study the findings in this study definitely indicate rise in complication rates especially when the patient has one or more co-morbidities. The risk group probably consists of patients with multiple co-morbidities, high BMI and older age. Our findings raise constrains and caution against current strategies to reduce hospital length of stay after TJR.
References


Osteochondritis dessicans- Primary fixation using bioabsorbable implants

Anand Galagali, Murlidhar Rao

Abstract
Introduction: Osteochondritis dissecans (OCD) is a localized condition where a section of articular cartilage and underlying subchondral bone separate from the joint space. It is important to diagnose unstable OCD early and fix the fragments primarily as the results of any surgical management at late presentations are guarded.

Case presentation: We present a girl aged 14 years who came with a history of acute pain, swelling, inability to bear weight on the right knee following a dance practice. MRI showed stage IV osteochondral fragment measuring 20x8mm. This was primarily fixed with bioabsorbable implants. 10 months follow up showed excellent results.

Conclusion: This case highlights the advantages of early primary fixation whenever possible as the results of microdrilling, abrasion chondroplasty and ACI are equivocal. By far, to our knowledge, this is the first case of successful treatment of stage IV OCD using bioabsorbable implants.

Keywords: Osteochondritis Dessicans, bioabsorbable implants, fixation. Osteochondral fractures, adolescent knee injuries, arthroscopy.

Introduction

Osteochondritis Dessicans (OCD) is a localized condition where a section of articular cartilage and underlying subchondral bone separate from the joint surface. If this involves a weight bearing surface it can progress to degenerative joint disease. The condition is found primarily in the knee, ankle and elbow joints. The knee is the most commonly affected, being involved in nearly 75% of cases. They are overuse injuries resulting from repetitive micro trauma. In children, they are seen in athletically active adolescents and 50-80% is seen on poster lateral aspect of medial femoral condyle. 15-20% of the times it is seen on lateral femoral condyle. Repeated stress and altered vascularity of subchondral bone result in localized osteonecrosis. These progresses through the stages of instability, nonunion and fragment separation. Acute osteochondral fractures differ from OCD lesions in that they result from single traumatic event. The vascularity is intact and 60-70% of the lesions are in the medial patellar facet. Recent papers report of successful treatment of OCD by internal fixation using bioabsorbable implants. Review of literature have shown few papers of stage 1,2 and 3 lesions of OCD being fixed primarily but this would probably be the first case of stage 4 lesion being fixed primarily by bioabsorbable implants.

Case report

This is a girl aged 14 years who presented with history of acute pain, swelling, inability to bear weight on the right knee following a dance practice. Clinically she had a hemarthrosis and restricted movement of the knee. Radiograph revealed a loose body in the lateral gutter and MRI/CT confirmed that it was an osteochondral fragment measuring around 20 x 8mm from weight bearing area of lateral condyle femur Fig.1 &2.

Considering the age of the patient, size of the fragment and weight bearing area, it was decided to do an open
reduction and internal fixation with bioabsorbable implants. 10, 11.

Arthroscopy was done 9th day after injury and the large defect on the femoral lateral condyle identified. The loose fragment was found in the lateral gutter. According to both Guhl’s classification12 and Ewing and Voto classification13 this was a stage IV lesion. It measured 20 x 8mm and consisted of smooth articular cartilage and subchondral bone (Fig.3). The cartilage was mildly frayed at the edges on one side but the surface looked smooth but pale. This was fixed back to the defect through mini arthrotomy. The raw area was curetted and prepared to accept the osteochondral fragment. A K-wire was used for temporary fixation of fragment. C-arm was not used as the lesion was visible through the arthrotomy incision. 1.5 mm bioabsorbable pin and a 2mm bioabsorbable cortical screw were used to securely fix the fragment. The child was kept non weight bearing for 6 weeks.

Static quadriceps exercises were started immediately post-surgery in cylinder cast. The cast was removed after 6 weeks and gentle active and passive knee mobilization was initiated. With this physiotherapy, full range of pain free movements was achieved by 10 weeks post-op. CT scan at the end of 9 months showed good alignment and fixation of the fragment (Fig. 4) and the child resumed dancing by 12 months post-surgery.

Discussion

OCD in adults could be the result of undiagnosed, untreated or conservatively treated juvenile onset osteochondritis. Cahill et al has shown that conservative treatment has failed in 40 out of 92 patients of juvenile OCD 14. The long term results of conservative or excision of fragments of lateral condyle end up with grade 2 or 3 OA at average follow up of 13 years.15

Many treatments have been tried for OCD, including removal of the fragment 16, drilling 17-19 and curettage of the crater, Microfracture, replacement of the native fragment with internal fixation, allograft replacement, autograft replacement and autologous chondrocyte transplantation 20.

The treatment of OCD lesions of the knee continues to be controversial. Treatment options differ according to the fragment type and age of the patient. Stable lesions in skeletally immature patients are treated with conservative management with good result 21. Drilling alone resulted in 50% improvement rate in adult form although much better results are reported in children 19, 22. The autologous cartilage transplant technique used in the treatment of OCD lesions has gained great popularity in recent years. This technique is a cartilage transfer method, which increases subchondral bone vascularization that helps the recovery of OCD lesion 23. Autologous chondrocyte implantation with or without bone grafting has been used with good success rate 20, 24, 25. The technique is done only in few selected centers backed by culture laboratory and is expensive.
Pascual-Garrido et al reported 88% cell viability in detached osteochondral fragments in OCD, thus supporting internal fixation as a good option. Smilie et al introduced the fixation method using wires, which was followed by other fixation methods like screws, Herbert screw or Wagner procedure. Herbert screws have shown 93% successful results however the disadvantage is requirement of a second surgery for implant removal. Bioabsorbable pins have been used with good success rate. Problems with these smooth pins are high rate of backout and lack of compression and stability. Two kind of threaded devices have been reported to be used for OCD in young children. Tabaddor et al reported use of threaded bioabsorbable device called “Smart nail” and reported good outcome in 22 of 24 patients. Camathias et al in recent study reported used of partially threaded bioabsorbable screws with good results in 12 of 13 patients. Thus good results are reported with use of bioabsorbable screws in OCD in children. However both these studies focused on lesion less than stage IV. In study by Tabaddor et al there was one case with grade IV lesion, however this case showed no healing and required repeat surgery with chondrocyte implantation. They did not recommend bioabsorbable fixation for stage IV lesions and suggested use of metal screws for the same. In study by Camathias et al stage IV lesions were excluded from the study probably based on recommendations of Tabaddor et al. Thus in this sense our report is first report of successful treatment of stage IV lesion with partially threaded bioabsorbable screw in a skeletally immature patient. This was possibly because of early presentation, prompt diagnosis, immediate surgical intervention and an adequate stable fixation achieved by use of a combination of screw and a pin. We feel adequate fixation is the key and more than one implant can be used if fixation is not stable. Also combination of screw and pin can accommodate for lack of compression by smooth pin and achieve a better fixation. Again in our follow up no complications like screw or pin back out, breakage, or synovitis were encountered. We found bioabsorbable implants to be safe and gives successful result in our case of stage IV OCD.

References

6. Weckstrom M, Parviainen M, Kiuru MJ, Mattila VM, Pihlajama¨ki HK. Comparison of bioabsorbable pins and


Percutaneous autologus bone marrow injection in the treatment of delayed and non union of long bone fractures – a prospective study

Jacob Eapen, Harsharaj K, Edward Nazareth, Rajesh S.

Abstract

Background: Bone marrow is a good source of osteoprogenitor cells. This study was intended to evaluate the effectiveness of bone marrow injection in delayed and nonunion.

Materials and methods: This was a prospective study conducted in father muller medical college, mangalore over a period of two years. Thirty four patients were treated in our series. Based on the amount of initial displacement, comminution, soft tissue injury, post operative reduction and stabilization we graded the fractures likely to go in for non union. Such cases when failed to show expected amount of clinical and radiological union within a certain period of time we chose them for bone marrow injection. Bone marrow was aspirated from the iliac crest and was injected to the fracture site under ITTV guidance. Patients were followed up periodically at 6th week, 12th week and 6months interval following the procedure.

Results: we noted union in 72% of our cases. Union was noted to be better when bone marrow was injected in delayed union cases as compared to non unions.

Conclusion: percutaneous autologus bone marrow injection is a very safe, economical, technically easy procedure to enhance bone healing when intervened early. However this procedure cannot be claimed to be an alternative to open bone grafting but can be used as an adjunctive therapy to enhance bone healing along with procedures like dynamisation of fractures.

Keywords: Bone marrow injection, Delayed union, Non union.

Introduction

Fracture healing is a continuum and establishing a diagnosis of delayed union and nonunion remains difficult. No standard criteria exist to define when a fracture can be classified as a delayed union or non union. Fracture healing is dependent on various factors viz., patient dependent, injury dependent and treatment dependent. Considering the various variables that influence fracture healing certain fractures likely to go for non union can be anticipated at the time of index injury and the initial treatment. Such fractures would warrant an osteogenic stimulus sometime during the process of fracture healing.

Open bone grafting is a standard well accepted method of dealing the non unions since the time of phemister’s work. Current basic science research has well documented the osteogenic potential of the autologus bone marrow. Hence this study was done to ascertain the effectiveness of percutaneous bone marrow injection and also to study the pearls and pitfalls of the procedure.

Materials and methods

Thirty four patients in the age group of 18-79 years with long bone fractures were taken in our study. Of these twenty eight cases were delayed unions and five were non unions. Period of study was two years. One case lost for follow up. Eleven cases were fractures shaft of femur,
Table 1 Type of fracture

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>22</td>
<td>66.7</td>
</tr>
<tr>
<td>Type 1 open</td>
<td>9</td>
<td>27.3</td>
</tr>
<tr>
<td>Type 2 open</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Type 3b open</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 2 Initial treatment

<table>
<thead>
<tr>
<th>Initial Rx</th>
<th>Frequency</th>
<th>Percentage</th>
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</thead>
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<tr>
<td>Casting</td>
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<td>3.0</td>
</tr>
<tr>
<td>Closed IMIL</td>
<td>14</td>
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<tr>
<td>Ex-Fix</td>
<td>3</td>
<td>9.1</td>
</tr>
<tr>
<td>Open plating</td>
<td>15</td>
<td>45.5</td>
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<td>Total</td>
<td>33</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Closed procedure were done in 17 cases and open procedures done in 15 cases at the time of injury.

Figure 1: a Humerus fracture 3 months post op

Figure 1: b Humerus - 3 months post Bone marrow injection

Figure 1: c Humerus- Final follow up at 6 months
thirteen tibial fractures, six humerus and four radial shaft fractures. Sixteen cases were treated by open reduction and internal fixation. Eighteen cases were treated by closed reduction and internal fixation. The time period from initial fracture treatment to bone marrow injection varied from two to 12 months. Our study included twenty three closed fractures and nine cases were Gustilo Anderson type one open fractures and two cases were type two open fractures. Infected cases, malignancies, pathological fractures were excluded in our study.

All patients were admitted and procedure was carried out in the operation theater after obtained written informed consent. Bone marrow was aspirated from the iliac crest using 16 gauge bone marrow aspiration needles. Procedure was done under short general anaesthesia e.g. propofol. Using IITV guidance aspirated marrow was injected at the fracture site. Post operatively compression bandage was applied for two days. Appropriate physiotherapy was instituted based on the stage of fracture healing. Patients were followed up periodically at 6th, 12th week and 6 months interval. They were clinically assessed for mobility and tenderness at fracture site, pain on weight bearing and radiologically assessed for callus size, cortical continuity and progressive loss of fracture line. We considered the result as failure when fracture union was not observed after two attempts of bone marrow injections.

The collected data was analysed by frequency, percentage and chi-square test using spss version 13 software to evaluate the results

Table 3 : Pattern of fractures

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Frequency</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Commnndd</td>
<td>12</td>
<td>36.4</td>
</tr>
<tr>
<td>Simple</td>
<td>21</td>
<td>63.6</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Closed procedure were done in 17 cases and open procedures done in 15 cases at the time of injury.

Table 4 : State of union

<table>
<thead>
<tr>
<th>State of Union</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed</td>
<td>28</td>
<td>84.8</td>
</tr>
<tr>
<td>Non union</td>
<td>5</td>
<td>15.2</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 5 : Initial treatment vs Outcome

<table>
<thead>
<tr>
<th>Type</th>
<th>Outcome</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>United</td>
<td>PH.</td>
</tr>
<tr>
<td>Casting</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Closed IMIL</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>78.6%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Ex-Fix</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>100.0%</td>
<td>0%</td>
</tr>
<tr>
<td>Open plating</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>66.7%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>72.7%</td>
<td>18.2%</td>
</tr>
</tbody>
</table>
Results

Union was achieved in twenty four out of the thirty three cases [72%]. Majority of the failures were noted in patients above 45 years of age. Failure was observed more in comminuted open fractures and in non union cases. The delayed union fractures progressed to achieve union in significant proportion. The mean time of clinical and radiological union was 15 weeks after injection. No major complication related to the procedure was observed.

<table>
<thead>
<tr>
<th>Age in years</th>
<th>United</th>
<th>Outcome</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>United</td>
<td>Non union</td>
<td>Total</td>
</tr>
<tr>
<td>25 and above</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>26-45</td>
<td>14</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>46-65</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Above 65</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

Discussion

Factors influencing fracture healing are multifactorial. Those fractures that were anticipated to go in for non unions based on the comminuted, soft tissue injury, fracture site bone defect and failure to achieve good reduction were taken into the study.

As we knew that bone marrow injection has only osteoinductive property and no osteoconductive property the selection of cases included in the study had high selection bias. Majority of the cases in the study were delayed unions. Non unions with obvious large fracture gaps, sclerosed bone ends were not drawn into the study. Patients with no or least comorbidities, who had good potential to heal, but failed to unite in the expected time period were taken in the study.

Few of the cases, where closed reduction and intramedullary nailing was done, had a small fracture gap in one of the cortex in one of the views of radiographs taken. Here minimal attempt to callus formation was noted but progressive loss of fracture line/gap was absent. In such cases dynamisation was done at the time of bone marrow injection. Thus in these cases though union was
delayed union. Most of the non union cases taken up in the study except one failed to unite after bone marrow injection. Similar results were noted in the study done by paley et al, and Connolly et al.

Regarding the volume of marrow to be injected we couldn’t deduce a definitive conclusion because of the following reasons: 1] in cases where patients were above 50 years of age group few of the bone marrow aspirations ended up in a dry tap, and in few a bone marrow of less than 10ml was aspirated. These volumes of aspirate if injected would be insignificant with respect to the amount of osteogenic cells present in them as this aspirate was not a centrifuged concentrate of bone marrow. 2] Few of the fracture site or gap was relatively very small thus space available to accommodate large volume of bone marrow aspirate was less. In such cases a significant portion of injected marrow diffused inadvertently to surrounding tissue planes. These were the two issues we came across in few of our cases which made us sceptical about the effectiveness of this procedure.

This procedure is technically easy. It is also safe as we had not noted any complication related to the procedure and no infection occurred following the procedure in any of our case series.

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Outcome</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>United</td>
<td>P.H.</td>
<td>Non union</td>
</tr>
<tr>
<td>Ankle</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Both bone forearm</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Fermur</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Humerus</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Radius</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 7: Site vs outcome

<table>
<thead>
<tr>
<th>State of union</th>
<th>Outcome</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>United</td>
<td>P.H.</td>
<td>Non union</td>
</tr>
<tr>
<td>Delayed</td>
<td>22</td>
<td>5</td>
</tr>
<tr>
<td>Non union</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>6</td>
</tr>
</tbody>
</table>
Conclusion

Autologus bone marrow injection is a simple, safe technique. It can enhance fracture healing by giving an osteogenic stimulus in those fractures that have a possibility to go for non union. It cannot be termed as an alternative to open bone grafting as it doesn't have a osteoconductive property but definitely can play a role as an adjunctive measure along with other treatment options like dynamisation of fractures. This procedure is most effective when used to prevent non union by injecting at a stage of delayed union.

References

1. Phemister DB. Treatment of ununited fractures by onlay bone grafts without screw or tie fixation and without breaking down of the fibrous union. J Bone joint surg 1947;29-A or B:946-60.
Bilateral anterior fracture-dislocation of shoulder joint – A case report

Nithin.S; Kiran Kalaiah; P. Gopinath; G.Marulasiddappa

Abstract:
The shoulder is the most frequently dislocated joint, but bilateral glenohumeral dislocations are rare and almost always posterior. Bilateral anterior fracture dislocations of humeral neck in a patient with seizure are extremely rare. More cases need to be reported to have an insight in treatment and results. We report one such case of bilateral anterior fracture dislocation of shoulder after first time epileptic attack.

We describe a rare case of 30 year old gentleman who presented with first onset of seizure following alcohol withdrawal. Following physical examination and radiographic assessment, fracture dislocation of bilateral proximal humeri were diagnosed. Open reduction and internal fixation with multiple k – wires and plate and screw showed early shoulder rehabilitation. Cases with history of seizure, electric shock & trauma to the shoulder need to be evaluated for fractures of proximal humerus, dislocation and simultaneously both. Bilateral anterior fracture dislocation of shoulder needs to be addressed with proper pre-operative planning and good rehabilitative measures.

Keywords: bilateral, fracture dislocation, anterior, shoulder

Introduction

Fracture-dislocation of the proximal humerus is typically associated with epilepsy, electrocution or extreme trauma, the so-called “Triple E” syndrome coined by Brackstone1. Bilateral fracture-dislocations of the proximal humeri are usually posterior and associated with convulsive episodes 2–3. We describe a rare case of a patient who suffered simultaneous bilateral anterior humeral neck fracture-dislocations in a patient with a first onset seizure12. He subsequently underwent open reduction internal fixation of both fractures.

Case report

A male, aged 30 years presented with severe deformity and unable to move his both upper limbs of 20 days duration after fall from height. He was sitting over cement well when he had a sudden onset of seizure he became unconscious and fell on the ground. There was no external wound and associated injury in other parts of the body. He was taken to a local osteopath and had massage.

On presentation he complained of severe pain with difficulty in movement of both the shoulders. Physical examination findings revealed bilateral flattening of shoulder; restricted and painful movements in all ranges of shoulder joint. Distal neuro-vascular status of both upper limbs were normal.

Radiological investigation revealed comminuted fracture neck of right humerus and greater tuberosity of left humerus with bilateral subcoracoid dislocation of shoulder. The left shoulder was 3 parts fracture and right
was 4 parts fracture according to Neer’s classification. Closed manipulations under general anesthesia were attempted, but the dislocations could not be reduced. So, open reduction was necessary on both sides. The shoulders were operated through deltopectoral approach. Joint capsule divided and fracture site directly visualized. Fracture site reduced and humeral head secured to glenoid cavity with k-wires on left side. As it was a comminuted fracture on right side it was initially reduced and fixed with plate and screws. Later it was stabilized by passing k-wires through the fragments. Primary rotator cuff repair was done on both the sides. Deltoid muscles were repaired. Wound closed in layers. The shoulders were kept immobilized for 3 weeks in a U-slab until the removal of wires. The K – wires removed at the end of 3 weeks. At 1 year of follow up patient had recovered with good range of movements.

**Discussion**

Simultaneous bilateral anterior dislocation of the shoulder associated with a bilateral 3- or 4-part fracture of the proximal humeri is quite rare and only a few cases have been reported in the literature. The most common mechanisms of bilateral anterior dislocation or fracture dislocation of the shoulder are violent bilateral traction and sudden muscular contractures, or bilateral deceleration forces associated with trauma. In most cases with anterior dislocation of the shoulder, the associated fracture is a 2-part fracture. The present case was unique in that one side was a 3-part anterior fracture-dislocation, and the other was a 4-part anterior fracture-dislocation and the injury was caused by a first seizure episode.

Bilateral simultaneous shoulder fractures are usually the consequence of a severe trauma, as in road accidents, falls, high-energy traumas, and electroconvulsive therapy employed in the treatment of severe mental disorders, when patients are given electric shocks to the brain to make them have convulsions. All such injuries cause the fractures by direct trauma, when the shoulders are beaten against a hard surface.

The injury mechanism of anterior dislocation of the shoulder is forced extension, abduction, and external rotation. A direct blow to the posterior aspect of the shoulder or a sudden and violent contraction of muscles around the shoulder can result in anterior dislocation. Unilateral anterior dislocation of the shoulder is common because of the position naturally adopted by the upper extremity during a fall. However, bilateral occurrence is rare because in almost all instances one extremity takes the brunt of the impact.
Treatment options for proximal humeri fracture dislocations include operative and non-operative methods, but non operative treatment of complex (i.e., three part and four-part fractures is well known to result in malunion and stiffness of the shoulders. The greater tuberosity is displaced in the approximately 15% of all anterior dislocations. When a two part fracture dislocation is associated with a greater tuberosity fracture that is displaced, the diagnosis of rotator cuff tear is almost certain, and this can cause long term instability and functional impairment if the greater tuberosity fragment is not anatomically reduced. Therefore we selected surgical fixation for this patient. There is currently insufficient evidence from published studies to determine the best treatment in active patients with displaced comminuted three or four part fractures of the proximal humerus.

**Conclusion**

Bilateral simultaneous anterior dislocation of the shoulder associated with a bilateral 3- or 4-part fracture of the proximal humeri is very rare. Open reduction and internal fixation with K – wires, cobra plate or PHILOS proximal humeral locking plate is recommended as a suitable option in young active patients. However results can be variable.

Long term, larger scale studies need to be carried out for further validation of treatment results. Prompt investigation and treatment of the underlying cause is necessary to prevent further fractures and long-term joint damage.

In summary it can be stated that despite the rarity of lesion it should be kept in mind when patients with shoulder pain after a seizure adequate x-rays and preoperative planning is essential. Bilateral simultaneous anterior fracture dislocation of the shoulder is very rare. With high velocity trauma, seizures, electric shock we need to have a high suspicion for such fracture dislocations. These cases need open reduction and internal fixation with early mobilization.

**References**


Paraosteal osteochondromatosis proliferation (Nora’s lesion) of the great toe

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Abstract
Paraosteal osteochondromatous proliferation also called Nora’s lesion is a rare tumor which occurs on the proximal/distal phalanx, metacarpals, metatarsals of hand (more commonly) and feet. These lesions show 50% recurrence following excision. It has atypical histo-pathological features that must be differentiated from chondrosarcoma, low grade parosteal osteosarcoma and conventional osteosarcoma. Among benign lesions florid reactive periostitis, myositis ossificans, periosteal chondroma and osteochondroma should be considered.

Key words: Paraosteal osteochondromatosis, Nora’s lesion, Excision

Introduction
Benign parosteal osteochondromatous proliferation (BPOP) is a rare lesion involving the small bones of the hands, feet and less often the long bones. Nora et al first described them in 1983. Although, grossly these lesions resemble osteochondromas; histologically they exhibit marked proliferative activity and bizarre, enlarged and binucleate chondrocytes mimicking chondrosarcoma. These lesions were confused and included with juxta-cortical osteosarcoma in the early reports. The importance of these lesions is that their aggressive histological picture and high rate of local recurrence can lead to a mistaken diagnosis of malignancy.

Case report
A 51year old male patient presented to the outpatient department with complaint of painful swelling over the great toe of left foot. Patient noticed the swelling about 5years ago which gradually increased in size; there was no history of trauma, no history of pain, no interference with daily work, no history of nocturnal pain, no history of fever with chills, and no interference in agricultural work. Patient had pain in the swelling since 2 weeks for which he came to us.

On examination, two or three hard to firm mass measuring around 4cm x 2cm each were present all round the great toe. Range of movements of the great toe was normal. Plain X-ray of the left foot taken in anteroposterior and oblique views showed—multiple calcified masses all around proximal and distal phalanx of left great toe. No articular involvement was seen, and there was no evidence of destruction of the bone. Routine investigations were normal and renal parameters were also normal. CT or MRI scan were not done due to patient’s economic restraints.

Excision biopsy was planned under spinal anesthesia. Two incisions one on the planta-medial and the other on the planta-lateral aspect were taken over the great toe to expose the mass over the proximal and distal phalanx. A large calcified mass on medial aspect without attachment to bone or tendon was found at the base of proximal phalanx of the great toe. Multiple calcified small masses
were found on lateral aspect were also removed. No necrosis seen in any of the masses removed. There was no connection with periosteum/cortex/medulla.

Approximate mass of size 4x3cm was removed along with small masses measuring 2x2cm. They were sent for histopathological examination. The surfaces of the mass were irregular, bosselated, whitish, and stony hard in consistency. The cut section of the mass showed gritty, stony hard, solid, white with chalky white areas. Microscopy revealed cartilaginous tissue arranged in distinctive lobulated pattern forming a cap. Below it seams of bony trabeculae with marrow element in between are seen. The clinical and histopathological features of the tumour were consistent with a bizarre parosteal osteochondromatous proliferation (Nora’s lesion). The patient was followed up for 14 months. The tumor recurred after 2 months of excision but patient was not willing for revision surgery as the swelling did not increase in size and the patient did not have any pain or interference with daily work.

Discussion

Bizarre parosteal osteochondromatous (BPOP) proliferation is an uncommon reactive mineralizing mesenchymal lesion that typically affects the surfaces of bones in the hands and feet, usually the proximal and middle phalanges, and the metacarpal of hand4,5 and metatarsals of foot. More than 160 cases have been reported in the literature so far4. These lesions have a remarkable tendency to recur: recurrence rates between 29% and 55% in a 2-year interval have been reported, and almost half of those patients have had a second recurrence. Nora and colleagues presented 35 cases of BPOP with 18 (51%) local recurrences1. Meneses and colleagues reported a recurrence rate of 55% in a series of 65 patients6, and Dhont and colleagues reported a recurrence rate of 29% in 24 patients7,10. However, despite a high tendency to recur and a sometimes atypical histologic appearance, no malignant transformation, metastases, deaths or associated systemic diseases have
been described so far in patients with BPOP. The etiology of Nora’s lesions is not known. It may be related to a reparative process following trauma to the periosteum, as this was noted in 30% of cases in the series of Meneses et al. Ossification in BPOP resembles callus tissue at the bone cartilage interface and many authors consider trauma as a cause.

Although BPOP has a characteristic clinical and histologic appearance, it may be confused with other benign and malignant lesions. Owing to the parosteal location, BPOP must be distinguished from parosteal osteosarcoma, which is rarely found in the hands and feet. The absence of cellular atypia helps to distinguish this lesion from osteosarcoma. The lesion might be mistaken for osteochondroma because of its surface location and cartilaginous component. Osteochondromas are extremely uncommon in the small bones of the distal extremities. They show the typical continuity with the medullary canal and the cartilage does not show any signs of atypia. Rybak and colleagues presented the cases of 4 patients with pathologically proven BPOP in which cortico-medullary continuity with the underlying bone was demonstrated on imaging. The absence of such a communication has been singled out as a critical imaging feature of BPOP. Rybak and colleagues indicated that BPOP could not be identified by radiologic features alone. Histopathology examination is the best method to identify this lesion and should be performed for definite diagnosis.

Other benign, non-neoplastic lesions like periostitis ossificans may also simulate BPOP. This florid, reactive periostitis affects the bones of the hands in most patients, although other parts of the skeleton cannot be excluded. Turret exostosis is a dome-shaped parosteal bone proliferation located on the dorsal aspect of the phalanges. It has been proposed that BPOP, florid periostitis and turret exostosis are all part of the same lesional spectrum. The lesion may represent an intermediate lesion between florid reactive periostitis and turret exostosis. Florid reactive periostitis may progress to BPOP, as described by Dorfman and colleagues.

Horiguchi and colleagues report the expression of basic fibroblastic growth factor in nearly all chondrocytes: chondromedulin-I in the tissue of the cartilaginous cap and vascular endothelial growth factor only in the large chondrocytes near the osteocartilaginous interface of the lesion. Their findings suggest that the processes occurring in the cartilaginous cap of BPOP are similar to those of enchondral ossification in the growth plate, concluding that BPOP is a reparative process after periosteal injury. Immunohistochemical and molecular analysis strengthened this assumption. However, most patients do not report a history of previous trauma. Moreover, if BPOP is a reactive lesion, its remarkable tendency to recur after excision is difficult to explain.

Orui and colleagues reported the case of 1 patient with BPOP that occurred 2 years after bilateral leg erythema nodosum. Systemic or focal inflammation might have been responsible. Zambrano and colleagues presented the cases of 3 patients with subungual (Dupuytren) exostosis and of 2 patients with BPOP. Their findings of consistent chromosomal rearrangements indicate that BPOP is a neoplastic, rather than reactive, process. The cytogenetic analysis of 5 patients with BPOP by Nilsson and colleagues showed a balanced translocation t (1; 17) (q32; q21). To investigate the specificity of this reciprocal translocation, they screened the karyotypes of more than 43,000 neoplasms and found no identical translocation.

Figure 4: Excised mass
It seems to be a recurrent and pathogenetically significant aberration in BPOP\textsuperscript{16}. Endo and colleagues described the case of a 39-year-old woman with BPOP arising in the proximal phalanx of her third toe. Their cytogenetic analysis is comparable with the findings of Nilsson and colleagues. The occurrence of a translocation, as mentioned previously, supports the assumption that a neoplastic process may be the etiologic agent.

The true prevalence of BPOP is difficult to assess because most lesions are reported in case studies and because larger, mostly histologic studies are retrospective. Therefore, further work is needed to fully elucidate the etiology of BPOP.

Excision is the recommended therapy of symptomatic BPOP\textsuperscript{4}. Intralesional excision seems to have a great potential for local recurrence, but it preserves stability without decortication of the affected bone. En bloc negative margin excision by the excision of the pseudo capsule over the lesion and any periosteal tissue beneath the lesion and the decortication of any areas in the underlying host bone that appear abnormal has been shown to be beneficial in preventing local recurrence\textsuperscript{4}. Wide resection could possibly lead to segmental amputation because of the anatomic conditions in the long bones of the fingers and toes, and it cannot be recommended as first-line surgical treatment\textsuperscript{6,7}.

Though it shows high rate of recurrence no malignant transformation, metastasis, deaths or associated systemic illnesses have been seen in patients with Nora’s lesion. Owing to high local recurrence rates and a lack of adjuvant therapy options, the Nora lesion will continue to pose a challenge for orthopedic surgeons and clinical research.

References
A rare case of chondroblastoma in scapula-a case report

P. Puttaswamy; Nithin. S; B.G.Sagar; Sunilkumar . P. C

Abstract
Chondroblastoma is a benign bone tumor, but locally destructive lesion although metastases may occur. It commonly presents in the second decade of life. It is typically localised in the epiphyses of the long bones. We report a rare case of chondroblastoma in scapula. Chondroblastoma is a rare benign tumor which is common in long bones. But there may be unusual presentations such as in flat bones (scapula). Radiographic diagnosis of an atypical chondroblastoma is more difficult because of a variety of possible diagnoses, including benign and malignant lesions; classical features may not be appreciable in all the cases, as was seen in our patient. Hence, histopathological examination of lesion must always be done.

Introduction
Chondroblastoma is a rare benign bone tumor, but locally destructive lesion although metastases may occur. It usually presents in the second decade of life. It is typically localised in the epiphyses of the long bones. Localization in flat bones is unusual. Males are affected more often than females, the ratio being approximately 2:1. Common clinical symptoms are pain and a decreasing range of motion of adjacent joints.

The authors report the case of a 17-year-old female who presented with an expansive osteolytic lesion in the infraspinous part of left scapula. The biopsy led to the diagnosis of chondroblastoma. This tumor is rare in flat bones, and may mimic other benign or malignant lesions. It is therefore essential to perform a biopsy in order to obtain a definite diagnosis.

Case report
A 17-year old female was admitted in our institute with complaints of progressive painless swelling of the left scapula since 3 months. There was no history of trauma or infection. No history of loss of appetite or loss of weight.

On physical examination there was a firm, large, mild tender mass located at the infraspinous part of left scapula. Margins were ill defined and gradually merging with rest of scapula. Swelling was mobile along with scapula. Her shoulder movements were normal. There was no pigmentation or venous dilation on overlying skin.

The plain X-ray showed an expansile, osteolytic lesion in the infraspinous part of left scapula. FNAC showed hemorrhagic fluid with features suggestive of aneurysmal bone cyst.

The CT scan showed expansile osteolytic lesion of left scapula involving body with soft tissue components and cystic areas, thinning and erosion of overlying cortex and narrow zone of transition. The lesion measures about 6.1X4.2X5.5cms. No evidence of calcification seen within the lesion. Features were suggestive of aneurysmal bone cyst or telangiectactic osteosarcoma.
MRI with contrast showed complex cystic mass lesion of left scapula body medial blade infraspinus location involving infraspinatus muscle measuring 4.5(AP)X6.8(ML)X6.8(SI)cm. There was destruction of scapula extending into subscapularis muscles. The lesion showed soft tissue intensity solid component and cysts show fluid-fluid level layering, the dependent show minimal T1 hyperintensity. Multiple thick septation and loculations noted. Solid component showed moderate post contrast enhancement. Rest of scapula spinous and glenoid process appeared normal. Probable diagnosis suggestive of aneurysmal bone cyst, round and spindle cell tumors arising from scapula or infraspinatus muscle.

Through a posterior scapular approach (Das Gupta’s approach) the tumor was excised enblocalong with marginal resection of scapula below the spinous process. The whole specimen was sent for histopathological examination which confirmed the diagnosis of Chondroblastoma.

The pathological findings were as follows: solid tumor composed of mixture of sheets of mononuclear cells and giant cells. These mononuclear cells are round to polygonal, have oval bland nuclei, few show longitudinal grooves with clear cytoplasm, distinct cytoplasmic borders & occasional mitoses. Interspersed among these are multinucleated osteoclastic giant cells, irregular zones of focal calcification (“chicken wire”) and areas of chondroid differentiation.

Patient has been followed up for 2 years with painless and complete range of motion.

**Discussion**

Chondroblastoma is a rare benign bone tumor, but locally destructive lesion although metastases may occur. It usually presents in the second decade of life. It is typically localised in the epiphyses of the long bones. Localization in flat bones is unusual. Males are affected more often than females, the ratio being approximately 2: 1. Common clinical symptoms are pain and adecreasing range of motion of adjacent joints.

The first description of chondroblastoma was given by Codman in 1931, who designated it as “epiphyseal chondromatous giant cell tumor”. Jaffe and Lichtenstein differentiated in 1942 the chondroblastoma from giant cell tumors and established the term “benign chondroblastoma”.

Radiographic diagnosis of an atypical chondroblastoma is more difficult because of a variety of possible diagnoses, including benign and malignant lesions in the area of predilection. As shown in the present patient, most of the classic criteria such as typical location and radiological appearance are not met in this case. In this context, the present case appears to be unique due to 1) the scapular location of the tumor, 2) diagnostic challenges and 3) treatment options. The chondroblastoma in the inferior angle of scapula has rarely been reported in literature. Therefore, we strongly suggest multiple biopsies of the tumor to get a distinct histological diagnosis. However, the occurrence of metastatic and malignant behaviour of chondroblastoma is extremely rare. Excision of the tumor is sufficient in most cases.

Chondroblastoma is a very uncommon condition. But there may be unusual presentations in flat bones. This
creates problems in making a correct diagnosis. Radiologically, a classical feature may not be appreciable in all the cases, as was seen in our patient. Hence, histopathological examination of tumour is always essential in all cases

Diagnosing the case of a chondroblastoma in scapula can be challenging. Certain tumours may present in unusual fashion. Although rare, chondroblastoma may present in flat bones, without any classical radiological findings. A detailed evaluation is essential.

References


Benign fibrous histiocytoma of the distal femur, a case report


Abstract
Benign fibrous histiocytomas of bone are unusual neoplasms that often are confused with giant cell tumour, metaphyseal fibrous defects or non-ossifying fibroma. Although these lesions have overlapping microscopic characteristics, they differ in their clinicopathologic presentations. This report describes the clinicopathologic features of a rare case of benign fibrous histiocytoma involving the distal femur. In addition, the concept of fibrohistiocytic lesions of bone is discussed with consideration of their pathologic classification and their clinical, radiographic, and microscopic differential diagnosis.

Introduction
Benign fibrous histiocytoma (BFH) is a rare tumor. Only a few cases have been reported in the literature. Being a rare tumor, its occurrence in distal end of femur is rarer. 10% of the cases of BFH in a series reviewed by Gleason involved the thigh (1). This report describes the clinicopathologic features of a rare case of benign fibrous histiocytoma involving the distal femur. In addition, the concept of fibrohistiocytic lesions of bone is discussed with consideration of their pathologic classification and their clinical, radiographic, and microscopic differential diagnosis.

Case report
A 31-year-old male labourer was admitted in the month of December 2009, with complaints of pain in the right knee of 3 days duration following a trivial fall. On examination, he had a swelling over the distal femur measuring 8cm x 5 cm. The swelling was diffuse, firm, tender, non-pulsatile, fixed to the underlying bone, with normal skin and no signs of inflammation. The knee joint was normal on examination, with full range of movements.

Radiographs of the right knee were taken to rule out any traumatic pathology to the distal femur but surprisingly it showed a geographic type of lytic lesion occurring in the metaphyseal region of the distal femur. The lesion was eccentric with sclerosed borders that had no soft-tissue shadow or periosteal reaction. Multiple coarse trabeculations were seen within this lesion.

The lesion radiologically resembled a giant cell tumour. FNAC was done. It showed features suggestive of giant cell tumor with a few atypical giant cells. The patient underwent curettage and bone cementing. The histopathology showed fibroblasts and multinucleated giant cells arranged in a storiform pattern features which are consistent with BFH.

The patient was followed up for 1 year and showed no signs of recurrence.

Discussion
Many authors have used the term benign fibrous histiocytoma to describe a lesion that shares similar microscopic findings with the one in this case. Dahlin described a benign and atypical lesion of malignant fibrous histiocytoma in 1978. The term benign fibrous histiocytoma although might be controversial, is useful to sub classify lesions with histological features similar to non ossifying fibroma2. The histiogenesis and classification

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of fibrohistiocytic lesions that involve bones are confusing and overlap several entities such as metaphyseal fibrous defect, non-ossifying fibroma, fibrous cortical defect, fibroxanthoma, and benign fibrous histiocytoma (BFH). BFH of somatic soft tissues is a well-recognized entity. A number of authors have proposed that BFHs occurring in the bone should be considered as a separate entity. Histologically these BFHs are composed of fibroblasts and histiocytes, and are arranged in a storiform pattern which is similar to non-ossifying fibroma and metaphyseal fibrous defect. These are commonly encountered in childhood and arise from self-limiting processes.

Most commonly this tumor occurs on the skin of the extremities. There has been confusion regarding the classification of bony BFH because the lesion is very poorly defined. Cale et al. suggested that there were 2 categories in the benign fibrohistiocytic lesions of bone: the metaphyseal fibrous defect and benign fibrous histiocytoma. The metaphyseal fibrous defect was a developmental entity that included 2 lesions: the fibrous cortical defect and the nonossifying fibroma.

In 1986, Dahlin and Unni reported 10 cases of BFHs in bones. All the patients were adults and 8 patients had pain in the area of the lesion. The lesions occurred in the diaphysis, epiphysis, and other bones with no metaphysis such as the sacrum, ilium, or vertebrae. They showed well-defined radiolucencies.

Despite sharing a similar microscopic appearance and a common symptom of pain, BFH can be clinically differentiated from non-ossifying fibroma, which is usually seen in older age-groups. Radiologically, BFHs, though well-defined, do not always have sclerotic margins and are not always confined to the metaphysis. These lesions are mostly located in the ilium and sacrum, but they also occur in the long bones and almost always involve an epiphyseal or diaphyseal component. BFHs may occasionally show indistinct borders with an aggressive pattern. These tumours can be locally aggressive and may recur after curettage. The differential diagnosis of BFH of epiphyseal origin is giant cell tumour. BFHs may represent the quiescent variety of giant cell tumours that undergo spontaneous regression. BFH should also be differentiated from xanthomas.

Curettage and bone grafting or bone cementing is a common treatment modality for BFH. Following up the patient is essential to rule out recurrences.

References


Chondroblastoma of coracoid process of scapula mimicking giant cell tumor - a case report

Ashwinikumar Mannur

Abstract

A primary skeletal neoplasm, chondroblastoma occurring in an uncommon location the coracoid process of scapula in a 29 year old woman which presented with clinical and radiological features of osteoclastoma and was managed by enbloc resection of tumor and bone grafting of cavity remaining in base of coracoid process, but which turned out to be Chondroblastoma on histopathological examination is reported.

Key words- Chondroblastoma; Giant cell tumor; Osteoclastoma; Coracoid process Scapula Enbloc resection of tumor.

Introduction

Chondroblastoma is an uncommon tumor; just over 500 have been documented. Ninety percent of patients are between the ages of 5 and 25 years; males predominate in a ratio of 3 to 2. Almost any bone may be involved but the knee, hip, and shoulder areas are most often affected. Scapula is very rarely involved and chondroblastoma of coracoid is almost unheard.1

Chondroblastoma usually involves the epiphysis and occurs before epiphyseal closure.

Giant cell tumor of bone is also a benign tumor with occasionally malignant potential. In most series there is a female predominance. More than half of the giant cell tumors occur about the knee, but almost all bones have been involved. Giant cell tumors of scapula are very rare in occurrence and giant cell tumors occurring in coracoid process of scapula per se are also almost unheard.2 3 4

A case of chondroblastoma occurring in an uncommon location the coracoid process of scapula in a 29 year old woman which presented like osteoclastoma clinically and radiologically and was managed as such by enbloc resection of tumor and bone grafting of cavity remaining in base of coracoid process but turned out to be chondroblastoma histopathologically has been reported.

Case report

A 29 year old woman presented with pain in her left shoulder and swelling in front of her left shoulder. She gave history of pain in her left shoulder since two years, which was mild in severity. She noticed a small swelling in front of her left shoulder which had increased to size of lemon at the time of presentation.

On examination, a globular, bony hard swelling 4cm x 4cm, not mobile in any direction was present in the left infracavicular region. She had pain while moving her shoulder but both active and passive movements were up to almost full range. X-ray shoulder taken at the end of seven months showed a small lytic lesion in the end of coracoids process of scapula.

CT scan of shoulder taken at a time presentation showed a swelling arising from coracoid process with 1) well-defined (geographic) margins, with a delicate sclerotic rim, (2) prominent trabeculations, (3) eccentrically expanded bone contour, 4) characteristic absence of calcification,
5) expanded cortex but no breakthrough suggestive of Osteoclastoma arising from the coracoid process of scapula.

Under general anaesthesia and patient in the supine position the tumor was exposed through anterior deltopectoral approach, a grayish, bony hard globular mass 4cm x 4cm in size was found to be present. The tumor was carefully dissected out from surrounding tissues and excised at its stalk at the base of coracoid process. Curettage of cavity remaining at the base of coracoid process after removal of the tumor was done and cancellous bone graft pieces harvested from the iliac crest were packed in this cavity. Wound was closed in layers and the left upper limb was placed in an arm pouch and movements were started on the second post operative day. Patient got relief of pain in her shoulder in the post operative period.

Histopathological examination of the tumor showed tumor tissue consisting of benign cartilage, round to oval tumor cells with moderate amount of vacuolated cytoplasm and distinct cell outlines, nucleus was oval to clefted. These cells were distributed in sheets and surrounded by hemorrhagic areas with intertwining osteoclastic changes. Very few giant cells with limited number of nuclei were present. Chicken wire type of calcification was seen amidst the tumor cells. These features strongly suggested chondroblastoma.

Patient was followed up regularly, every week for first three months, every for next three months, every month for next six months, every three months for next year, every six months for third year, every year for next two years. It was found that there was no recurrence even at end of five years.

Shoulder function was assessed by Constant score and at end of first year Constant score was 98 points which has persisted at the end of five years.

Discussion

Chondroblastoma and giant cell tumor are like younger brother and elder sister. Chondroblastoma is a benign bone tumor occurring in epiphysis, before epiphyseal closure more common in males in a ratio of 2:1 compared to females. Almost any bone may be involved but the knee, hip, and shoulder (proximal humerus) areas are most often affected. Scapula is very rarely involved and Wright J.L. and Sherman M.S. have reported a case of chondroblastoma arising from the acromion process of scapula. Chondroblastoma of coracoid is almost unheard of.

Chondroblastomas of scapula account for about 3% of all chondroblastomas. Chondroblastoma is common in 2nd decade, before epiphyses closure characterized radiologically by a lytic lesion with typical calcification within the lesion. Periosteitis is seen radiologically in 30 to 50% of cases of chondroblastoma.
Chondroblastoma histopathologically demonstrates few giant cells and stromal cells that are quite different from those of Giant cell tumors. Chondroblastoma histopathologically shows characteristic calcification around stromal cells which is likened to chicken wire and termed chicken wire calcification.\textsuperscript{10, 11, 12, 13}

According to most authorities, the treatment of choice is resection with a margin of surrounding normal tissue when this can be accomplished without great loss of function.\textsuperscript{14, 15} Giant cell tumor (Osteoclastoma) of bone is a tumor arising most commonly from the epiphysis after closure of epiphyses, most commonly seen in the third decade of life, there is a female predominance of about 1.5 to 1. Incidence of Giant cell tumors is significantly high in India and China, to the extent that up to 20% of bone tumors are Giant cell tumors.\textsuperscript{16, 17}

More than half of the Giant cell tumors occur about the knee, i.e. lower end of femur and upper end of tibia. Other common sites of involvement of giant cell tumor are proximal humerus and distal radius but almost all bones have been involved.\textsuperscript{18} Giant cell tumors of scapula are very rare and amount to less than 1% of all osteoclastomas involving the whole skeleton.\textsuperscript{18} The radiologic appearances of giant cell tumor in the scapula\textsuperscript{19, 20, 21} and in more commonly seen locations are similar and include: (1) well-defined (geographic) margins, occasionally with a delicate sclerotic rim, (2) prominent coarse trabeculae, (3) eccentric expansion of bony contour, (4) frequent extension to the subchondral plate, and (5) absence of internal mineralization.\textsuperscript{6} Absence of periosteal reaction.

Giant cell tumor of the scapula frequently demonstrates cystic and/or telangiectatic components on histological examination as it does elsewhere in the skeleton;\textsuperscript{22} at microscopy multi-nucleate giant cells predominate, although mono-nuclear stromal cell is also related to the pathology.\textsuperscript{22} Histologically there is characteristic absence of calcification which distinguishes osteoclastoma from chondroblastoma.

Jaffe and Leichenstein have not mentioned giant cell tumor of scapula.\textsuperscript{23, 24} Large series of giant cell tumors have not reported even a single case of giant cell tumor of scapula, leave apart GCT arising from coracoid process of scapula.\textsuperscript{25, 26, 27, 28, 29} Incidence of Giant cell tumors of scapula is claimed to be less than 1% of all Giant cell tumors involving all the sites in the skeleton.\textsuperscript{18} Ogose A, Sim FH, O’Connor MI, Unni KK have reported in a review of 18 patients with various bone tumors of the coracoid process, among which just one case of giant cell tumor involving coracoid process and no case of chondroblastoma were present.\textsuperscript{30}

Jun Aoki, Richard PMoser Jr. and Tuyethoa Vinh.\textsuperscript{31} in their review of 13 cases of Giant cell tumors of the scapula observed three cases of the giant cell tumor of the coracoid process, rest of sites within the scapula involved by the Giant cell tumor included - acromion (three cases) and body (three cases); glenoid (two cases); and superior and inferior angles (one case each).

Commonest modality of management GCT is curettage and bone grafting, wide resection, wide resection and reconstruction,\textsuperscript{16, 17, 28, 31, 32, 33, 34} and other methods in the appropriate sites.\textsuperscript{35, 36}

The Musculoskeletal Tumor Society\textsuperscript{37} has developed a classification system for shoulder girdle tumors that divides the scapula into two zones blade—spine portion comprises the S1 region: the acromial — glenoid complex comprises the S2 region.

This system helps provides functional classification for resections and reconstructions and a logical division of the abnormalities that develop in the scapula. Neoplasms of the S1 region include those that commonly develop in the flat bones (i.e., Ewing’s sarcoma, multiple myeloma, and lymphoma). Neoplasms of the S2 region include those that commonly develop at the ends of the bone (i.e., giant cell tumors and aneurysmal bone cysts).

An unusual and rare case of chondroblastoma arising from coracoid process of scapula in a 29year old female
patient showing characteristic clinical and radiological features of osteoclastoma and managed by en bloc excision of tumor and curettage and bone grafting of cavity remaining at base of coracoid process but which turned out to be chondroblastoma on histological examination is presented.

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Glomus Tumor - An unusual presentation

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Abstract

Classically glomus tumors present with severe pain, temperature sensitivity and localised tenderness. We present a case of glomus tumour of the fingertip in a lady aged 26 years with an unusual history. The tumor was surgically approached through lateral incision which allowed tumor exposure and removal without nail plate avulsion; the histological examination confirmed the clinical diagnosis of glomus tumor. Surgery is the preferred treatment for glomus tumor. However it can be a challenging sometimes because, despite being a well-defined tumor, its visualization can be difficult.

Key words: Glomus tumor, Finger, Pain

Introduction

Glomus tumors were first described by Wood in 1812 as painful subcutaneous tubercles, and Masson described its histological appearance in 1924.1 These are benign tumors that arise from glomus body which is a myoarterial apparatus structure that normally regulate skin temperature and are constituted by an afferent arteriole and vascular channels with endothelial cells, surrounded by cuboidal cells.2,3 Digital glomus tumors account for approximately 1% of all hand tumors and occur more commonly in women.4 Their most common location is the subungual region of the digits. The treatment of glomus tumors can be a challenge because, despite being a well-defined tumor, sometimes its visualization is difficult. We report the case of a glomus tumor located in a common location, with an unusual presentation.

Case report

A lady aged 26 years, referred to our hospital for pain in the tip of her right little finger. History showed that the symptoms had been present for six years and she had made several attempts to seek medical attention. She had no gross abnormalities of her fingers, and no previous trauma history. In the physical examination, the nail showed no discoloration. The pulp was normal in appearance. There was a little, palpable mass under nail plate. When palpated, the pain was minimal. We performed Love’s pin test, Hildreth’s test, and a cold sensitivity test which were all negative. Radiographs showed “scalloping” of the terminal phalanx. The MRI obtained revealed a spherical mass at the tip of distal phalanx on the lateral aspect. The lesion appeared as a dark, well defined mass on T1 weighted images and as a bright contrast enhancing mass on T1 post-gadolinium fat saturation images.

The mass was isointense of the dermis of the nail bed on T1-weighted image and hyperintense on T2-weighted image. The small size (3 mm x 4 mm) and the spherical nature of the lesion was easily demonstrated. Initial diagnosis was benign soft tissue tumor and to provide complete excision, surgical exploration was offered to the patient. Using surgical loop (x4.5), nail plate of little finger of the right hand was elevated through lateral incision with removal of the lateral fingernail, which allowed tumor exposure without complete nail plate avulsion and exposing the bone of the terminal phalanx. By lifting nail and nail matrix, the soft tissue tumor in 3mm x 4 mm...
A mass is detected at the subungual area and adjacent to the distal phalangeal bone. The mass was hyperintense of the dermis of the nail bed on T2-weighted image (b) and iso intense on T1-weighted image (c). Apart from being indented by the tumour the bone was not grossly involved. Removal of the tumour brought about complete relief of the symptoms. Histological examination confirmed the diagnosis of glomus tumor. Histopathologically, the mass consisted of a mixed population of small round epithelioid cells arranged in cordlike structures and spindle-shaped cells forming loose irregular bundles in a mucinous stroma. The epithelioid cells were arranged around small blood vessels. The pain of a glomus tumour, which is its characteristic feature, was not seen in this patient.

**Discussion**

Glomus tumors are benign hamartomas that arise from the normal glomus apparatus, located in subcutaneous tissue. The normal glomus body is a contractile neuromyoarterial receptor that controls blood pressure and temperature by regulating flow in the cutaneous microvasculature. The normal glomus body is located in the stratum reticulare throughout the body, but is more concentrated in the tips of digits, especially under the nail. So, the tumors are usually in the subungual area.

Many articles have noted that the diagnosis of the glomus tumor must be made through the history and clinical examination of the patients. Diagnosis of glomus tumor is accomplished through clinical and imaging examination. These tumors present as purple-blue subungual nodules usually located in the distal segment of the fingers under the nail matrix or in the pulp. One of the distinguishing features of the glomus tumor is the classic triad of symptoms: hypersensitivity to cold, paroxysmal severe pain, and point tenderness in the finger. Since, usually, glomus tumor is too deep, it is hardly palpable. Therefore in the presence of clinical triad, glomus tumor should be suspected. Patients may notice a bluish discoloration beneath the nail, and the nail fold...
may become elevated as the tumour proliferates within the enclosed space. There are three main clinical diagnostic tests. The first is Love’s pin test, in which the head of a pin is pressed gently against the tender lesion to localize the pain. The second is Hildreth’s test. After the patient feels severe pain, a tourniquet is applied to the base of the digit and Love’s pin test is repeated. For a positive result, the patient should not experience any pain. The last test is a cold sensitivity test that produces increased pain when the finger is exposed to cold. All the symptoms and clinical diagnostic tests were negative in our patient.

Imaging exams help the precise localization of tumors and the pre-surgical evaluation of their size. These are very important data in the choice of the surgical approach. As long as there is no bony erosion, radiographs cannot be helpful. Ultrasound often shows hypoecogenic lesions; however, it is an operator-dependent examination. Magnetic resonance is more sensitive and shows the extension of the lesion. Its greatest advantage is its high sensitivity (90%), especially if high resolution is used, detailing the characteristics of the tumor and allowing the diagnosis while the tumor is still small. Glomus tumor is a vascular entity, reflecting its typically dark on T1 and bright MRI appearance on T2 weighted images. Post-gadolinium and fat saturation images further delineate the mass. Although this signal pattern can be seen with any vascular tumor, the location at the digits and its small size should lead one to suspect glomus tumor. However definitive diagnosis can only be established by histologic examination.

Once the diagnosis has been accomplished, tumor excision is the definitive treatment. If there is discoloration on the nail and palpable sensitive mass, it is easy to determine the location of tumor. It is important to know the tumor location and size preoperatively by doing MRI for avoiding incomplete excision which is the most important factor in recurrence. Surgical total excision is the standard procedure for glomus tumors. Complete excision is curative and necessary to avoid recurrence. The standard approach is direct transungual excision: the nail plate is removed and the incision is made on the nail bed. It can afford a better exposure for completely subungual lesions. An alternate approach is through a lateral incision. The incision allows exposure to the dorsal distal phalanx without violating the nail matrix, so reducing the risk of postoperative nail deformity. However, the lateral approach affords a more narrow view of the tumor bed, with a higher chance of incomplete excision, compared to the transungual approach. In our case, the lateral approach was enough for complete excision because the lesion was located on the lateral aspect as confirmed by preoperative MRI.

**Conclusion**

We report a rare case of a glomus tumor of terminal phalanx of little finger with unusual presentation, without
classical symptoms and with negative clinical tests. Glomus tumors are difficult to diagnose, particularly since they are often small and situated deep in the fingertip. Yet, awareness of the diagnosis is emphasized to prevent unnecessary delay in treatment. Distal phalangeal localization should direct the clinician towards the diagnosis even in absence of clinical triad as in the present case. In addition, MRI scan should be performed to ensure proper diagnosis and treatment. Finally, complete surgical excision should be considered as the curative treatment of choice for glomus tumors.

References
Quadriceps tendon rupture–Ochronosis
an unusual cause

Shantharam Shetty, Ajith Kumar, Saurabh Gupta

Abstract

Introduction: Alkaptonuria, a rare hereditary autosomal recessive metabolic disorder, is characterized by accumulation of homogentisic acid in the connective tissues resulting from lack of the enzyme homogentisic acid oxidase. Tendon injuries and other tendon disorders represent a common diagnostic and therapeutic challenge in this condition, resulting in chronic and long-lasting problems.

Case report: An adult male aged 63 years presented with spontaneous quadriceps tear, treated with quadricepsplasty and intraoperative ochronotic black pigment seen.

Conclusion: Ochronosis can unusually present for the first time as spontaneous quadriceps tear. Good short term results seen with end to end quadricepsplasty without any autologous tissue graft.

Key words –
Ochronosis, quadriceps, alkaptonuria

Introduction

Alkaptonuria, a rare hereditary autosomal recessive metabolic disorder, is characterized by accumulation of homogentisic acid in the connective tissues resulting from lack of the enzyme homogentisic acid oxidase. Ochronosis, dark pigmentation of connective tissues, is the musculoskeletal manifestation of alkaptonuria.[1] The disease results in the accumulation and deposition of homogentisic acid in the cartilage, eyelids, forehead, cheeks, axillae, genital region, buccal mucosa, larynx, tympanic membranes, and tendons. The disease generally presents in adults with arthritis and skin abnormalities; occasionally, involvement of other organs may be seen.[2] The main clinical feature is dark brown colour of urine caused by high urinary output of homogentisic acid. There are no other symptoms or signs of the disease until the fourth decade of life when ochronosis is developed. Life-long accumulation of abnormal metabolites becomes overt in form of severe spondylosis, peripheral arthropathy, tendon rupture, bone osteoporosis as well as aortic valve stenosis and skin pigmentation.[3] The features of the disease are associated with affinity of homogentisic acid to the connective tissue and its effect on collagen structure. Only symptomatic treatment is applied in case of alkaptonuria and ochronosis. In alkaptonuric patients, cartilage, fibro cartilage and tendons are slowly impregnated by homogentisic acid. This leads to pigment deposition between and on the surface of collagen fibers (ochronosis) which hardens the tissues as in leather tanning, and can render them breakable. Ochronotic intervertebral discs show a tendency of calcification and ossification, which produces a characteristic radiological picture. Ochronotic cartilage is rather often split off in the weight bearing zones of the knee, shoulder and hip. This is followed by osteoarthrotic changes with a synovial reaction frequently leading to an osteochondromatosis.[4]
Case report

In this article, we report the case of an adult male aged 63 years who presented in our casualty with pain in left lower thigh and knee region and inability to bear weight on left leg after a trivial fall at home. No significant past medical history. No significant family history. On physical examination, there was tenderness over the proximal pole of left patella with visible gap in continuity of quadriceps tendon. Active SLR was not possible. Imaging was done in form of X rays which showed degenerative tricompartmental arthritic changes in knee without any bony injury and MRI scan which showed complete discontinuity of tendon. Preoperative workup was done and surgery was planned in form of quadriceps repair.

Ochronosis was an incidental finding intraoperatively, blackish deposition was found within substance of torn tendon on both ends. Sample was collected for biopsy and both ends were curetted and freshened out. End to end repair was done with no. 5 ethibond.

Postoperative workup was done in form of 24 hour urine sample darkened in sunlight. Caviar like papules were found around his eyes and the helix cartilage of his ears, and on the dorsum of both hands. There were brown macules on the sclera (Osler’s sign). Histopathological examination of blackish material confirmed diagnosis of ochronosis.

Discussion

This case is unique as the patient presented with spontaneous rupture of the quadriceps as the first symptom of alkaptonuria. 6 months follow-up results were satisfactory: good range of motion, no pain, and no extension lag (Fig 3). Good short term results in terms of VAS score and knee society score. Ando W et al, reported that tendon ruptures in patients with ochronosis should be treated as pathologic ruptures because histologic examination reveals that both ends of the ruptured tendon have extensive black pigment depositions where homogentisic acid and its metabolites have accumulated, and there are no normal collagen bundles present. [5]
Tendon should be primarily repaired and reinforced with autologous tissue because there are a few viable cells at the ruptured site. But in contrast to this, we did not use any reinforcement autologous tissue. Diagnosis was made on basis of biopsy sample which confirmed ochronosis (picture 3). Darkening of urine sample and negative Benedict’s test further supported diagnosis.\cite{6}

**Conclusion**

Ochronotic quadriceps tear is a rare entity and can present unusually as spontaneous quadriceps tear as 1st sign. In view of sparse and controversial literature available unlike other tendons, no reinforcement with autologous tissue is required for quadricepsplasty. In cases of spontaneous quadriceps tendon tears one has to keep in mind the unusual diagnosis of Ochronosis.

**References**

Hodgkin’s lymphoma of thoracic spine-case report

Rajesh S Bhat, Edward Nazareth, Harsharaj K

Abstract
About 90% of Hodgkin’s disease cases originate from lymph nodes whereas 10% from extranodal regions. Patients rarely present with spinal cord compression due to Hodgkin’s disease. Primary spinal extradural Hodgkin’s disease which does not have any other organ involvement in the body is even rarer.

We report a case of a boy aged 17 years who presented with vertebra plana and emphysematous diagnosis of tuberculosis. After four weeks patient presented as paraplegia turned out to be Hodgkin’s lymphoma. Post chemotherapy, radiotherapy was applied to thoracic region. and patient showed dramatic improvement.

Key words: Hodgkin’s lymphoma, Vertebra plana

Introduction
Lymphomas are malignant neoplasms of lymphoid lineage. They are broadly classified as either Hodgkin’s lymphoma or as non-Hodgkin’s lymphoma (NHL). Hodgkin’s lymphomas classified as nodular sclerosing, mixed cellularity, lymphocyte predominant and lymphocyte depleted types. Hodgkin’s lymphomas may be treated with radiation therapy, chemotherapy, or hematopoietic stem cell transplantation, with the choice of treatment depending on the age and sex of the patient and the stage, bulk, and histological subtype of the disease. The disease occurrence shows two peaks: the first in young adulthood (age 15–35) and the second in those over 55 years old.

Vertebra plana is a rare presentation of spinal lymphoma. When radiological picture of a patient of paraplegia presents vertebra plana, diagnosis becomes a challenge. In a developing country like India tuberculosis should also be a consideration. Even histology sometimes fails to conclude a diagnosis.

Case report
A boy aged 17 years presented to us in orthopaedic department with back pain following a trivial trauma. He was seen by a local doctor and treated with analgesics; details of treatments were not available to us. Since then pain worsened and he developed difficulty in walking. So he came our hospital.

Physical examination revealed a tender gibbus deformity of spine, with severe paraspinal spasm. Sitting and standing caused marked discomfort. His neurological functions of lower extremities were intact. The blood counts were within normal limits except for raised ESR which was 80mm/hour. The positive history of contact with a close relative (paternal grandfather) who had chronic cough with associated weight loss and died shortly before the child’s admission warranted an initial diagnosis of Pott’s disease in this patient. Radiographs demonstrated T9 T10 collapse with appearance of vertebra plana. The MRI of thoracolumbar spine confirmed collapse of T10 vertebral body with gibbus deformity at lower thoracic spine and altered signal intensity involving T10, 11, 12 vertebral bodies and intervening disc with minimal pre and paravertebral soft tissue components suggestive of Pott’s spine.

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Figure 1, 2: Initial Xrays: T9 T10 collapse with appearance of vertebra plana.

Figure 3 & 4: MRI of thoracolumbar spine: collapse of T10 vertebral body with altered signal intensity involving T10, 11, 12 vertebral bodies

The needle biopsy revealed chronic inflammatory cells with no evidence of tumour tissue. Based on the clinical, radiological findings and the inconclusive laboratory reports, empherical diagnosis of eosinophilic granuloma or tuberculosis was made. He was put on anti tuberculosis treatment and discharged with a Taylors brace and was advised strict bed rest. 4 weeks later the patient presented in emergency department with paraplegia. His repeat MRI showed collapse of T10 vertebral body with extension of altered signal intensity into the posterior elements of T10 vertebra. On contrast images there is evidence of peripherally enhancing pre and para vertebral collection (Abscess) from T10-12 levels with epidural components extending into the spinal canal and significant compression on the spinal cord. Oncology opinion taken, CT guided biopsy was done and report suggestive of high grade lymphoma and suggested IHC for confirmation and subtyping.

Radiation oncology opinion taken and he was put on palliative radiotherapy of spine 30GY. He was started on chemotherapy of COP regimen.

At the time of discharge, the patient was able to walk with crutches while wearing a thoracolumbar orthosis after second chemotherapy. One year after the chemotherapy, radiographs showed a solid fusion and bracing was discontinued. The patient was walking without crutches and without a brace.

**Discussion**

The present report describes, to our knowledge, the lymphoblastic lymphoma originating as a paraspinal mass accompanied by complete paraplegia (following a collapse of the vertebrae). The child presented with neither an anterior mediastinal mass nor lymphadenopathy, the two most presenting form of lymphoblastic lymphoma. The positive history of contact had supported the initial diagnosis of Pott’s disease in this patient.

Only 5% of cases of Hodgkin’s lymphoma may develop spinal cord compression. In only 0.2% cases, cord compression is the initial presentation. It is reported that in the spinal cord, the thoracic segments are most commonly affected, followed by lumbar region, and rarely the cervical region.

To make a diagnosis of Hodgkin’s lymphoma, one needs to find the characteristic milieu of cells- lymphocytes, plasma cells, histiocytes and eosinophils; as well as...
mononuclear and binucleate Reed-Sternberg cells. When there is previous history of Hodgkin’s lymphoma diagnosed on nodal biopsy, histologic interpretation becomes easy. In the absence of a previous biopsy, a diligent search has to be made for Reed-Sternberg cells. The differential diagnosis of Hodgkin’s lymphoma presenting as spinal cord compression would include non-Hodgkin’s lymphoma, non-specific inflammation, tuberculosis and rarely eosinophilic granuloma⁴,⁸.

With current treatments, Hodgkin’s lymphomas in most children are apparently curable through precise histologic diagnosis, thorough staging of the disease, and multiagent (and sometimes multimodal) treatment. The short-term morbidity of chemotherapy regimens is considerable, but the effects are usually manageable⁵.

**Conclusion**

The present report is therefore aimed at raising the clinical suspicion of Hodgkin’s lymphoma of the vertebra in patients with clinical features are suggestive of tuberculosis of the spine. The diagnosis of Hodgkin’s lymphoma requires detailed clinical evaluation, status of lymph nodes, liver, spleen and histo-pathological confirmation. However, when cord compression is the first manifestation, the diagnosis is difficult and the patient has to be carefully examined.

**References**


**Figure 5, 6, 7 & 8**: repeat MRI: collapse of T10 vertebral body with extension of altered signal intensity into the posterior elements of T10 vertebra. In the contrast images there is evidence of peripherally enhancing pre and para vertebral collection (? Abscess) from T10-12 levels with epidural components extending into the spinal canal and significant compression on the spinal cord.