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EDITORIAL

CONTENTS

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President's Message

It gives me immense pleasure to present to you the **"TIMES OF ORTHOPEDICS" (TOO)** series.

As the TSI President of the year, my focus is on improving the communication between the TSIans spread across the entire country and to use every medium to hear about your achievements, successes, problems and difficulties. The field of Orthopedics is dynamic and constantly changing with new drugs, techniques and concepts.

TOO will add to our knowledge base with ease of reading and keep us updated.

We all need to be more evidence-based in our practice and I look forward to our upcoming Traumacon 2017, wherein we launch TOO.

I convey my best wishes to the editors Dr. Sushrut Babhulkar, Dr. Amit Ajgaonkar and Dr. Rajeev Chatterjee. I am sure they will make TOO and its journey exciting for the years to come.

Happy reading!.

Editor Message

It gives us great pleasure and pride to pen the below as the editors of the very first issue of "Times of Orthopedics", a peer reviewed journal.

The aim of this series is to have a mix of academic, scientific and lifestyle-related articles to bring you up to date with developments in our field. Times of Orthopedics is being launched with an aim to provide rapid and reliable source of information in the mode of original articles, review articles, case reports, short communications, etc. in all areas of the field. TOO will focus on the areas of Trauma predominantly, but also a wide and relevant aspects of bone tumors, pediatric orthopedics, foot and ankle surgery, joint replacements, metabolic bone diseases etc will also be covered. Although several important topics are mentioned, we believe TOO will not limit the consideration for publication other allied topics, if found suitable to cover under the wide scope of this journal.

An enormous amount of work has gone into the development of this journal and I believe you will see that effort reflected in this and the future editions in the impact it will have on the readers. It has been an interesting start, many aspects of which our President has shared in his welcome notes. As we look at TOO, it is important to keep in mind that it represents the collective thinking of a group of innovative individuals at Science Integra with whom I am privileged to work. Firstly, we want TOO to be a premiere academic journal in the engagement of our fraternity. We want it to look different, to be different, to be one journal that, with its own app (launching soon), will be as dynamic as the work going on in our disciplines, a rarity in academic publishing. Secondly, we want it to be a vehicle for a new type of conversation and its place in the academic review, tenure and promotion. Lastly, we want TOO to lead the way in defining scholarship in the fraternity, scholarship in which faculty, students, and community members participate from idea to presentation. We do not know how, but we intend to get there.

Authors are encouraged to share their ideas and valuable research outcomes through this platform and provide the Indian readers updated and most important information in this regard. We will work to make TOO a success not only in India but a platform to reckon across countries too. Those wanting to be a part of this winning team may share your papers by sending as an e-mail attachment to editorial office at sushrutdsurgeon@gmail.com or production@scienceintegra.com

REVIEW

Ipsilateral femoral neck fracture and shaft femur fracture

Author: Dr. Sushrut Babhulkar

Ipsilateral neck and shaft femur fractures though rare is a very interesting injury to handle. Which fracture to fix first? Which device to use to get best outcome always confuses our minds. Both the fractures of neck femur and fracture shaft of femur are independently common but concurrent femoral neck fractures with ipsilateral femoral shaft fractures are reported in 2-5% of patients with fracture shaft femur.[1-4] Delaney & Street first described this combination injury in 1953[4] and subsequently many authors described this injury.[2,3, 5 -11]

The diagnosis of this combination fractures is missed in 20% - 50% cases, mainly because of failure to radiographically evaluate the hip joint and entire femur when patient has the fracture shaft of femur.[3,4,8,12-15] Attention is easily drawn to more dramatic shaft fractures, while the possibility of another fracture in the same femur is not considered and thus missed. Sometime the fracture neck femur is detected during the surgery when, patient is taken on the operation table for antegrade femoral nailing and the fracture is noticed while taking the point of entry. Few of the fracture neck femurs may be iatrogenic injuries created at the time of antegrade intramedullary nailing. Failure to take appropriate radiographs, external rotation of the shaft of the femur and the presence of a subclinical occult fracture may account for preoperative misdiagnosis.[16] Plain x-ray of proximal femur and knee joint must be obtained as a part of initial evaluation followed by fluoroscopic evaluation in each and every patient of fracture shaft femur. Ideally x-ray femur must include hip and knee joints. Fracture neck femur detected during nailing may be initially missed one or may occur during the preparation for point of entry[17] during nailing, or lateral insertion of nail or wrong point of entry.[18,19] The neck fracture may be diagnosed immediately after nailing or several days later when patient are mobilised, and few cases have been reported as iatrogenic fractures.[15] The faulty introduction of a femoral nail may cause an iatrogenic fracture of the femoral neck, but few of them, so described are probably due to displacement of an incomplete or undisplaced fracture during nailing.[20] The shaft femur fracture in this combination injury is usually in the mid shaft and is often comminuted. This comminuted mid shaft femoral fracture secondary to axial loading should alert the surgeon for the associated neck femur fracture.[21] In this combination injury the knee and femoral shaft absorb most of the impact of energy, thus reducing the energy transferred to the neck, which will minimize the displacement of associated fracture neck femur, which accounts for missed and delayed diagnosis of fracture neck femur because of minimal symptoms.[21]

Mechanism of Injury

All most all these combination of injuries result from high-energy trauma, secondary to motor vehicle accidents.[1-4,6] However, in few cases the injury might result from falls from height, motorcycle accidents and pedestrians who meet with the motor vehicles. Hence, one has to be careful, while dealing with cases especially in unconscious patient, polytrauma patient, multiple fractures, and segmental fractures.

Proper x-rays are essential for the evaluation and in addition to shaft femur it must include hip and knee joints. If in doubt internal rotation view of hip, x-ray pelvis and CT should be performed to rule out fracture neck femur before patient is subjected to surgery.[21]

Management

Ipsilateral femoral neck and shaft fractures are best treated by surgical stabilization. Despite the advances in internal fixation methods this combination fractures continues to create dilemma for choosing the best option amongst the internal fixation devices and timing of surgery.[22-24] Conservative treatment is rarely indicated and surgical fixation remains the gold standard. Femoral neck fractures in young patients is considered as orthopedic emergency. The issue is which fracture should have the optimal treatment,

which may compromise the optimal treatment of the other injury.

However Alho, [24,25,26] Watson, and Moed [26,27] have suggested that femoral shaft fracture was the main determining factor of the patients' overall outcome. Furthermore, the risk for complications is greater in the treatment of this combination injury pattern than for single-level fracture. It is observed that the patients with femoral shaft nonunion required more operative procedures to achieve union when compared with patients with femoral neck nonunion.[26,27] The femoral shaft nonunion proved more difficult than expected to treat with some patients with femoral shaft nonunion requiring more than one operative procedure to achieve union. Lag screw fixation of the femoral neck fracture and reamed intramedullary nailing for shaft fracture stabilization were associated with the fewest complications. However, the shaft portion of this injury may not receive attention on priority, the thought being as usual the shaft femur fracture will be easier to handle, since the rate of nonunion of femoral neck fracture and osteonecrosis are very high, if the fracture is not anatomically fixed early.

The rationale of definitive fixation of femoral neck as the initial step in surgical fixation is based on technical and biological considerations.[21] It is technically difficult to fix the fracture neck femur in the presence of antegrade femoral nail or stable fixation of femoral neck will not allow to pass the standard antegrade femoral nail. Hence, either one will have to use retrograde nailing interlocking and fix fracture neck femur with multiple screws or DHS or use second generation reconstruction nail for stabilization of both the fractures.[22,23] However, because of concern about the suboptimal fixation of comminuted shaft fracture few authors prefer to fix femoral shaft fractures first.[1,7,24-30] Femoral shaft fractures are frequently unstable rotationally and axially and are best managed by standard reaming interlocking nail. Adequate fixation of femoral neck fracture is achievable with the use of supplementary screws, though it might be difficult. For this miss a nail technique with use of Sirus nail has been invented. However, with the advent of cephallomedullary nails, second generation reconstruction nail both the fractures can be effectively fixed[1,7,13, 15, 26,29-37] with good results.

There are multiple treatment options, that include:

1. Retrograde nailing interlocking for shaft with multiple cancellous screws for neck (Figures 1 and 2)
2. Retrograde nailing interlocking for shaft with DHS and anterotation screw for neck (Figures 3 and 4)
3. Lag screw-DHS/multiple cancellous screw for neck with DCP for shaft fracture (Figure 5)
4. Reconstruction nail
   - Gamma nail (Figures 6,7,8)[33,34]
   - Russell Taylor nail (Figure 9)[31,35]
   - Proximal femoral nail (PFN)[32,36]
5. Antegrade nailing interlocking with Miss a Nail Technique
6. Miss a Nail technique by Sirus nail
7. Various other combinations

The screw fixation of fracture neck femur for compression is a priority and shaft femur can be treated either by retrograde nailing or fixation by dynamic compression plate.[22,27] Author prefers the fixation of shaft first by retrograde nailing interlocking followed by fixation of fracture neck femur by DHS with anterotation screw. Sometimes instead of DHS multiple cancellous screws may be used (Figures 1 to 5).

The other method of fixation is antegrade intramedullary femoral nailing for shaft fractures with multiple screw fixations for neck fracture.[13,14,29,31] This is achieved either by miss a nail technique or by using Sirus nail. The first generation interlocking nails did not afford adequate fixation for combination injuries, but second-generation nail is basically designed to take care of simultaneous fixation of both the fractures.[32-38] There are many reports and publication of use of Reconstruction nailing for the fixation of these ipsilateral combination injuries.[30-38] The attractiveness of this type of fixation was that closed nailing avoiding extensive open reduction procedures could treat the complete spectrum of femoral shaft fractures.[32-38]

The proximal end of nail is designed to accommodate two lag screws that gain purchase in femoral head and neck of the femur.[30, 32,33,36,37] The fixation of proximal femoral fractures also acts as proximal locking for interlocking fixation of the shaft (Figures 6 to 9). The operative technique and use of these devices are technically demanding than routine nailing interlocking. Correct rotation of the nail and direction of anteversion for lag screws in femoral neck has to be properly guided for proximal fixation.[34,35] The possibility of displacement of femoral neck fractures during surgical fixation has to be considered while fixation by reconstruction nail, hence one may to consider temporary fixation of femoral neck injury with temporary K wire or guide wire or one screw to begin with.

1. Multiple screw for neck with retrograde nailing interlocking [22,27]

Figure 1 Showing multiple screw fixations for fracture neck femur with retrograde nailing for comminuted shaft femur fracture. A. Preoperative X-ray showing transcervical fracture neck femur with ipsilateral comminuted fracture shaft of femur. B. Post operative X-ray at 3 months showing stabilization of shaft by closed Retrograde nailing and percutaneous fixation of neck femur by two cancellos screws. C. 6 months postoperative xray showing healing of both fractures

Figure 2 A. X-ray showing Basal fracture neck femur with ipsilateral fracture shaft femur with bone loss B. showing multiple screw fixations for fracture neck femur with retrograde nailing for shaft femur with primary loss of bone. C-Treated by Bone grafting in second stage at 4 weeks. D-The patient developed stress fracture just below the heads of the cancellous screw and above the tip of nail, E-treated by revision with exchange nail by longer retrograde nail and removal of one screw. Final X-ray at 6 months showing good healing of both fractures with solid callus.

2. DHS with Retrograde Nail

Figure 3 A & B-Preop Xray showing basal fracture neck femur with comminuted fracture 2. DHS with Retrograde Nail shaft femur with floating knee injury. C & D-X-ray showing stabilisation of cervico-trochanteric fracture by DHS and shaft fracture fixed by retrograde nail and Tib Plateau fixation by Plate.

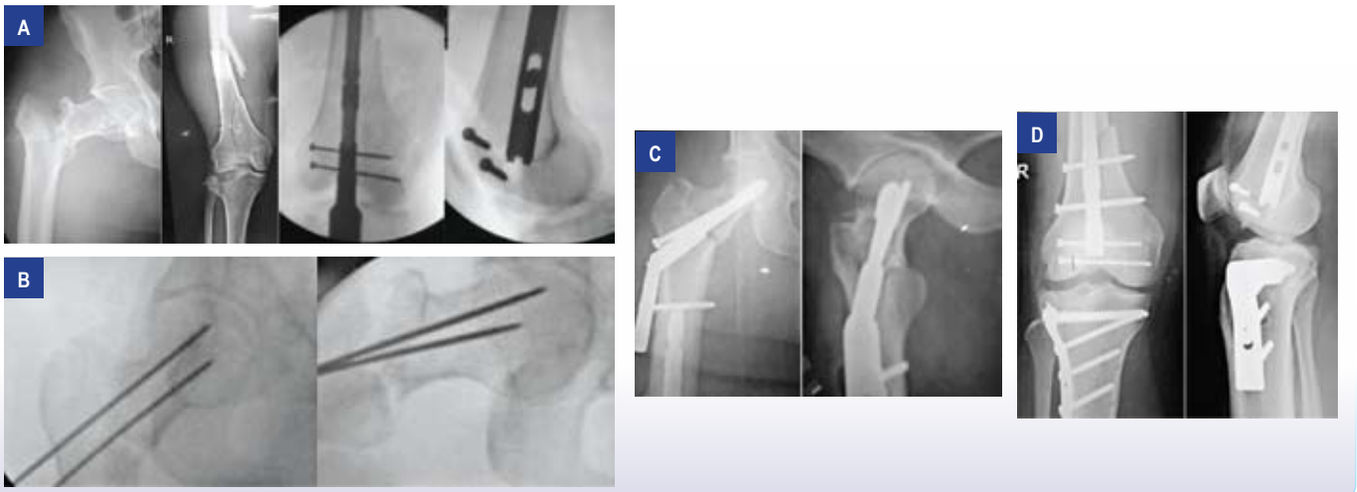


Figure 4 A- Preop Xray showing basal fracture neck femur with comminuted fracture shaft femur. B- X-ray showing stabilisation of intertrochanteric fracture by DHS and shaft fracture fixed by retrograde nail showing excellent union of both fractures at the end of 6 months

3. DHS with DCP[22,25,26]

Figure 5 A-Preoperative X-ray showing cervicotrochanteric fracture neck femur with ipsilateral shaft femur fracture. B-X-ray showing stabilisation of cervicotrochanteric fracture by DHS and shaft fracture fixed by DCP

4. Reconstruction Nailing- Gamma Nail[34,35]

Figure 6 **Figure 6.** A-X-ray showing basal fracture neck femur with ipsilateral shaft fracture B-treated by Gamma nail, X-ray at 11 months showing good union of both fractures

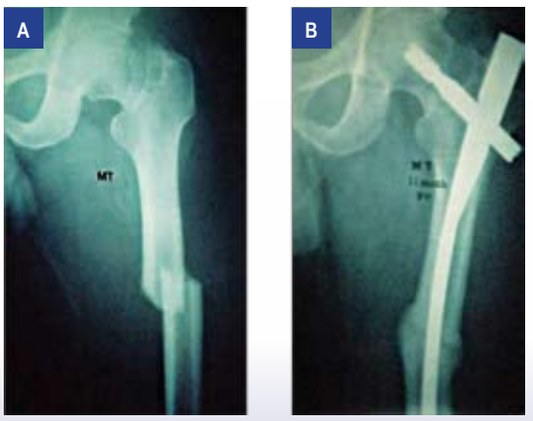
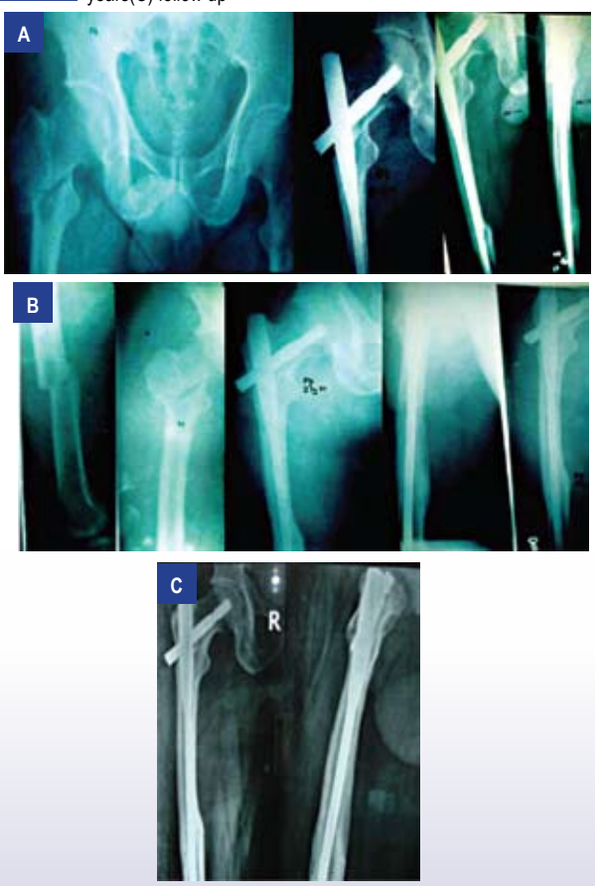


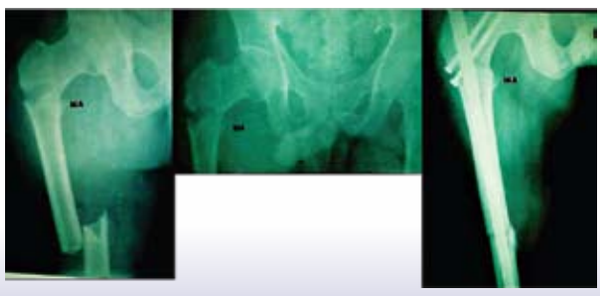
Figure 7 A-Preoperative X-ray showing Ipsilateral subcapital fracture neck femur with shaft fracture treated by Gamma nail. B-Post operative X-ray showing excellent union of combination fracture treated by Gamma nail - 8 yrs follow up

Figure 8 Figure 8. Combination injury Subtrochanteric fracture with ipsilateral shaft fracture treated by long Gamma Nail-(A) 3 years(B) and 10 years(C) follow up



5. Reconstruction nailing- Russell Taylor ail[32,35,36,39]

Figure 9 A- Preoperative Xray showing Ipsilateral Trochanteric & shaft fracture B- treated by Russell-Taylor reconstruction nail showing good stabilization of both fractures.



Post operative protocol

Patients should be mobilized quickly. Rehabilitation should begin within 2-3 days after fixation. Nonweight bearing hip knee exercises should be started and patient should be encouraged for nonweight bearing crutch walking. Weight bearing is delayed especially to protect the fracture neck femur. In most of the cases partial weight bearing should begin between 6-8 weeks after fixation and full weight bearing depending upon the fracture neck fixation and comminution of fracture shaft femur. Early progression to weight bearing facilitates callus formation and fracture union. All nails should be passed after reaming of diaphysis of femur and no undreamed nails should not be used.

Complications

1. Nonunion
2. Malunion
3. Avascular necrosis of femoral head
4. Implant failure

The femoral neck fracture nonunion or avascular necrosis of femoral head has been reported in about 7% of these cases.[2,3,28] To avoid this complications priority is given to femoral neck fixation and hence intracapsular fractures are preferably fixed by lag screw or multiple cancellous screws.[22,29]

At times there might be nonunion of femoral shaft fractures. Hence, early intervention for bone grafting may be considered if delayed union is observed.

Conclusion

It's Mandatory to take x-ray of hip and knee joint in any fracture shaft femur, may be at times CT pelvis is required.[17] Priority of fixation must be given to femoral neck fractures and any combination of fracture fixation described above should be considered. Whenever planning for nailing interlocking, keep all types of third generation reconstruction nails ready including, Gamma nails or Reconstruction nails as stand by. Adequate inventories must be kept handy & ready, including DHS implants, Cancellous screws and reconstruction nails.

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The National Osteoporosis Foundation analysis of risk of fracture and supplementation with calcium plus vitamin D

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Fractures: A health burden worldwide

Fracture is a broken bone that is completely or partially broken. There are a number of types of fractures depending on the way a bone and the surrounding skin are damaged.[1] In a population-based study, researchers reported an 11% increase in the incidence of fractures from 1989-91 to 2009-11.[2] Fractures treatment is an economic burden, both with respect to treatment costs and loss of productivity.[3] Two-thirds of the fractures happen due to a sudden accident or a traumatic event, but the remaining fractures are due to the pathological disease of a bone. Osteoporosis and cancerous bone are the two most important pathological diseases of the bone that can lead to fractures.[4]

Osteoporosis: The predominant cause of bone fractures[4]

Postmenopausal women and elderly are at an increased risk of osteoporosis.[5] The World Health Organization (WHO) operationally defines osteoporosis as the condition in which bone mineral density (BMD) is 2.5 times less than a normal BMD of a normal young adult (T score <2.5).[6] Whereas, if the T score is in the range of 1–2.5 then that condition is known as osteopenia.[7] Center for Disease control and prevention (CDC) statistics has demonstrated that 1 out of every 4 elderly women may have osteoporosis.[8]

According to the International osteoporosis foundation, for every 3 seconds a new osteoporotic fracture is being documented amounting to 25,000 fractures per day and 9 million fractures per year.[9] According to the Indian studies, middle-aged (30–60 years) Indian women from low-income groups have low BMD at all the skeletal sites and are at high risk of osteopenia (52%), osteoporosis (29%), and bone fractures relative to the developed countries which is attributed to inadequate nutrition.[10] Pharmatherapeutic options for osteoporosis, including bisphosphonates or antiresorptive agents have been shown to be effective only in patients with optimal calcium and vitamin D supplementation.[11]

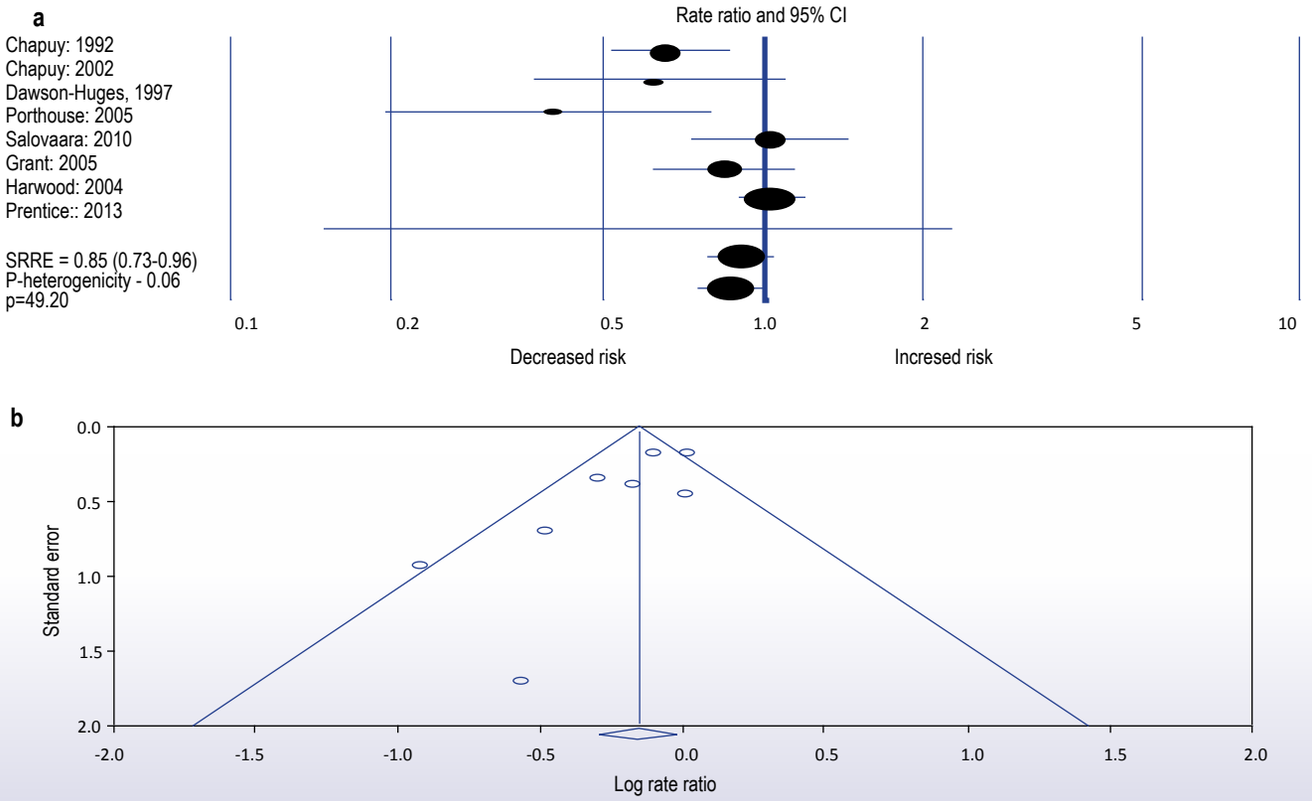
Calcium and Vitamin D in bone homeostasis: A consequence on bone health[12,13]

A bone goes through the phases of bone resorption and bone formation in a continuous fashion to maintain its intact structure, known as bone homeostasis. Osteoporosis is an indicator of imbalance between bone formation and resorption. Calcium and Vitamin D work in to maintain bone structure and bone health. Calcium have been proven to build bones and Vitamin D has been shown to maintain appropriate amount calcium in the body.[12]

Calcium

Calcium is an important structural component of the bone. About 99.5% of the total body calcium is in the bones. Insufficient blood calcium levels increase bone resorption by increasing parathyroid hormone (PTH) level in blood, decreasing calcium excretion, and stimulating production of calcitriol that increases intestinal absorption of calcium. Similarly, increased blood calcium causes an increase in the calcitonin levels, which stops the bone resorption process. These cyclic events of calcium homeostasis have a key role in bone resorption.[11]

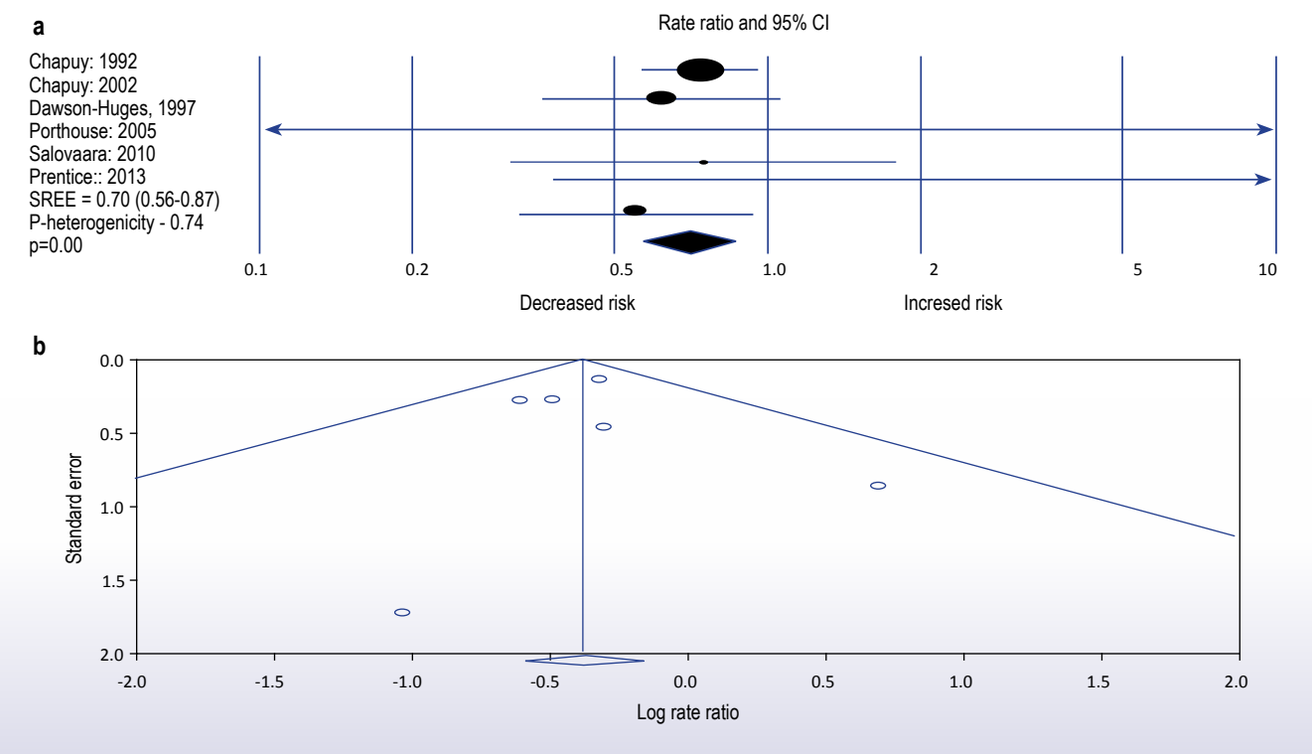
Figure 1 a. Reduction of Total fracture incidence with Calcium plus Vitamin D supplementation, b. Funnel plot[14]



Vitamin D

Calcitriol (1,25-dihydroxyvitamin D3) is the active form of vitamin D in the blood. Lack of vitamin D decreases the intestinal absorption of calcium and disturbs the calcium and bone homeostasis. Hence, an adequate intake of vitamin D helps regulate the amount of blood calcium levels and reduces the bone loss.[11]

Figure 2 a. Reduction of Hip fracture incidence with Calcium plus Vitamin D supplementation, b. Funnel plot[14]



Supplementation of Calcium plus Vitamin D for reducing fractures

Calcium and vitamin D supplementation maintains the balance between bone resorption and formation, and maintains bone homeostasis to reduce the incidence of new fractures.[11]

Evidence supporting the combination of Calcium plus Vitamin D supplementation: Meta-analysis by National Osteoporosis Foundation[14]

An expert panel of National Osteoporosis Foundation conducted a meta-analysis to rule out the inconsistencies about appropriate effect of the combination of calcium plus vitamin D supplementation in reducing rate of fractures. The analysis included eight RCTs during the period of 2011 and 2015.Considering the heterogeneity of the RCTs, a random-effects meta-analysis was considered and hence all the measures were average effects, not the common effects.

The study results:

- Researchers observed a 15% of significant reduction in the incidence of total fractures among individuals who received Calcium plus Vitamin D (summary relative risk estimate [SRRE] - 0.85; 95% confidence interval [CI]: 0.73-0.98, Figure 1a).
- Researchers also observed a significant 30% reduction in hip fracture incidence in individuals receiving combination of Calcium plus Vitamin D (SRRE - 0.70; 95% CI: 0.56-0.87, Figure 2a). These results did not seem to have publication bias, which is apparent through the funnel plots (Figures 1b and 2b).
- According to the researchers, the reported benefit was found to be valid both in institutionalized and community settings.

Hence, combination of Calcium plus Vitamin D seems to offer a promising benefit for patients with osteoporosis in all clinical settings by reducing the incidence of total and hip fractures.[14]

Summary

Fractures are a significant health problem both in terms of treatment as well as cost incurred by the patient. Patients with osteoporosis, especially those who are elderly and postmenopausal women have been observed to be a greater risk of fractures. Further, treatment of fractures in osteoporotic patients is an expensive and may put a strong economic burden worldwide; especially in the developing countries such as India. Clinical evidence indicates the crucial importance of Calcium and Vitamin D supplementation along with bisphosphonates for achieving successful outcomes. The National Osteoporosis Foundation commissioned meta-analysis showed a **15–30% of significant reduction in the incidence of fracture in all clinical settings in patients receiving calcium and vitamin D supplementation.**

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SAVE THE DATES: CONFERENCES IN 2017 & 2018

There are various national and international conferences that are conducted in the field of Orthopedics to upgrade doctors with the latest trends and developments happening in orthopedic management. The table below highlights the details of upcoming national and international conferences related to field of thyroid in 2017 and 2018.

NATIONAL AND INTERNATIONAL CONFERENCES

EBJIS
European Bone and Joint Infection Society 36th Annual Meeting
7–9, September, 2017
Nantes, France

ASSH
American Society for Surgery of the Hand 72nd Annual Meeting
7–9 September, 2017
San Francisco, United States

TI
Trauma Innovation
11–15 September, 2017
London, United Kingdom

AAST & CCACS
American Association for the Surgery of Trauma 76th Annual Meeting and Clinical Congress of Acute Care Surgery
13–16 September, 2017
Baltimore, United States

BOAAC
British Orthopaedic Association Annual Congress
19–22 September, 2017
Liverpool , United Kingdom

IFPOS-APPOS
Pediatric Orthopedics and Spine Combined Meet
22-24 September, 2017
Goa

Nailscon Corbett
6-8 October, 2017
Uttarakhand

ISIAT
4th International Symposium on Intra-Articular Treatment
5-7 October, 2017
Prague, Czech Republic

OTAAM
Orthopaedic Trauma Association Annual Meeting 2017
11-14 October, 2017
Vancouver , Canada

AAHKS
American Association of Hip and Knee Surgeons 27th Annual Meeting
2-5 November, 2017
Dallas , United States

TRAUMA
Current Concepts in Trauma 2018
24-25 March, 2018
Hyderabad

Comminuted proximal tibia

An Assessment and management overview

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Introduction

The most severe form of the injury affecting skeletal and also the soft tissue are the Schatzker V and VI fractures, and the AO-OTA "C" type bicondylar fractures. Typically, these fractures are high-energy injuries in young patients and sometimes may also pose a threat to the surrounding neurovascular tissues and as a consequence the viability of the affected limb.

The bicondylar fractures are conservative managed, in the era before the use of internal fixation. The conservative management provided "acceptable results" in the early 1970s and through 80's and 90's.[1] The main disadvantage of non-operative management included stiffness and mal-union. However, with advent of better implants and surgical anatomy ORIF is become the mainstay for these complex injuries.

Conventional techniques of open reduction and rigid internal fixation of both condyles through a single anterior incision needed soft tissue stripping. Hence, these were associated with wound healing complications when adopted for all bicondylar fractures.[2,3,31] Fine-wire external fixation as a means of reassembling the Metaphysio-Diaphyseal Dissociation (MDD) gained popularity[4,5,31] but it was recognized that this method was associated with its own unique complications such as the potential for septic arthritis of the knee due to intra-articular wire placement, and the risk of pin site infection.

The introduction of modern low profile anatomical plates with outriggers for insertion such as the Less Invasive Skeletal Stabilization System – LISS provides for insertion of plates via smaller incisions, thus minimizing soft tissue damage. In the modern implants, the capacity to use locking screws, subchondral raft screws, oblique strut screws have lead to the feasibility of securely capturing the opposite condyle – a feature that can be exploited in fixing bicondylar fractures with a single lateral plate. Furthermore, medial column fixation can be contemplated later on based on need to avoid medial collapse and subsequent varus deformity.[6]

The management of tibial bicondylar fractures is influenced by the patient's condition, the surgeons' assessment of the "fracture personality" based on x-ray findings, CT scan 3D assessment, ligamentous injuries, and local soft tissue status.[31]

Patient-related factors include age, co-morbidities, associated injuries, as well as the patient's expectations of function following treatment. Salient aspects of the fracture personality that affect management and outcome are the degree of articular and metaphyseal comminution, bone loss, and the direction of the fracture lines. Soft tissue swelling can become significant enough to cause raised compartment pressures even in an apparently low-energy injury. In high-energy injuries, bruising and loss of skin integrity can take a few days to manifest even if there are no obvious skin wounds at presentation.

Initial "Wait" period

Tibial bicondylar fractures typically occur in young patients with high-energy injuries . Associated skeletal injuries, History of accident should point us towards the magnitude of trauma and thus also give a hint towards magnitude of hidden damage. Specific to tibial bicondylar fractures, assessment should include soft tissue status, distal neurovascular status, and continued monitoring for compartment syndrome. This initial wait- period may extend from 3 to 12 days depending on the appearance of reasonable wrinkle sign, decrease of swelling and edema around fracture site, 'cooling down' of the fracture blisters. Fracture blisters sometime may need aggressive management in terms of aspiration and emptying under sterile precautions. Antibiotics may be warranted if there are too many of these which require opening up leading to a reasonably big raw area.

Local damage control of a tibial bicondylar fracture is best achieved with closed supervised intelligent observation either just by elevation and posterior support or still better option is by employing a uniplanar stable spanning external fixation. This allows provisional reduction of the fracture, maintains fracture alignment and leg length, gives excellent pain control, helps in reduction of swelling, and allows for unhindered assessment and care of soft tissues. It also allows easy monitoring for compartment syndrome. Furthermore, it allows painless transport for patients to specialist trauma centers if required. Concerns about the possible risk of compartment syndrome due to acute restoration of length, and the increased risk of thrombo-embolic phenomena have proven unfounded.[8,9] Spanning fixation does not cause long-term restriction of knee movement and classically it should be applied on the Anterior/Antero-medial plane which will give an extra focal approach without jeopardizing the routinely used lateral approach to the fracture area.[10,31]

It is important to avoid the zone of soft-tissue injury and bony injury – typically, the pins are placed at least 2 to 3 cm away from the furthest limit of bony injury visible on radiographs, and the same distance from visible soft-tissue injury. The knee joint is kept in about 15^0 of flexion to provide for non-weight-bearing mobilization of the extremity.

Additional pins can be used for increasing stability in area lateral to medial in the distal femur, and anteromedial to posterolateral in the tibia.[11] Despite of external fixation limb should be elevated up to accentuate decrease of swelling and edema. The progress should be closely monitored in this initial wait period by the definitive operating surgeon time to time.

Assessment work-ups

Before the availability of computed tomography (CT) scans, oblique radiographs of the knee joint complemented standard anteroposterior and lateral radiographs of the knee and proximal tibia. cCurrently, CT scanning, using 3-mm cuts is the investigation of choice for accurate assessment of the fracture. Scans should be carried out only after application of spanning external fixation – this removes the possibility of multiple overlapping shadows, including an impacted femoral condyle interfering with interpretation of the scan. The axial cuts are studied to determine the direction of the fracture lines, especially those of the medial condylar fragment.

The sagittal and coronal reconstructions provide an estimation of metaphyseal 'bone loss', and the position of depressed articular fragments. Some of the fracture patterns of unicondylar variety (depressed and split) also give us a hint towards considering a possibility of entrapped meniscus thus hindering the reduction of articular surface by mere compression. This then needs visualization of the articular surface and removing the entrapped meniscus prior to compressing the articular surface.

Researchers have observed 36% incidence of meniscal injury, diagnosed by magnetic resonance imaging (MRI), in tibial plateau fractures but could not find any correlation with fracture type or amount of fracture depression.[12] In a study, Mui et al., have shown that CT scans have a high specificity with regards to ligamentous injuries in tibial plateau fractures but are poor in assessing meniscal injuries.[13] MRI scan could over-diagnose meniscal injuries. Meniscal injuries detected do not always require surgery as often these injuries are just contusions.[14,31]

While MRI has been shown to be sensitive in identifying meniscal and ligamentous injury in tibial condylar fractures, it is of less importance in complex bicondylar fractures than in the simpler fracture patterns.

Definitive treatment

As is often seen, it is not unusual for soft tissue swelling to take up to few days to settle enough to execute a definitive fixation. As stated earlier, the use of spanning external fixation allows patient mobilization during this period, and allows for unhindered monitoring of the status of the skin.

The two broad aspects of definitive treatment are :

1) Restoration of the articular surface

2) Restoration of the MDD

Irrespective of the technique employed, the principles remain the same as with any other fracture surgery. The articular block is first anatomically reduced and stabilized. The metaphyseo-diaphyseal part of the fracture is dealt with by indirect reduction, providing relative stability whilst ensuring satisfactory length, alignment and rotation judged clinically and confimed under Image intensifier on table.

Articular surface reconstruction

Articular surface reconstruction can be accomplished by closed means in the simpler fracture patterns. However, higher energy fractures are usually associated with depressed articular fragments, and need an open reduction of the lateral condylar articular surface and screw fixation. Open Intraraticular submeniscal approach allows for a direct visualization and reconstruction of the articular surface,

monitoring the lifting up of the depressed fragments and also joysticking the articular fragments or entrapped loose articular fragments or meniscal structures if need be. Indirect articular reduction could be achieved by ligamentotaxis using a femoral distractor applied such that it does not interfere with intraoperative fluoroscopy and surgical field. Arthroscopy-assisted fracture reduction is useful in simpler fractures, such as partial articular fractures,[15] but fluid leakage into compartments and possibility of compartment syndrome often precludes it in higher energy fractures. There is, however, potential advantage of assessing the intra-articular structures and treating any meniscal injuries. Since a very few number of trauma surgeon fancy concomitant use of arthroscopy this currently is not the standard of practice.

The anatomy of the proximal tibia (convex lateral condyle thus more brunt of vertical impact)and fracture vector is such that the vast majority is associated with depression of the articular surface of the lateral condyle. If there is an associated Postero-Medial or Postero Lateral independent, displaced articular fragment then it needs a separate and prior attention. Postero Medial fragment needs to be addressed first by an independent Postero medial incision, elevation, reduction and then fixation using a buttress plate. If this is not done as an initial attack, the main articular surface doesn't fall in place and a later attempt to reduce this fragment is always a wasted attempt. A precise reduction of Postero medial fragment is critical to avoid immediate varus collapse and restriction of flexion of the knee. Some of the lateral/medial depressed fragments cannot be elevated by closed reduction they then can be elevated by making a bone window percutaneously, and tapping with a bone impactor. This is achieved by creating a cortical window on the opposite side and employing varied angled and beaked bone impactors to slowly drive in the depressed articular fragment controlled either by image intensifier or by direct sub meniscal approach articular surface visualization.

The Direct visualization of the articular surface can be achieved by performance of a submeniscal arthrotomy, and elevating the meniscus after dividing the coronary ligament. The depressed fragments are gently disimpacted, and elevated to the level of the articular surface. The fragments are temporarily held in place with K-wires, and substituted with screws. 6.5 mm screws afford excellent grip, but there is a vogue now to use multiple smaller screws in a "raft" configuration – these are 3.5-mm or 4-mm screws, placed subchondrally. There is biomechanical evidence to suggest that a "raft" of these screws affords as good a grip or even better as the larger screws, particularly in osteoporotic bone.[16,17]

Bicondylar tibial plateau fractures often have bone defects due to compression of the cancellous subchondral bone. After reduction of the articular fragments, options for filling the metaphyseal bone defects include iliac crest autograft, allograft and bone substitutes such as calcium phosphate and hydroxyapatite. A randomized trial has shown calcium phosphate to have reduced subsidence rates in comparison with autograft.[18] Iliac crest autograft however continues to be the 'gold standard' and has the potential advantage of providing osteogenic, osteoinductive and osteoconductive properties, at the potential expense of donor site morbidity.

After the articular surface has been reconstructed, metaphyseal defects filled, and the fracture stabilized, the meniscus is reattached using strong absorbable sutures, in effect completing a red-on-red repair. The capsule and iliotibial band are closed, thus completing the articular reconstruction. Attention is then turned to restoration of the MDD and assessment of medial column stability.

Restoration of the metaphyseo-diaphyseal dissociation

Double plating using one incision: This procedure involves significant soft tissue stripping leading to an unacceptably high incidence of infection and non-union,[19] and is hence not preferred now.

Single lateral locking plate: Biomechanical studies suggest a clinically insignificant difference in collapse of the medial condyle following fixation of experimental bicondylar fractures with a single lateral locking plate.[20] However, the direction of the fracture line in the medial condyle can vary.[21,22] A predominantly "back to front" medial condylar fracture can be gripped adequately with locked screws from a lateral plate.

However, lateral to medial screws from a lateral locked plate cannot provide adequate purchase on an oblique fracture, or a predominantly posteromedial fracture. The literature suggests failure in restoring and maintaining alignment in about 8–13% of patients of bicondylar fractures treated with single lateral locked plates.[6,23] Therefore, the use of a single lateral locking plate in all bicondylar fractures is likely to result in failure in certain fracture patterns due to inadequate grip of the medial fragment . If one feels a varus jog despite of lateral column fixation, a simple anteromedial plate to avoid medial beaking in of cortex leading to late varus collapse can be easiliy avoided. This subcutaneous antero medila plate can also be removed early on (3-4 months) if it is impeding over the overlying skin.

Clinical Example 1

Figure 1 Pre-operative radiograph showing Bicondylar Tibia fracture with Metaphysio-Diaphyseal Dissociation

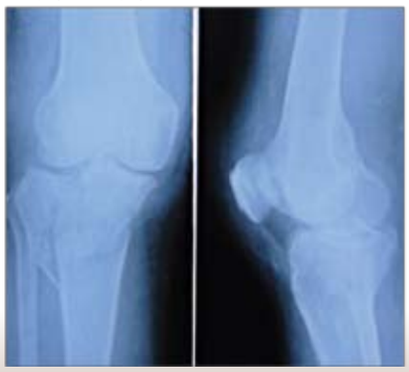

Figure 2 Post-operative radiograph showing initial treatment with spanning external fixator in view of tense swelling and huge fracture blisters all around the knee and leg

Figure 3 Post-operative radiograph showing definitive management with anterolateral locking plate . This is an example wherein single column fixation with cancellous screws were able to hold the oppsite medial column well . Hence in veiw of additional soft tissue environment compromise, no necessity of dual plating .

Double plates with two incisions: This is used if there are complications of a midline incision to stabilize both condyles. First, the medial condylar fragment is stabilized using a posteromedial approach.[24] A one-third tubular plate, in antiglide mode, usually suffices in patients with good bone quality. Newer precontoured locked plates, designed for the posteromedial surface of the proximal tibia can also be used

The lateral condylar fracture is then approached through a separate anterolateral incision – the preservation of the anterior skin bridge results in a negligible risk of wound breakdown]. A lateral condylar plate is used to restore the MDD following the restoration of the articular surface through open reduction and "raft" fixation.

Clinical Example 2

Figure 4 S M. 55 yrs, male, RTA, Bicondylar fracture, No associated Neurovascular injury

Figure 5 Pre-operative CT – AP and PA projections accurately delineating the fracture pattern

Figure 6 Pre-operative CT – Meidal & Lateral Projections

Figure 7 Preoperative CT – Oblique projections showing involvement of articular surface

Figure 8 Post-operative AP and Lateral radiographs showing dual plating – anterolateral locking plate and spanning anteromedial reconstruction plate (Temprary Internal Fixator Plate – effectively avoid Varus collapse- remove this in 6 -8 weeks). Articular surface has been restored with reconstitution of Metaphysio-Diaphyseal Dissociation to normal physiological valgus.

Figure 9 Post-operative CT Scan with 3D reconstruction – Anterior and Posterior views showing well-fixed double plates with reconstituion of MDD.

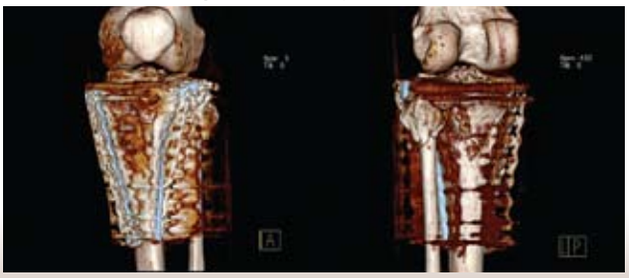

Figure 11 Medial and Lateral View showing plate positions.

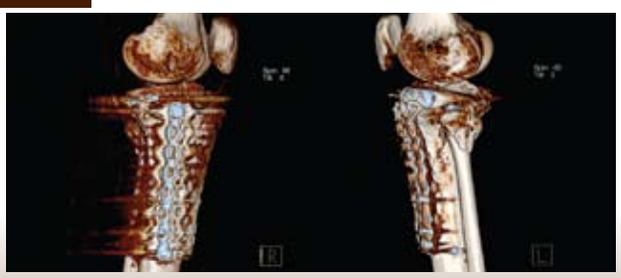

Figure 11 CT projection showing plate position in a Double palte fixation mode

Figure 12 4 months Post-operative radiograph after anteromedial spanning plate removal for subcutaneous prouding showing well healed fracture and restored articular surface .

Clinical Example 3

Figure 13 Pre-operative radiograph of Schatzker Type 6 fracture with ipsilateral comminuted patella fracture

Figure 14 Post-operative radiograph showing double plate fixation – Lateral and medial . Patella fracture managed by tension band wiring .

Figure 15 3 months Post-operative radiograph with good maintainance & healing of Metaphysio-Diaphyseal Dissociation and restored articular surface .

Plating in unusual fracture patterns: According to a study, the axial CT sometimes reveal unusual fracture patterns, usually posterior or posterolateral. In such cases, specific approaches, directed to neutralize the fragment are required.[31] If there is a large posterolateral fragment, then a posterior approach to the knee will provide adequate access to achieve fracture reduction and plate fixation in buttress mode. A variant of the posteromedial approach can be used for posteromedial fracture lines.[26] Similarly, an associated fracture of the tibial tuberosity can be stabilized with a plate and screws.

Clinical Example 4

Figure 16 Radiograph showing double plate fixation but missing the posteromedial fragment .It thus is necessary to identify and fix this PM fragment independently. Not all Double plating will essentially capture the PM fragment

Clinical Example 5:

Figure 17 Pre-operative radiograph showing Schatzker Type 5 fracture, AO/OTA type C

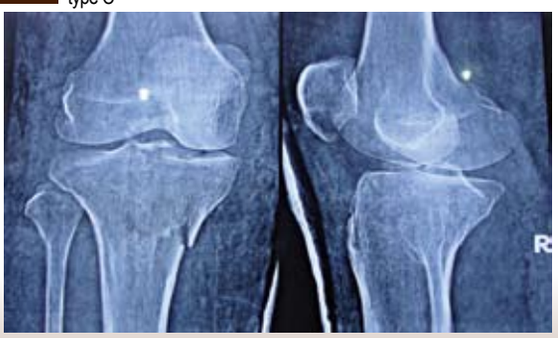

Figure 18 CT scan with 3D reconstruction showing accurate fracture pattern .

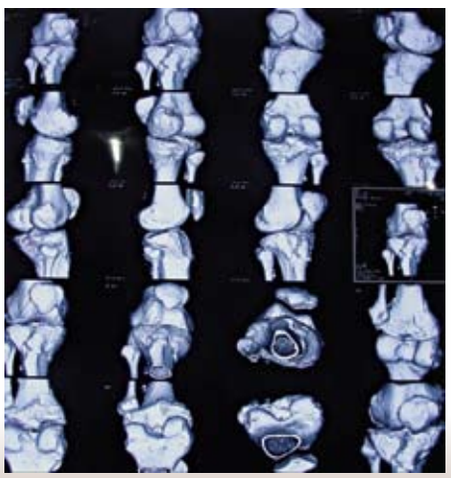

Figure 19 Post-operative radiograph showing Lateral locked plating and an independent posteromedial buttress plate

Figure 20 At 2 months follow-up, radiograph shows well healed fracture with restored articular geometry

External fixators are a definite physical encumbrance to the patient and are falling out of vogue as a definitive treatment for such injuires. There is also a definite risk of pin-site problems, though this can be reduced significantly with careful pin handling, careful techniques of pin insertion and postoperative care.[28] Pin-site infection in very proximal tibial locations can lead to septic arthritis, and it is generally recommended that the most proximal pin in the tibia should be no higher 12–15 mm from the level of the knee joint.[29]

Circular fixators such as an Ilizarov frame or a Taylor Spatial Frame can be repeatedly adjusted during the course of fracture healing to reduce gaps, and to correct the slight but significant collapse that often occurs at the metaphyseal level during fracture healing. The capacity to fine-tune reduction of the metaphysis is the most important facet of treatment with a circular external fixator. In addition, there is no "footprint" on the tibia following removal of the fixator, allowing easy performance of secondary surgery should this be necessary.

According to a multicentre randomized controlled trial by the Canadian Orthopedic Trauma Society, advantages of circular frame included lower infection rates, less intraoperative blood loss, and a shorter hospital stay as compared to plate fixation. Also, the number of unplanned repeat surgical interventions, and their severity, was greater in the open reduction and internal fixation group. But, the functional outcomes were similar to plate fixation patients at 2 years. Due to the higher number and severity of complications in open reduction and internal fixation, the study researchers favored the use of circular external fixation for these fractures.[30]

Summary

Bicondylar fractures have a high risk of complications of treatment., require an armamentarium for the treating surgical team. The treatment of these fractures with either

internal with the use of various anatomical plates, varying configurations and designs, or external fixation, depends on the nature of injuries. Irrespective of the method of stabilization chosen, the principles of stabilizing high-energy injuries are soft tissue care, accurate articular surface reduction, and maintenance. This should be achieved along with satisfactory length, rotation, and alignment. Finally, the treatment choice is dependent on the soft tissues and fracture configuration.

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PIN UP

OSTEOPOROSIS

Osteoporosis is a disease in which the bones have become more porous and therefore more fragile and prone to breaking

Normal bone

Your body is constantly making new bone and breaking down (reabsorbing) old bone. When bone making and losing is in balance, the bone are able to support the body.

Osteoporotic bone

Changes in hormone levels, activity, medications, or diet can affect the bone-making system. When the system gets out of balance, the amount of bone lost is greater than the amount of bone made. This imbalance cause s bone to become less dense and fragile.

SYMPTOMS OF OSTEOPOROSIS

You might be experiencing symptoms of OSTEOPOROSIS? Find out by answering the questions below!

Do you feel pain in your bones or muscles?

Is your spine starting to hunch forward?

Ar your fragile bones suspceptible to fracture?

Do you have family history of osteoporosis?

Did you notice height loss?

Are you eating a diet low in calcium and vitamin D? Are you inactive?

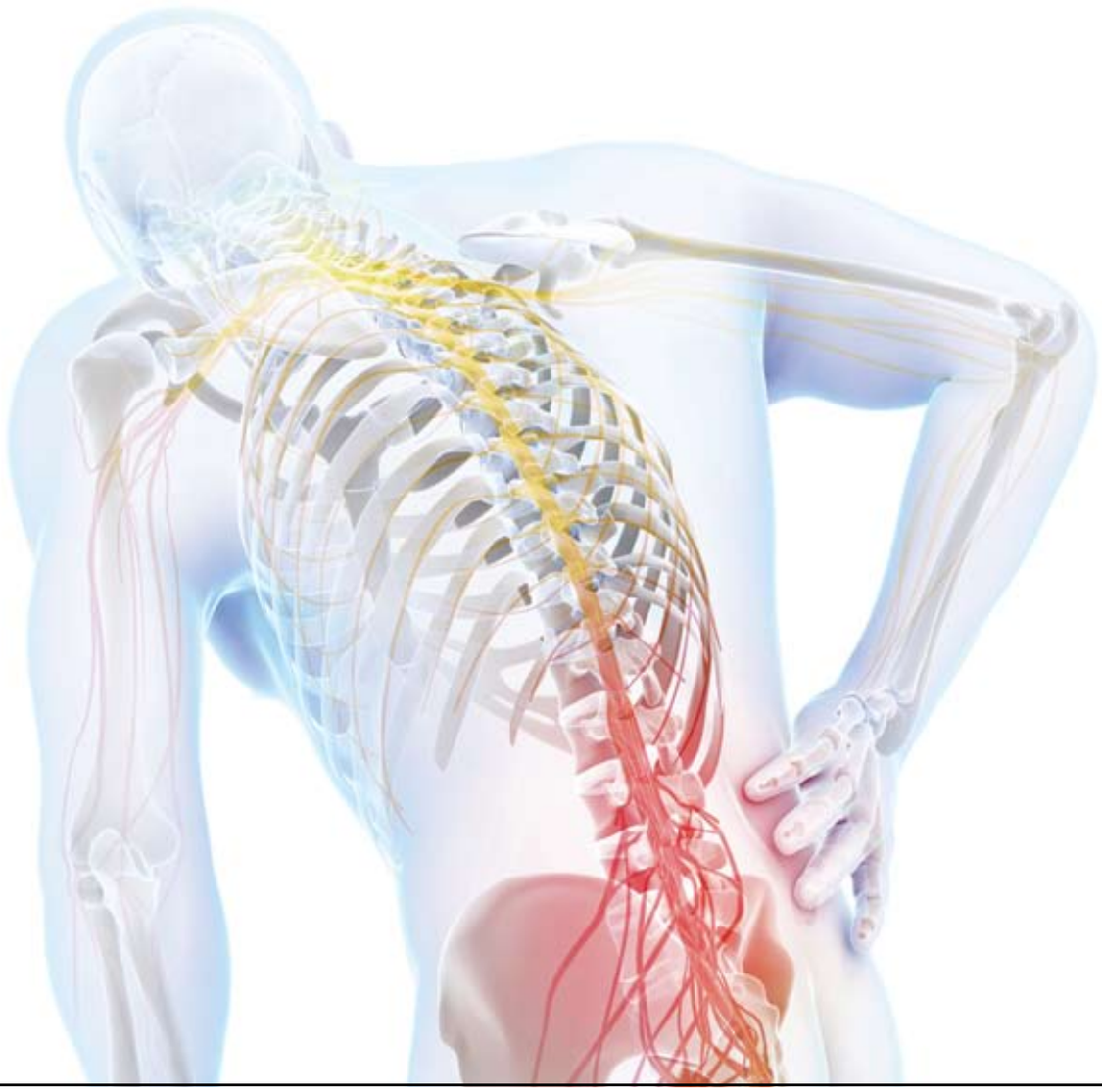
Do you feel severe back pain?

Did you exprience frequent falls?

Do you need long time to get out of bed?

Are you at menopause?

If you answered "Yes," to more than one of these questions, then you may be more at risk of developing osteoporosis. Consult your doctor for further information about osteoporosis.



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