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Floating Knee Injury

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Introduction

"All fracture is an individual problem and the decision to treat it by internal fixation or indeed conservatively should be based on a realistic assessment of the advantages and hazards of each method in circumstances of those particular cases. This calls for a high degree of clinical judgment which is harder to acquire or to impart technical virtuosity in operating theatre".

Among all the open fractures tibia and femur is the largest bone that is involved in open to the increase in vehicular accidents and industrial mishaps; high-velocity trauma produces open tibial and femoral fractures. Stabilization of fractures by external fixations proved to be cumbersome, and a high percentage of complications associated with casting and compression plating has led to an increasing in the popularity of intramedullary nailing in the tibia.

Ipsilateral fractures of the femur and tibia have been called "FLOATING KNEE INJURY'" and may include combinations of diaphyseal, metaphyseal and intraarticular fractures.

Floating Knee injuries are complex injuries. The type of fractures, soft tissue and associated injuries make this a challenging problem to manage. We present the outcome of these injuries after surgical management

Generally caused by high energy trauma, the soft tissue is often extensively damaged and life-threatening injuries to the head, chest or abdomen may also be present.

Many of these fractures are open, with associated vascular injuries. Surgical stabilization of both fractures and early mobilization of the patient and the extremity produce the best clinical outcomes.

The use of a radiolucent operating room table and the introduction of retrograde intramedullary fixation of femoral fractures have facilitated surgical stabilization of some floating-knee fracture patterns. Although treatment planning for each fracture in the extremity should be considered individually to achieve the optimal result, the effect of that decision must be considered in light of the overall injury status of the entire extremity.

Collateral ligament and meniscus injuries may also be associated with this fracture complex. Complications (such as compartment syndrome, loss of knee motion, failure to diagnose knee ligament injury, and the need for amputation) are frequent. Better results and fewer complications are observed when both fractures are in diaphysis than when one or both are intra-articular.

Aims and Objectives

The aims and objectives of the present study are as follows-

(a) To study of different modality of treatment is **FLOATING KNEE INJURY** by various operative methods.

(b) To study complication and outcome of the injury.

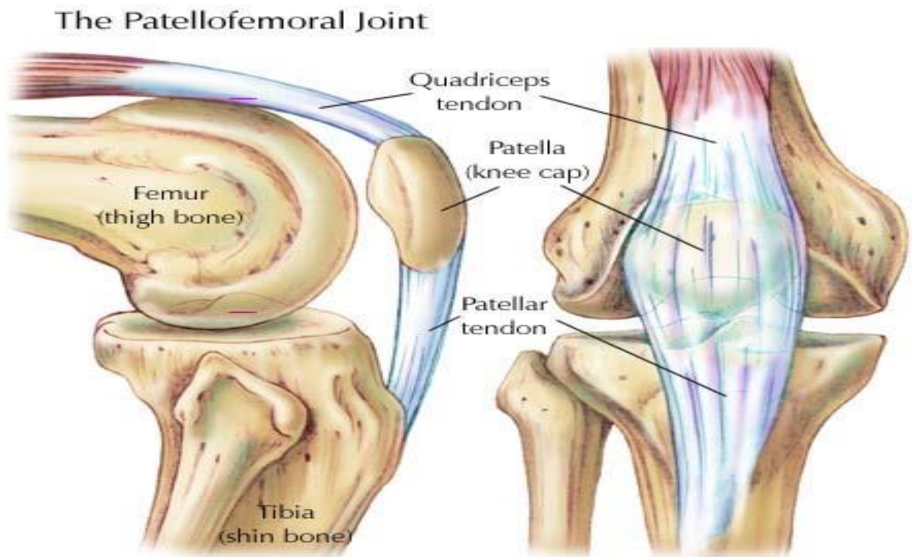
(c) To study and design predictor for better prognosis.

Applied Anatomy of Floating Knee

This is supracondylar- femur with upper-end tibia, with inter-condoyle extension.

Knee is largest and most complex joint. Structurally it resemble a hinge joint, it is a condylar type of synovial joint between two condyle of femur and tibia. In addition, it include saddle joint between the femur and patella

(a) PATELLO-FEMORAL JOINT

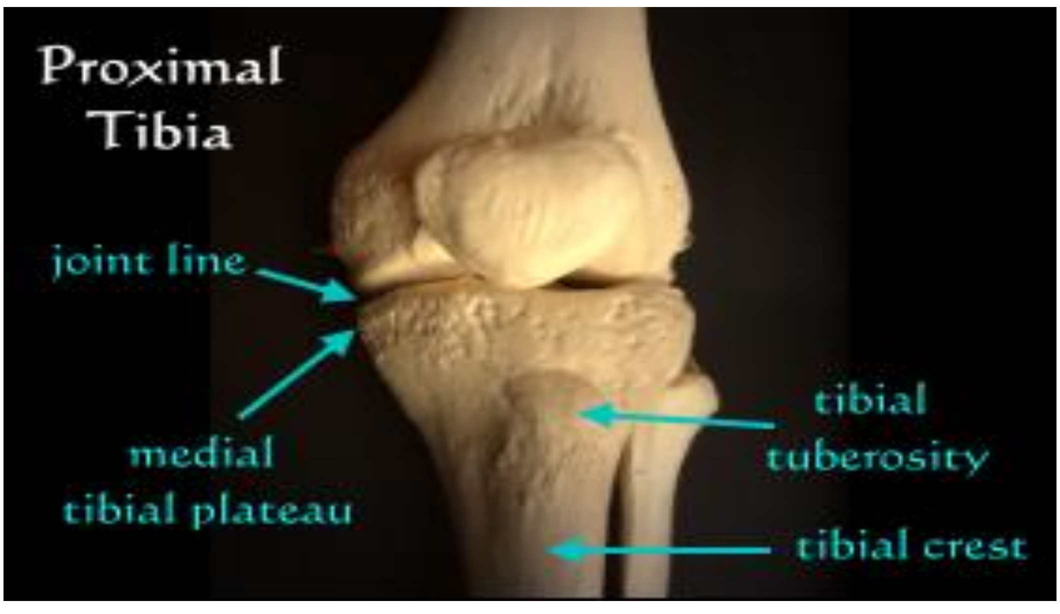


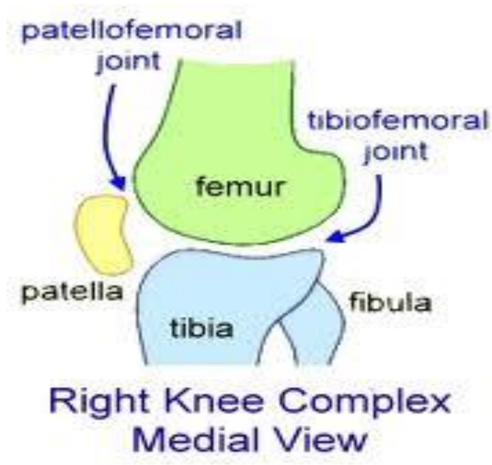
It is articular surface of the patella is adapted to that of the femur.

It is extends onto the anterior surface of both condyle like an inverted U, "odd" facet contacts the lateral anterior end of the medial femoral condyle in full flexion, when the highest lateral patellar facet contacts the anterior part of the lateral condyle.

As the knee extends, the middle patellar facets contact the lower half of the femoral surface; in full extension only the lowest patellar facets are in contact with the femur.

(b) TIBIO-FEMORAL JOINT





(c) TIBIAL- SURFACE

Proximal tibial surface slopes posteriorly and downwards relative to the long axis of the shaft. Posterior surface, distal to the articular margin, displays horizontal, rough groove to which the capsular and posterior parts of the medial collateral ligaments are attached. Medial patellar retinaculum is attached to the medial and anterior condyle surfaces, which are marked by vascular foramina. Medial articular surface is oval and longer than the lateral tibial condyle.

Around its anterior, medial, and posterior margins, it is related to the medial meniscus. Posterior surface is covered by the meniscus, so that overall a concave surface is presented to the medial femoral condyle.

Lateral margin is raised as it reaches the intercondylar region.

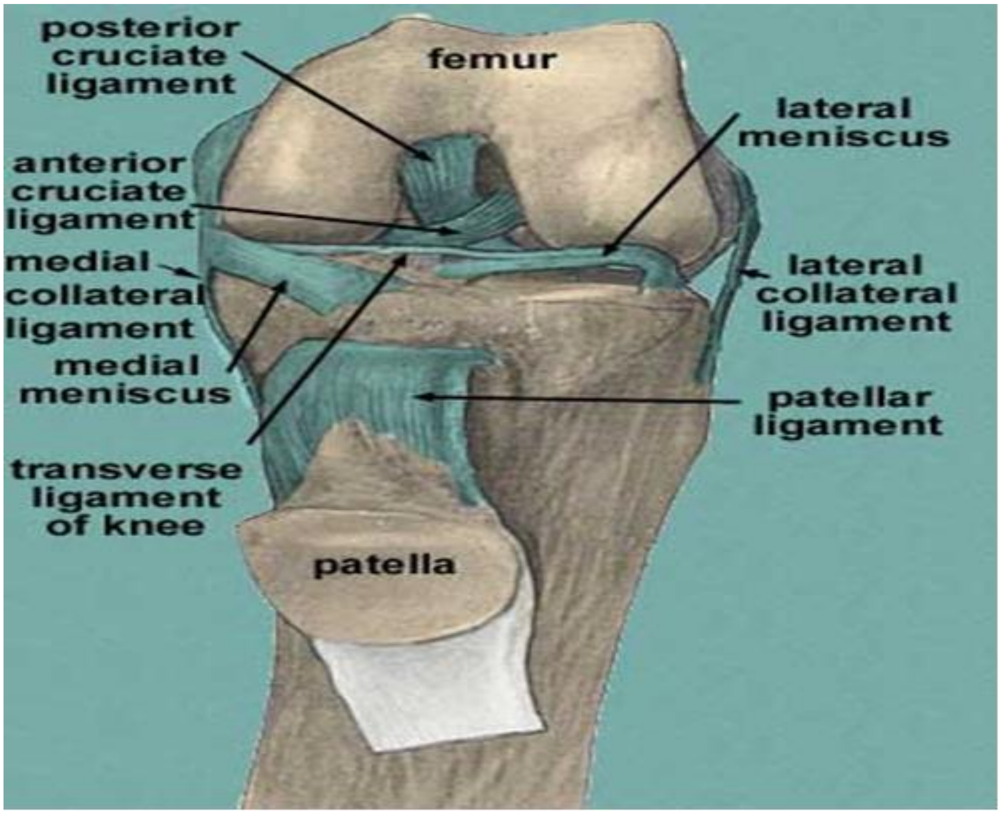
Lateral margin is raised as it reaches the intercondylar region.

Lateral condyle overhangs the shaft posterolateral above a small circular facet for articulation with the fibula.

Articular surface is more circular and coapted to its meniscus.

(d)INTERCONDYLAR AREA

(INTERCONDYLAR EMINEN*CE*)



It is rough surface area between the condylar articular surfaces is narrowest centrally where there is an intercondylar eminence, the edges of which project slightly proximally as the lateral medial intercondylar tubercles. Intercondylar area widens behind and in front of the eminence as the articular surfaces diverge.

Anterior intercondylar area is widest.

Antero medially, anterior to the medial articular surface, is a depression in which the anterior horn of medial meniscus is attached. Behind this smooth area receives the anterior cruciate ligaments.

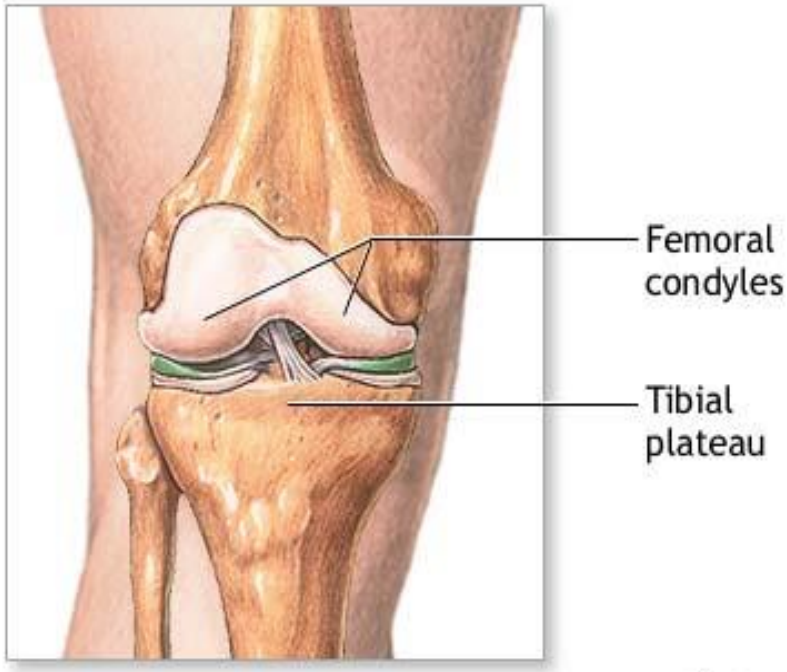
The eminence, with medial and lateral tubercles, is the narrow central part of the area and the raised tubercles provides some stabilizing influence on the femur.

Posterior horn of the lateral meniscus is attached to the posterior slope of the intercondylar area.

Posterior intercondylar area inclines down and backwards behind the posterior horn of the medial meniscus.

Rest of the area is smooth and provides attachment for the posterior cruciate ligaments, spreading back to a ridge for the capsular ligaments.

(e) FEMORAL SURFACE

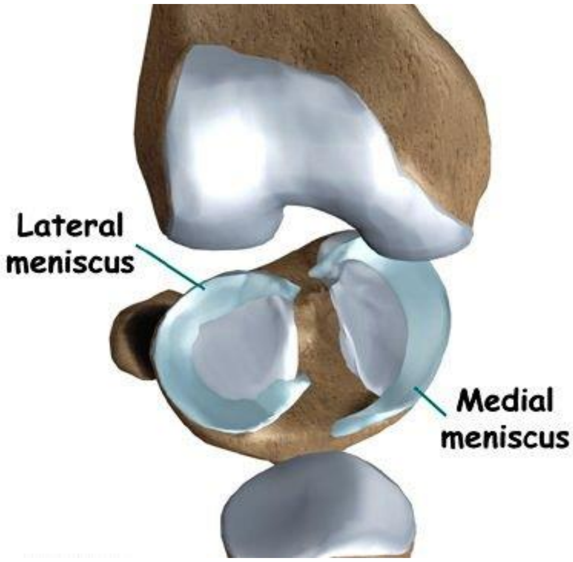


Femoral condoyle, bearing articular cartilage, are almost wholly convex. Shapes of their sagittal profiles are somewhat controversial. One view is that they are spiral with a curvature increasing posteriorly that of the lateral condyle more rapidly.

Tibio femoral congruence is improved by the menisci, which are shaped to produce concavity of the surfaces of the presented to the femur. The combined lateral tibio-meniscal surface is deeper .The lateral femoral condyle has a faint groove anteriorly which rests on the peripheral edge of the lateral meniscus in full extension.

A similar groove appears on the medial condyle, but does not reach its lateral border, where a narrow strip contacts the medial patellar articular surfaces. The difference between the shape of the articulating surfaces correlate with the movements of the joints.

(f) MENISCUS

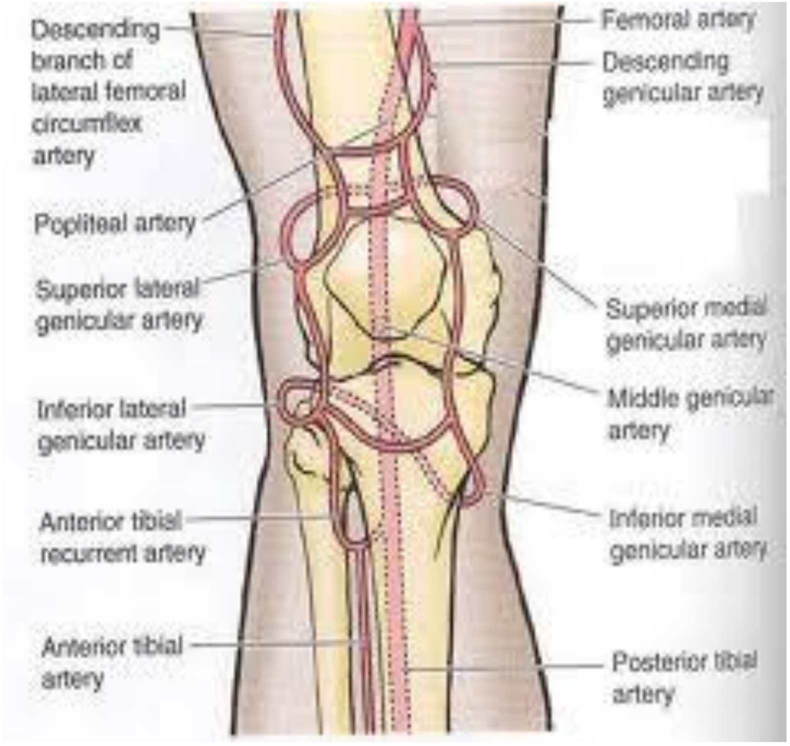


Meniscus is crescent laminar deepening the articulation of the tibial surface that receives the femur. Peripheral attached borders are thick and convex; free borders thin and concave, peripheral zone is vascularized by capillary loops from the fibrous capsule and synovial membrane, while their inner regions are avascular, peripheral tears in the vascular zone have the capacity to which makes repair a possibility.

Medial meniscus is attached by its anterior horn to the anterior tibial intercondylar area in front of the anterior cruciate ligaments, Posterior horn is fixed to the posterior tibial intercondylar area, between the attachments of the lateral meniscus and posterior cruciate ligament, Peripheral border is lateral meniscus and posterior ligaments Peripheral border is attached to the fibrous capsule and the deep surface of the medial collateral ligaments. Tibial attachment is known as “coronary ligament’. Relatively these attachments ensure that the medial meniscus is fixed and moves much less than the lateral meniscus.

Lateral is forms approximately four fifth of a circle ,Anterior horn is attached in front of the inter condylar eminence, posterolateral to the anterior cruciate ligament ,Posterior horn is attached behind this eminence, in front of the posterior horn of the medial meniscus ,Near its posterior attachment it commonly sends a posterior cruciate ligaments to the medial femoral condyle anterior to the posterior cruciate, Medially ,part of the tendon of popliteus is attached to the lateral meniscus ,and so mobility of its posterior horn may be control by the meniscofmoral ligaments and popliteus.

(g) GENICULAR ANASTOMOSIS



The knee joint is innervated by branches from the obturator, femoral, tibial and common peroneal nerves. The genicular branch of the obturator nerve is the terminal branch of its posterior division. Muscular branches of the femoral nerve, especially to vastus medialis, supply terminal branches to the joint. Genicular branches from the tibial and common peroneal nerves accompany the genicular arteries: those from the tibial nerve run with the medial and middle genicular arteries, while those from the common peroneal nerve run with the lateral genicular and anterior tibial recurrent arteries.

Superficial network spreads between the fascia and skin around the patella in the fat deep to the patellar tendon. Deep network lies on the femur and tibia near the adjoining articular surfaces, and supplies the bone and marrow, articular capsule and synovial membrane.

Medial and lateral superior genicular,, the medial and lateral inferior genicular, the descending genicular, the descending branch of the lateral circumflex femoral, the circumflex fibular and the anterior and posterior tibial recurrent arteries.

(h) RELATIONS AND 'AT RISK' STRUCTURE

Anteriorly, the tendon of quadricepsfemoris, the patellar tendon, tendinous expansions from vastus medialis and patellar retinaculam.

Posteromedial is Sartorius, and the tendon of gracilis which lies along its posterior border, both descending across the joint.

Posterolaterally, the biceps tendon and the common peroneal nerve which lies medial to it are in contact with the capsule, separating it from popliteus.

Posteriorly, the popliteal artery and associated lymph nodes lie on the oblique popliteal ligament: the popliteal vein is posteromedial or medial, and the tibial nerve is posterior to both.

Nerve and vessels are overlapped by both heads of gastrocnemius and laterally by plantaris.

Gastrocnemius contacts the capsules side of the vessels.

Semimembranosus lies between the capsule and semitendinosus, medial to the medial head of gastrocnemius.

(I) FACTORS MAINTAINING STABILITY

PATELLOFEMORAL JOINT

Alignment of the femoral and tibial shafts is such that the pull of the quadriceps on the patella imparts a force on the patella that is directed both superiorly and laterally.

Static bony factors that counter this tendency to move laterally are the congruity of the patello-femoral joint and the buttressing effect of the larger lateral part of the trochlear groove.

If the patella s small, or resides too high above the trochlea, or if the trochlear groove is too shallow, then instability may result.

Static ligamentous factors are the medial patello-femoral ligament and medial retinaculum.

Vastus medialis oblique, contains transverse fibers these pull the patella medially, which counters the tendency to lateral movement.

Clinical Classification of Floating Knee Injury

Type I injury is the "**True floating knee**," in which neither the femoral nor the tibial fracture extends into the knee, ankle, or hip joint.

Type II fractures are "**Variant floating knees**."

Blake and McBride proposed a system that differentiated these injuries on the basis of the presence or absence of an intra-articular fracture.

Type 1 Floating knee, involving only femur and tibia not joint **(Blake & McBride classification)**

Type 2A Floating knee showing involvement of distal femur and proximal tibia. Tibia is intra-articular.

Type 2B Floating Knee showing involvement of the hip joint Femur is intra-articular.

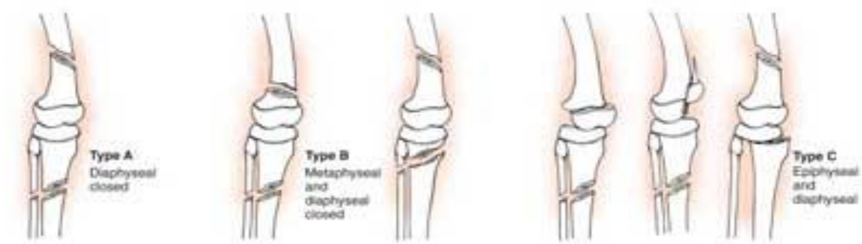
Type 2C Floating knee showing intraarticular involvement of both tibia and femur.

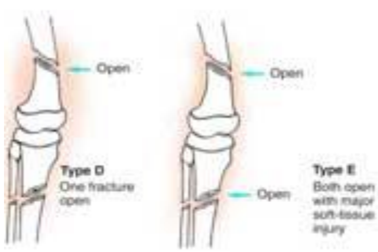
Fraser classification system of ipsilateral femoral and tibial fractures.

Letts's classification of paediatric floating knee injuries.

Type A **Type B** **Type C**

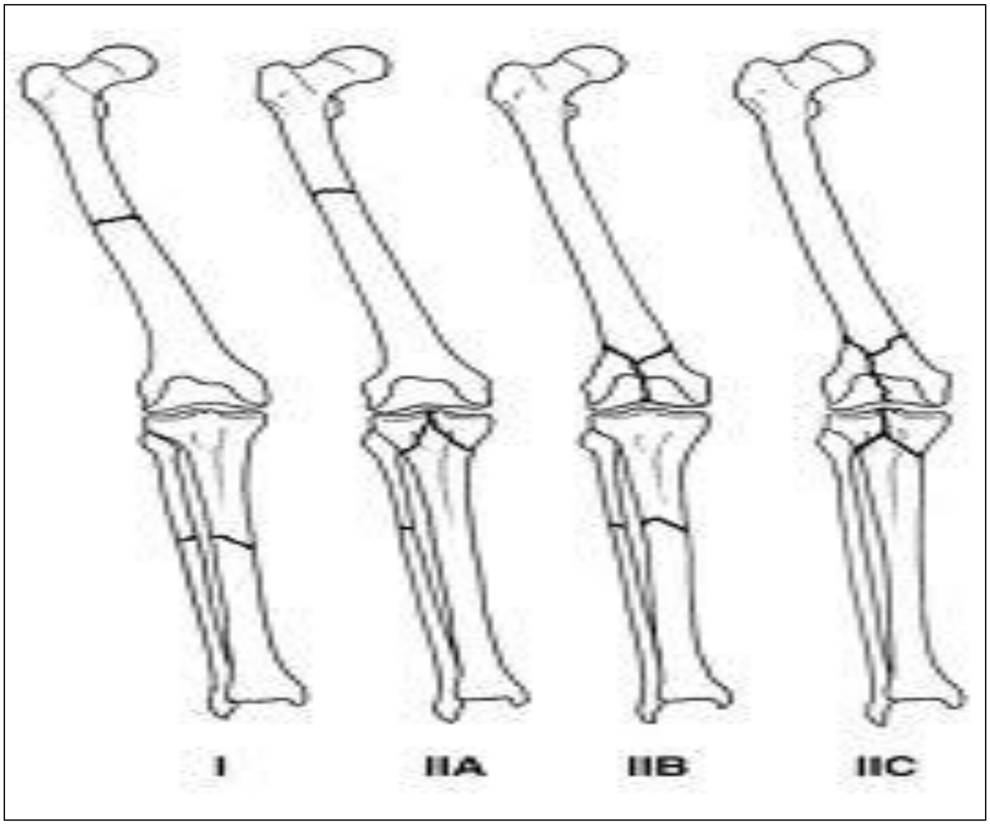
Diaphysial Diaphysial and metaphysial Epiphysial. and Diaphysial





Type C **Type D both are open fractures**

Blake & McBride classification



Type I Blake and McBride

Type 2c Blake and McBride

Biomechanism

For floating knee injury we are using intramedullary nailing and external fixator and also platting.When a long bone is fixation is used to describe the degree of immobility of the fracture fragments provided by nail. Stable fixation means a fixation with little displacement under load.

A) Shearing strain

b) Torsional strain

c) Bending strain

Before fracture healing and bony stability occurs by natural healing process most of the load is shared by the nail and the bone which depends on.

1) Stability of fixation.

2) Load resisting capacity of the nail.

Stability of fixation depends upon the following details

Accurate reduction of fracture:

1) Working length : It is length between two nearest locking bolts across the fracture site.
   Shorter the length higher the Stability. It is not the overall length of the structure

that counts but the in between loading point that is part that is subjected to bending or torsional movements.

2) Load resisting capacity of the device under loading, stress is created throughout the supporting structure because the stress represents force per unit area. Larger cross section area will distribute the force so that there will be lower level of stress per contact points.

Strength of intramedullary nail depends upon

A) Diameter

B) Design

Larger the diameter greater the strength. 11 deg of Herzog's bend provides additional contact point posteriorly and give inherent stability to nail canal by fixing it to posterior cortex.

BIOMECHANISM of external fixations

The aim of application of external is to achieve an environment conductive to fracture and soft tissue healing It is important to consider the engineering characteristics of the fixation system to be used, so that a frame with the appropriate geometrical configuration may be chosen to match the biomechanical and biological demands. In external fixation, a minimum of metal exists inside the tissue. The fracture elements are at will realign, distracted, or compressed. The wound area is well exposed, local lavage, flushing, dressing and surgical procedure is easy and convenient and cause minimal discomfort to the patient.

MALGAIGNE, IN 1849 in an attempt to avoid metal implantation in bone, which then frequently caused hospital gangrene, devised adjustable metal hooks which pierced the skin to hold the fracture fragments together. The hooks were withdrawn after early fracture healing.

Mechanism of platting osteosynthesis

Platting is a load-share device, not a load–bearing device. Platting principle depends upon the tension band principle. It is applies to the conversion of tensile forces to compression forces on the convex side of an eccentrically loaded bone. Another argument for placing a plate on the tension side of a bone its effect on the working length of the plate. The working length is the distance between the two points on either side of the fracture where the plate is firmly fixed to the bone. Short working length increases the stability and strength of a construct. Working length of the plate is minimal, since it is in contact with bone on either side of the fracture. Platting is giving direct bone healing and giving absolute stability to fracture. They resist axial, torsional, and bending loads. Plate when loaded axially converts the forces applied to shear stress at the plate-bone interface. The axial force is countered by frictional force between the plate and bone. Frictional force is the product of the frictional co-efficient that exists between the plate and the bone and force perpendicular to the plate. The force normal to the plate is equal to the axial force generated by the torque applied to the screws fixing the plate to the bone. The screw with greatest torque contributes the greatest amount of force normal to the plate and therefore bears the greatest load. A decrease in screw torque or friction coefficient at the plate-bone interface can lead to plate bone motion. Such motion creates excessive gap strains that exceed the strains conductive to primary or even secondary bone healing.

We can achieve compression by doing

(a) Self –compressing plate.

(b) Tensioning device.

(c) Eccentric screw placement

(d) We can use Buttress plate, Condylar plate, and Biological locked internal fixator plate. (LIFP).

Material And Methods

This is a prospective study of the 30 "floating knee" injuries. All the patients were operated in our institute between MAY 2009 TO MAY 2012 and followed till an average 18 months.30 patients with floating knee injuries were managed over a 3 year period. This was a prospective study where both fractures of the floating knee injury were surgically fixed using different modalities. The associated injuries were managed appropriately. Assessment of the end result was done by the Karlstrom criteria after the bony union.

The patient was examined thoroughly for a vital sign, head injury, thoracolumbar and abdominal injury, and associated injuries.

The distal circulation was checked and was examined for any neurological deficit. All the wounds were covered by sterile dressing after cleansing and normal saline wash. A full-length roentgenogram in anteroposterior and lateral views was taken of the affected leg. Temporary immobilization was given by the above-knee splint. Tetanus prophylaxis in form of Tetanus Toxoid and Tetanus immunoglobulin were given parenteral antibiotics and analgesics were started. All limbs were kept elevated on Bohler Braun splint inward till the patient got fitness for surgery. Knee ligament injuries were diagnosed by clinical assessment by the surgeon after surgical stabilization of the fractures.

All open fractures regardless of grade were fixed with a simple or hybrid external fixator. All closed floating knee injury, were treated using intramedullary nailing or Plate osteosynthesis where plate fixation was done by MIPO (minimal invasive plate osteosynthesis), MIPPO (minimal invasive percutaneous plating osteosynthesis) or open reduction and buttress plate osteosynthesis, Antegrade or retrograde nailing of the femur and Antegrade nailing or plate osteosynthesis of the tibia allow rapid stabilization of the fractures and early mobilization.

Due to positioning problems, femoral neck and subtrochanteric femoral fractures should be addressed primarily without including the tibial fracture in the procedure. Attention should be given to the high incidence of knee ligament injuries found with this injury pattern. Physiotherapy and mobilization were started as soon as possible after surgery. Patients were followed up regularly till bony union (clinical and radiological). Functional assessment and the final outcome were measured using Karlstrom's criteria after the bony union.

The cardiopulmonary and general condition of the patient was assessed by a physician if the patient was 35 years of age and above, Routine blood investigations, chest roentgenogram, and electrocardiogram were performed, and Local parts were shaved and prepared for open trauma wounds.

Anesthesia: All the patients were operated on under either spinal or general anesthesia.

All the patients are treated in the supine position on the radiolucent table with a bump of two rolled sheets placed under the pelvis on the affected side. The patient is prepared and draped from the iliac to the foot. Open fracture wounds and areas of potential compartment syndromes are evaluated and treated before proceeding with fracture fixation. Femoral fracture is usually stabilized first. If the patient is hemodynamically unstable after the femur is nailed, the tibial fracture can be stabilized with a splint, and the patient can then return to the intensive care unit without the need for femoral traction.

Another advantage of primarily stabilizing the femur is the avoidance of inadvertent displacement of the femoral fracture that would occur with tibial nailing before femoral stabilization. Deformation if the tibial fracture can be controlled with a manual reduction during stabilization of the femur. However, an unstable femoral fracture might displace and cause more soft-tissue injury when the knee is flexed for nailing of the tibia. If the tibia is much comminuted, or if femoral nailing is expected to be difficult, the tibial fracture should be stabilized with an external fixator before nailing the femur. Depending on the location and nature of the fracture, Antegrade intramedullary fixation is utilized. Retrograde nails are preferred if the femoral fracture does not extend proximally into the subtrochanteric area. If there is an open knee injury, the femur and can be nailed through the knee laceration after thorough irrigation and debridement. If there is gross contamination that cannot be adequately debrided, Antegrade femoral nailing and tibial external fixation can be considered. If floating knee with an open tibial fracture, the lower leg should be irrigated and debrided before stabilizing the femur. The open tibial fracture can be secured with an external fixator or distractor to minimize additional soft-tissue injury while the femur is being nailed.

This fixator can then be changed to an intramedullary nail or left as a fixation definitive based on the severity of the soft-tissue injury. When nailing the femoral fracture, the leg is carefully protected from undue deformation through the tibial fracture. The femoral fracture is reduced with manual distraction without causing angulation which would increase the soft-tissue injury. Applying manual traction may be difficult in patients with proximal tibial fracture.

In this situation, the surgeon should insert a distal femoral or proximal tibial traction pin that allows femoral traction without displacing the tibial fracture. If the tibial fracture will be treated with an external fixator, the tibial fixator should be quickly applied before femoral fixation. The distal femoral fracture can also be treated by utilizing a radiolucent table. The incision for this procedure can be extended distally to allow treatment of either a proximal or a shaft fracture of the tibial. A midline incision from the proximal patella extending down over the anterior portion of the tibia can accommodate retrograde fixation of a femoral shaft or supracondylar fracture, as well as internal fixation or intramedullary fixation of tibial fracture. The lateral incision used in the approach for condylar blade-plate fixation of distal femoral fracture can be extended distally and anteriorly to incorporate the exposure of the proximal tibia. If necessary, the incision used for the retrograde femoral nail may be extended distally and incorporated into the approach for the tibial plateau fracture. Non-displaced fractures extending into the knee may be best treated with percutaneous fixation and early range-of-motion activities.

These injuries have fewer complications than displaced intra-articular that require open reduction and internal fixation. Early weight bearing on diaphysial fracture should be delayed if the patient has an ipsilateral intra-articular fracture. Pain associated with the diaphysial fracture may also hinder the rehabilitation of the knee. The femoral neck fracture should be stabilized before addressing the tibial fracture. Although many surgeons fix this fracture on a fracture table, some prefer the standard radiolucent table.

Femoral neck fracture in young adults should be reduced and fixed in a timely fashion. In these situations, the femoral fracture should be stabilized first, and the patient should then be repositioned before addressing the tibial fracture.

The tibial plafond fracture likewise should be treated after the femoral fracture. Treatment of this injury should be selected without regard for the fracture of the femur.

Tibial plafond fractures are best treated with primary closed reduction and external fixation.

PERFORMA

STUDY OF DIFFERENT MODALITY OF TREATMENT FOFLOATING KNEE INJURY"

1.GENERAL DATA

Name:

Age/Sex:

Address:

Contact no.:

OPD no:

Indoor no:

D.O.A:

D.O O

D.O.D:

2.HISTORY

(A) Presenting Complains

(a) Pain in knee region

-History of trauma

-Onset

-Duration

(b)Swelling

(c)Associated injuries

(B) Past injury –Any other significant injury

3.EXAMINATION

(A) General examination

Vitals: Temperature

Pulse

Blood pressure

RR

(B) Local examination

(a) Inspection

Wound description: Open/close

Grade of wound

Site

Size

Condition of skin: Blister

Stretching of skin

Other

(b) Palpation

-Tenderness

-Swelling description

(c) Distal Neuro vascular status

-Temp: warm/Cool

-Sensation: present /absent

-Pulse: present /absent

4.INVESTIGATION

(a) Routine Investigation: Blood and urine Investigation

(b)X-ray: Knee: AP and Lateral and oblique

Knee with femur and Knee with tibia: AP/lateral

(c) CT scan with 3D reconstruction; done /not done

(d)MRI; done or not done

5.Classification

BLAKE AND Mc BRIDE

1) Type-I

2) Type-II

Type 2A

Type 2B

Type 2C

KARLSTROM AND OLERUD – Depend upon the grading system

LETT"S for PAEDIATRICS FLOATING KNEE INJURY

6.*MANAGEMENT*

ON ADMISSION: Patient is stabilized haemodynamically and splintage and all primary treatment are given. Patient is also given priority according to need management whether to get operated to or be put on conservative management.

(A) Pre op

-Splint

-Elevation

-Traction

-Antibiotics

-Analgesics

- Serratiopeptidase / chymotrypsin

-blood

(B) Operative Procedure

ORIF: - Anterior

-Anteromedial

-Anterolateral

-Postero- lateral

-Postero- medial

(B) Implants used

- Plate

-Screws

-Intramedullary nails

-Fixators

(c) Surgical time

(d)Primary Bone grafting

Primary Bone Substitute

No use of graft

(e) Operative note

(f) Management of associated injuries

(h)Immediate post op

-Antibiotics

-Pain management

-swelling present or absent

-Limb elevation

-Skin condition: Infection or wound gap

-Mobilization: when

-Partial Weight bearing allowed or not

-Range of motion

-Frequency

Radiological: AP, Lateral, oblique,

7. FOLLOW UP

(A)One month follow up

-Pain

-swelling; present or absent

-Skin condition; any infection or wound gap

-Mobilization ; when?

-Partial Weight bearing allowed/not allowed

-Range of motion

Radiological -AP and lateral, for radiological healing, status of implant, infection.

(B) Three month follow up

-Pain

-swelling; present or absent

-Skin condition; any infection or wound gap

-Mobilization ; when?

-Partial Weight bearing allowed/not allowed

-Range of motion

Radiological – AP and lateral

For radiological healing, status of implant, infection.

(c) Six month follow up

-Pain

-swelling; present or absent

-Skin condition; any infection or wound gap

-Mobilization ; when?

-Partial Weight bearing allowed/not allowed

-Range of motion

Radiological –AP and lateral for radiological healing, status of implant, infection.

8. COMPLICATIONS

-1) Immediate

-Hypovolemic shock

-nerve palsy

-Thromboembolic phenomenon

-Vascular injury.

(B)Late

1) Stiffness of joint
2) Osteoarthritis
3) Secondary dislocation after operation
4) Non-union /Mal union
5) Reflex sympathetic dystrophy
6) Implant failure
7) Late infection

Results

CRITERIAS OF OLERUD AND MOLANDER

PAIN

25	None
20	Minor
15	During Walking
5	During Walking on smooth surfaces
0	Constant and severe

STIFFNESS

10	None
5	In the morning
0	Constant

SWELLING

10	None
5	Only in evening
0	Constant

STAIRS CLIMBING

10	No problem
5	Impaired
0	Impossible

SPORTS

10	Normal
5	Impaired
0	Impossible

SUPPORTS

10	None
5	Tape or wrap
0	Stick or crutch

DAILY ACTIVITY AND WORK

25	Unchanged level
20	Loss of tempo
10	Change to easier job or part time job
0	Severely impaired work capacity

TOTAL: 100

Accordingly **OLERUD *AND MOLANDER*** criteria scoring system is given.

91-100	EXCELLENT
61-90	GOOD
31-60	FAIR
0-30	POOR

DEFORMITIES

Deformity	No. of Patient	Percentage
Valgus		
Varus		
Rotational mal-alignment		

KNEE RANGE OF MOVEMENT

Knee movement	No. of Patient	Percentage
No restriction		
<15 deg restriction		
15-30 deg restriction		
>30 deg restriction		
Total		

SHORTENING

Shortening	No. of Patient	Percentage
1-2 cm		
2-5 cm		
5-10cm		
Total		

Observation and Discussion

The associated injuries and the type of fracture (open, intra-articular, communication) are prognostic indicators in the Floating knee. Appropriate management of the associated injuries, external fixator, intramedullary nailing of both the fractures and post-operative rehabilitation are necessary for a good final outcome. In children with ipsilateral femoral and tibial fractures, far better results were seen after operative treatment of their injuries.

Type II injuries often have worse outcomes than type I injuries. The different varieties of floating knee injuries necessitate individual consideration of the fracture type and the overall status of the soft tissues of the extremity.

Regardless of displacement, an optimal outcome after intra- articular fractures is dependent on stable fixation, early range-of-motion activities and protected weight-bearing.

Intra-articular involvement of the fractures, higher skeletal injury scores and severity of soft tissue injuries are significant indicators of poor outcome results. a preoperative scoring system that took into consideration the age, smoking status at the time of injury, injury severity scores, open fractures, segmental fractures and comminution to prognosticate the final outcome of these fractures.

The best results were seen when both fractures were treated by intramedullary nailing. We found that these patients returned to their normal level of activity earlier than when the fractures were treated with other modalities. Tibia fractures treated with external fixation had a longer union time probably related to the soft tissue injury and comminution at the initial injury. In our study patients with tibia plateau fractures had knee stiffness and persisting pain in the knee while the other patient had a Grade 3B open tibia fracture treated by external fixation. This shows that the poor prognostic factors were related to the type of fracture (open or closed, intra-articular fractures, severe comminution). The associated injuries played a major role in the initial outcome of patients in our study with regards to delay in the initial surgery, prolonged duration of surgery, anesthetic exposure and delay in rehabilitation. From our study, we found Floating knee injuries to be a group of complex injuries that needed careful assessment to detect poor prognostic factors (open, intra-articular, comminuted fractures) and associated injuries, surgical fixation of the fractures with thorough planning of surgeries and prolonged rehabilitation. A combination of all these would determine the ultimate outcome of these patients.

When the knee joint is isolated partially or completely due to fracture of the femur and tibia the term "Floating Knee" is used. Survivors of high-speed traffic accidents often have injuries to several of the parenchymal organs as well as multiple fractures. Careful evaluation of these injuries and resuscitation of the patient must precede the definitive management of specific fractures Hayes JT suggested that automobile passengers with floating knee braced their feet firmly against the sloping floor of the front seat just prior to the collision, their legs getting crumpled under the massive decelerating forces produced by the impact. Pedestrians have frequently catapulted some distance from the point of impact and were further injured by striking the pavement. In a study of 222 cases of the floating knee by Fraser, all cases were involved in road traffic accidents. Studies showed associated injuries like head injuries, chest injuries, abdominal injuries and injuries to other extremities. Most of the injuries to the head, chest and abdomen were life-threatening. Adams, on et al in their study, encountered 71% major associated injuries with 21% vascular injuries. The reported mortality rate ranged from 5% – 15%, reflecting the seriousness of the associated injuries. Deliberate and careful examination of the patient must be carried out in order to determine whether a major intracranial, abdominal or thoracic injury is present.

Such injuries should take precedence over extremity injuries in the priority of treatment. There are plenty of studies in the literature detailing different management options for the Floating Knee. Hayes JT opined that in a patient with multiple fractures in the same extremity, operative fixation of one or more of the fractures was valuable in the management of the entire limb. Ratcliff AH found that internal fixation of both the fractures should be done wherever possible as these patients were less likely to develop knee stiffness or shortening and were in hospital and off work for less time than those treated conservatively. Omer GE treated the, Floating Knee by both conservative and operative fixation found that where internal fixation was done for both femoral and tibia fractures, the healing time was about 8 weeks earlier than the group managed conservatively. Behr JT treated patients with the Floating knee by closed intramedullary nailing with Ender's nails and achieved femoral union at an average of 10.3 weeks and tibial union at 18 weeks. Ostrum RF treated patients with a retrograde femoral tibial intramedullary nail through a 4 cm medial Para patellar incision. The average time to union of the femoral fractures was 14.7 weeks and that for the tibial fractures was 23 weeks. They opined that this method was an excellent treatment option. The general consensus in recent studies is that the best management for the Floating knee is the surgical fixation of both the fractures with intramedullary nails. Dwyer used combined modalities of treatment with one fracture managed conservatively and the other surgically. They concluded that the treatment method for the tibia did not interfere with joint mobilization.

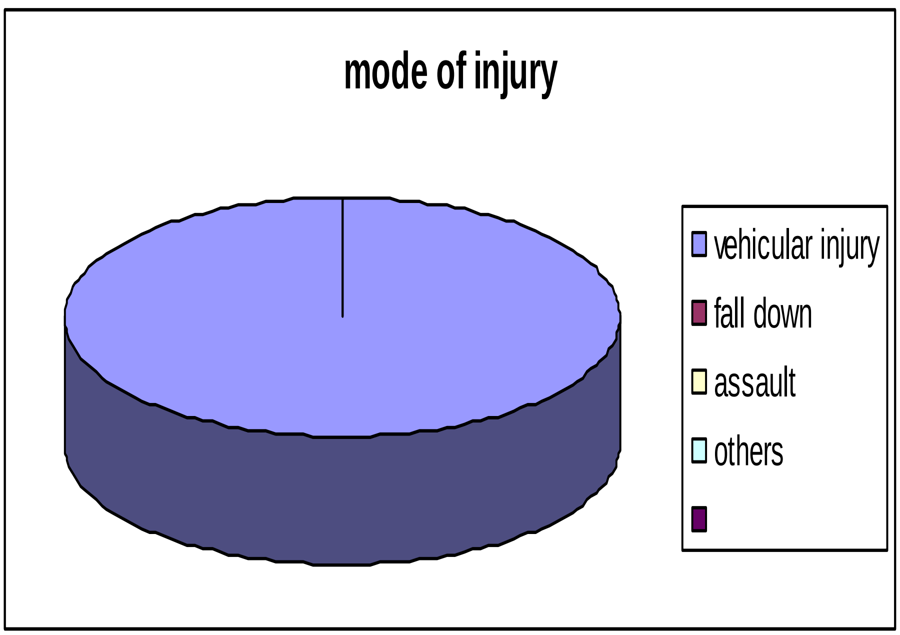
Lundy recommended surgical stabilization of the fractures for early mobilization which produced the best results. Theodoratos recommended intramedullary nailing as the best choice of treatment except for grade 3B & C open fracture. The single-incision technique for nailing of both fractures has been recommended by several authors. Rios J compared single-incision versus traditional antegrade nailing of the fractures and found the former to have less surgical & anesthesia time with reduced blood loss. Shiedts found an increased incidence of a fat embolism when both fractures were treated by reamed nails. Szalay demonstrated knee ligament laxity in 53% of patients while 18% complained of instability.

Analysis of Result and Discussion

I have studied 34 factures, in this 30 patients were used prospectively studied in our series having varying degree of open and closed floating knee injury. There were 04 patients died in emergency department due to associated injury like head, chest and abdominal injury.

Table1. MODE OF INJURY

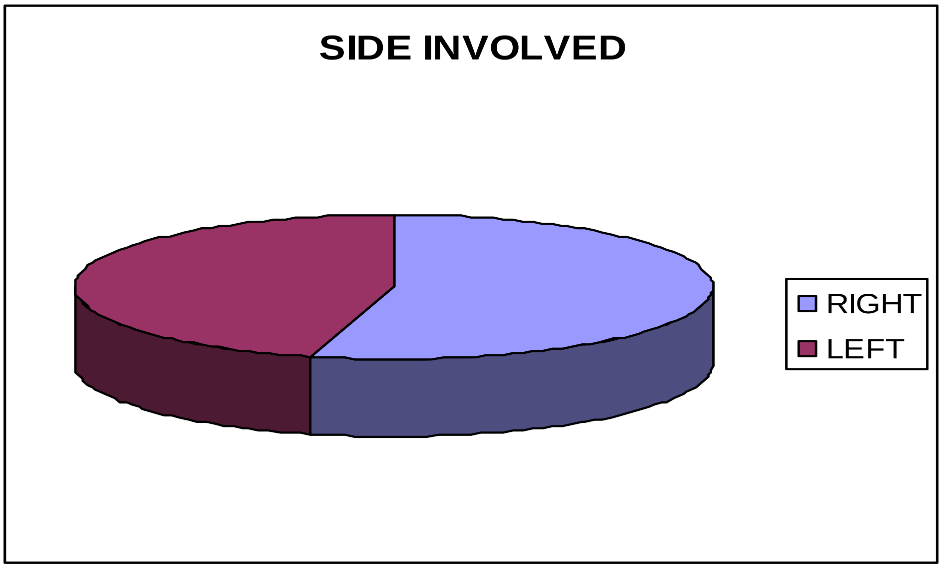
Mode of injury	NO.	percentage
vehicular injury	34	100%
Fall down	0	0
Assault	0	0
Others	0	0
Total	34	100%



Vehicular accident was the only cause in our series to produce floating knee injury. This shows increased no of accidents due to high speed motor vehicle collisions.

Table2. SIDE INVOVLED

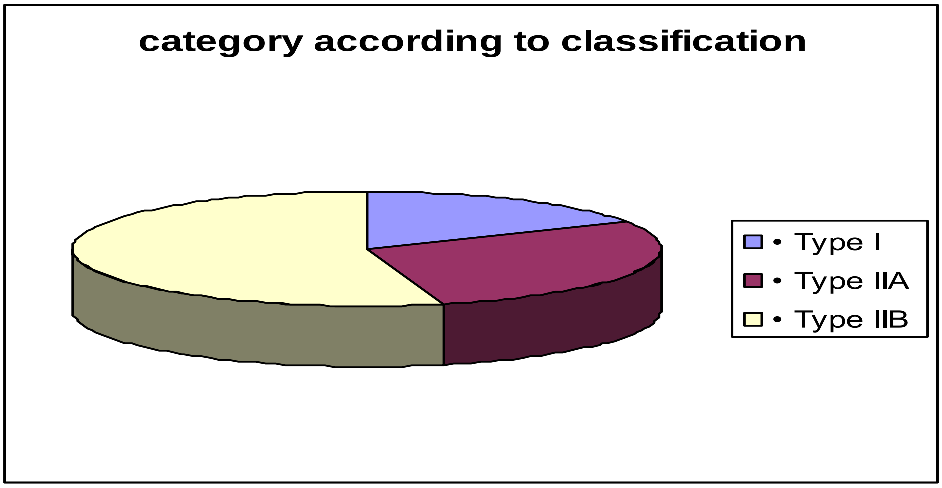
Side involved	No.	Percentage
Right lower limb	19	55.88%
Left lower limb	15	44.11%
Bilateral	0	100%



In this series, there is more right side involvement .Involvement of right side in large no of patient is not significant or having any logical co-relation.

Table 3. CATEGORY ACCORDING TO CLASSIFICTION

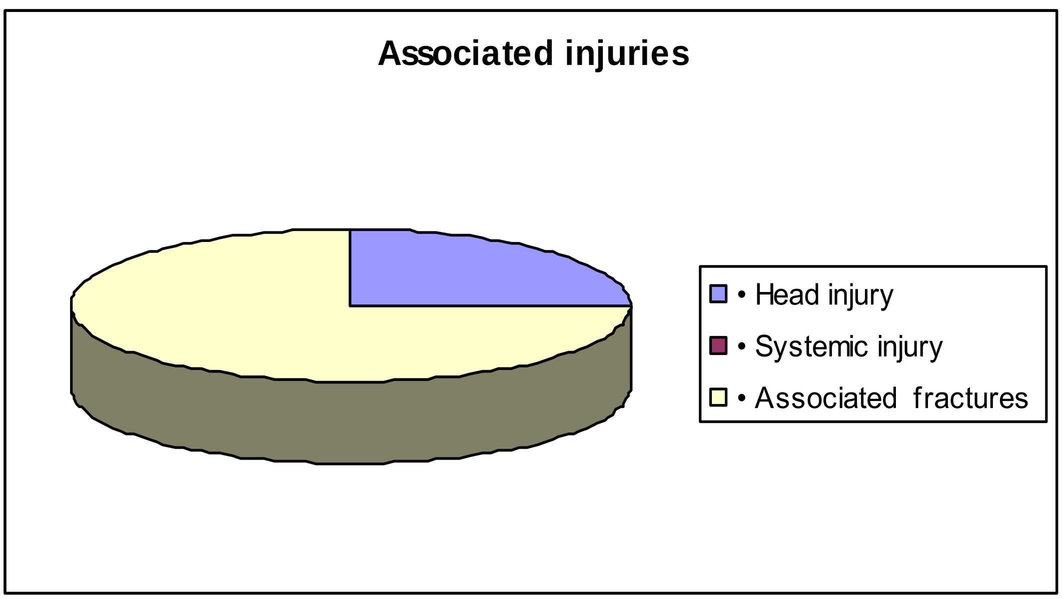
CLASSIFICTION	No.	Percentage
Type I	6	17.64
Type IIA	10	29.41
Type IIBC	18	52.94
Total	34	100%



In this series open grade IIb type fractures is very common to occur.

Table4. Associated injuries:

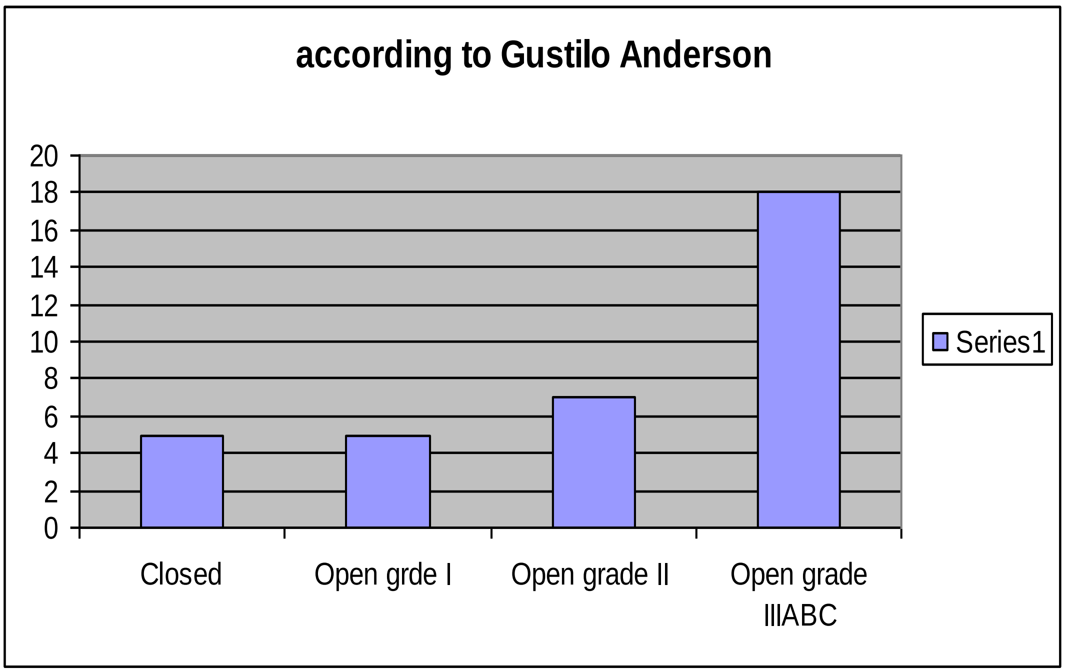
Associated injuries	**No**	**Percentage**
Head injury	4	11.76%
Systemic injury(abdominal injury)	2	05.88%
Associated fractures	3	08.82%



All associated injury was that of appendicular skeleton, ipsilateral or contralateral. Head, Chest and Abdominal injuries were most common cause of death in emergency department.

Table4. Classification according to Gustilo-Anderson

	No.	Percentage
Closed	5	14.70%
Open grade I	5	14.70%
Open grade II	7	20.58%
Open grade IIIABC	17	50.00%
Total	**34**	**100%**

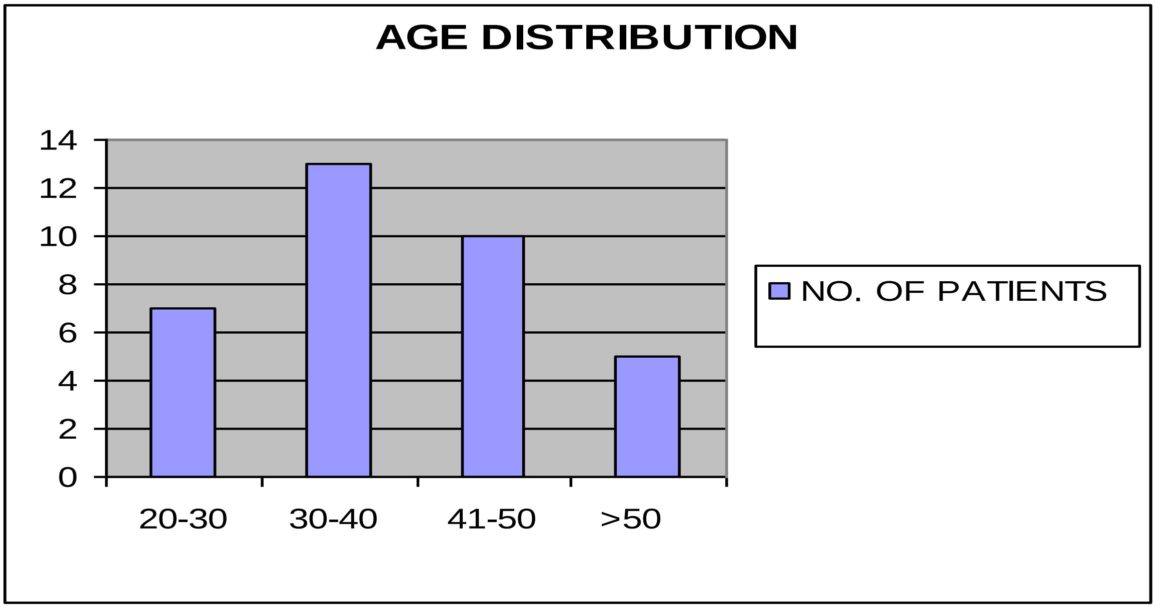


In this series concludes that most of the floating knee injuries are open injury with vascular involvement. The ratio of open /closed fractures was equal at 30:4

Table5. AGE DISTRIBUTION OF PATIENTS

AGE(YEARS)	NO.OF PATIENTS	PERCENTAGE
20-30	6	17.64%

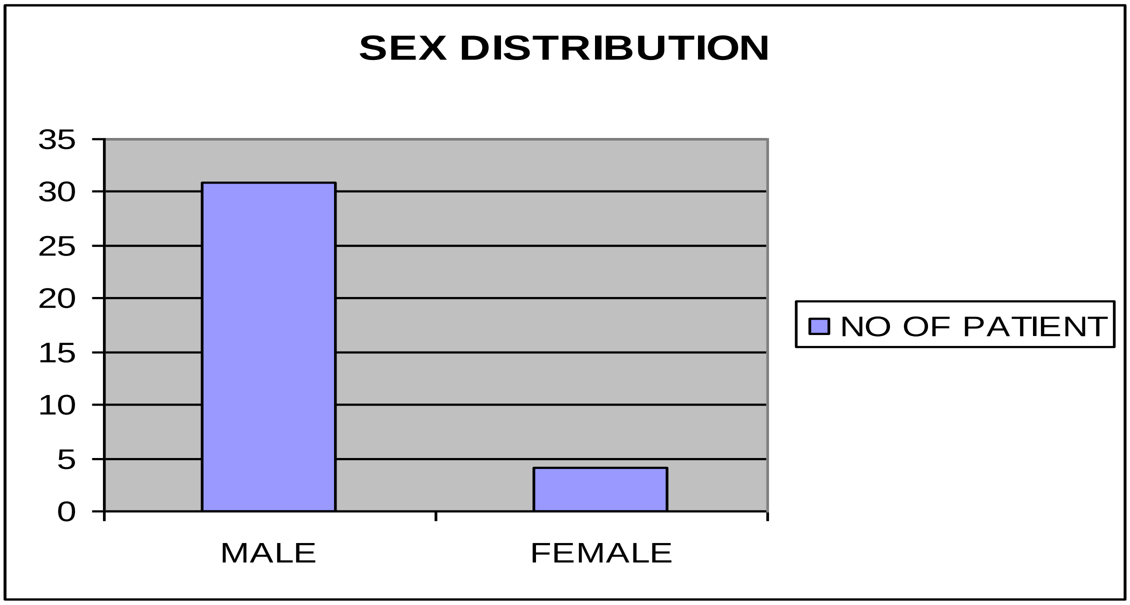
30-40	13	38.23%
41-50	10	29.41%
>50	5	14.70%



In our series, patient was age group 20 to 70 years ,average age was 38.43 years .There was increased incidence in the younger people noted in our series.

Table6. SEX DISTRIBUTION

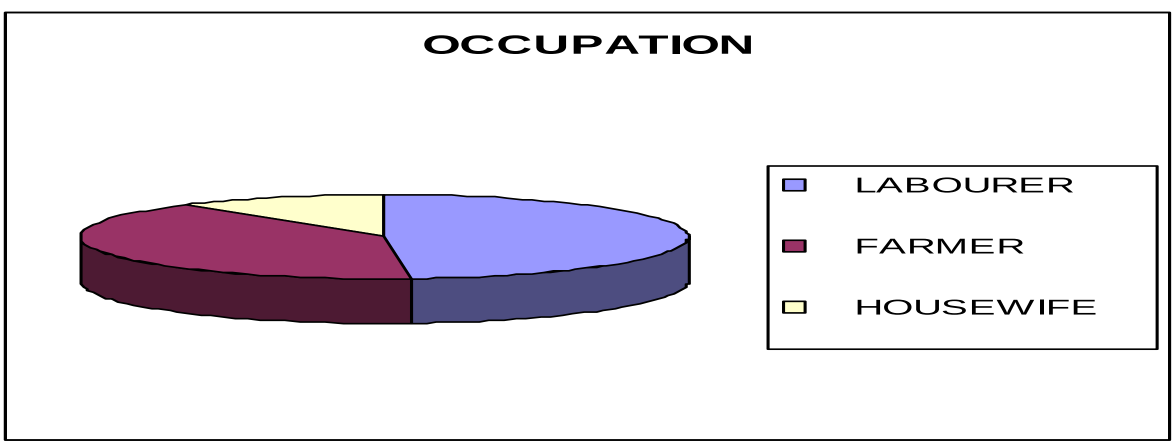
SEX DISTRIBUTION		
Sex	No. Of patient	Percentage
Male	30	88.23%
Female	4	11.76%



There is definitive male preponderance, because of road traffic accident.

Table7. OCCUPATION

Occupation	No. patients	Percentage
Laborer	17	50%
Farmer	13	38.23%
Housewife	4	11.76%
Total	34	100%



Laborer and farmer sustained maximum injury of femur and tibia in our series. All females were housewife and they sustained injury by vehicular accidents.

Table8. DEFORMITIES

Deformities	No. of Patient	Percentage
Valgus	17	56.66%
Varus	12	40.00%
Rotational mal-alignment	01	3.33%

On final assessment 17 patients were Valgus deformity and 12 patients were varus and only 01 having rotational mal-alignment.

Table9. JOINT MOVEMENTS KNEE RANGE OF MOVEMENT

Knee movement	No. of Patient	Percentage
No restriction	08	26.66%
<15 deg restriction	16	53.33%
15-30 deg restriction	04	13.33%
>30 deg restriction	02	6.66%
Total	30	100%

Table 10. SHORTENING

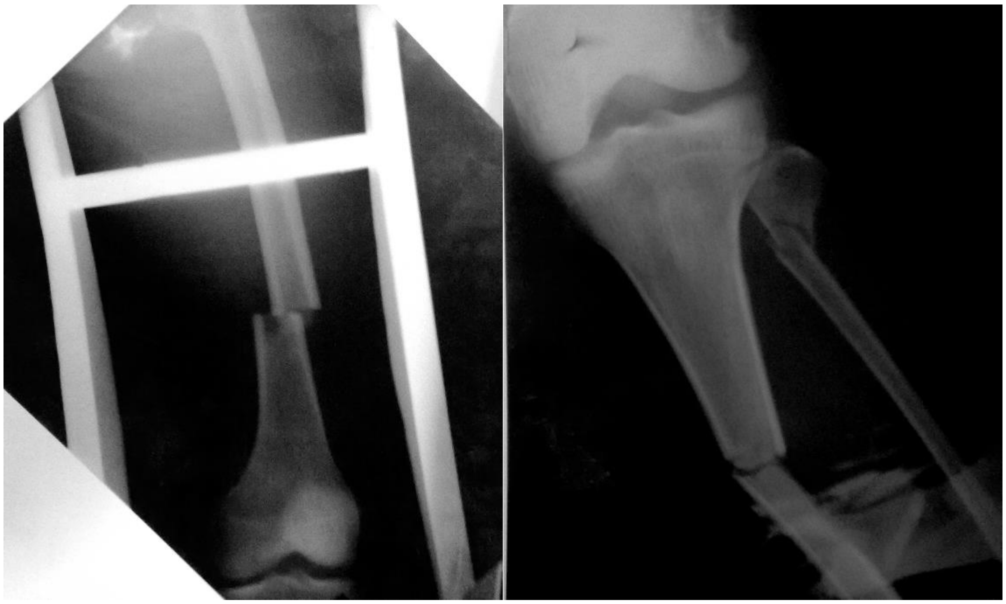
SHORTENING

Shortening	No. of Patient	Percentage
1-2 cm	14	46.66%
3-5 cm	13	43.33%
6-10cm	03	1.11%
Total	30	100%

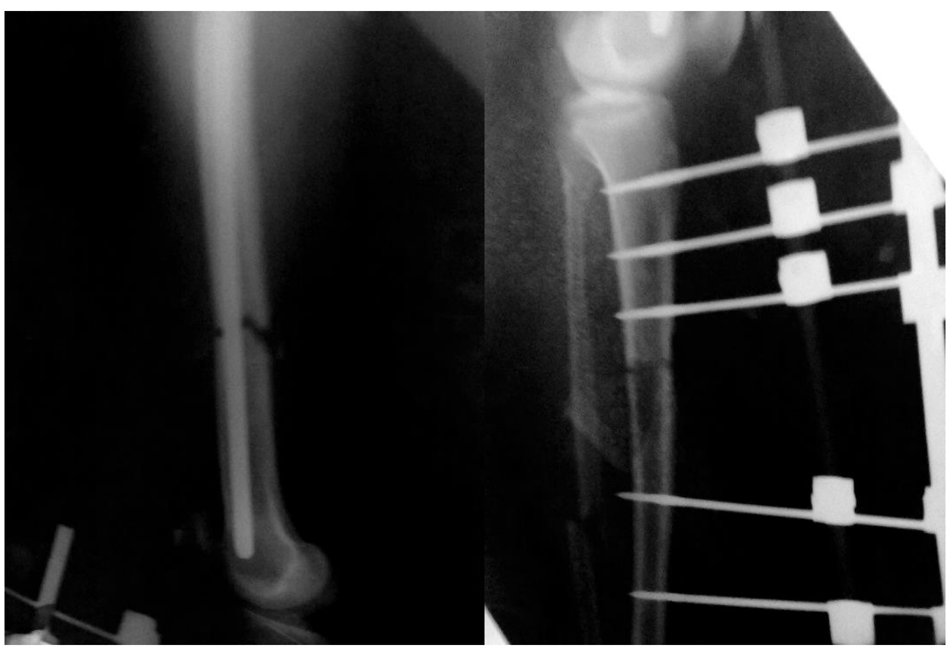
In this series conclude that most of floating injury patients having shortening.

CASE I Good result

Pre-op Type-I BLAKE *AND Mc BRIDE*



Post-op

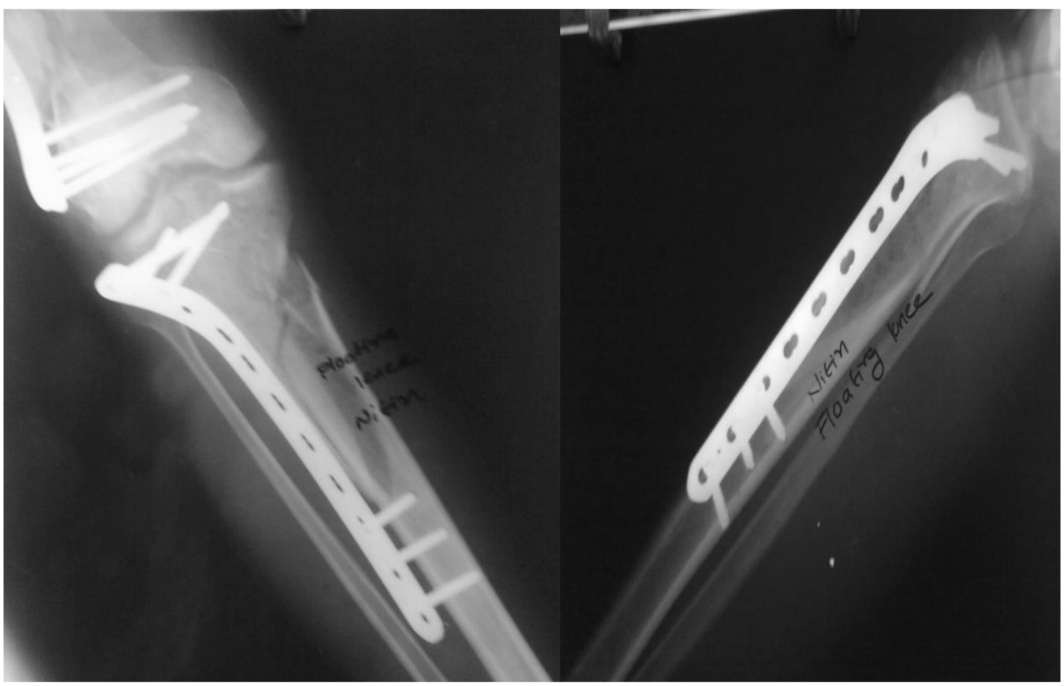


CASE II poor result

Type IIc BLAKE *AND Mc BRIDE*

Pre-op

Immediate post -op



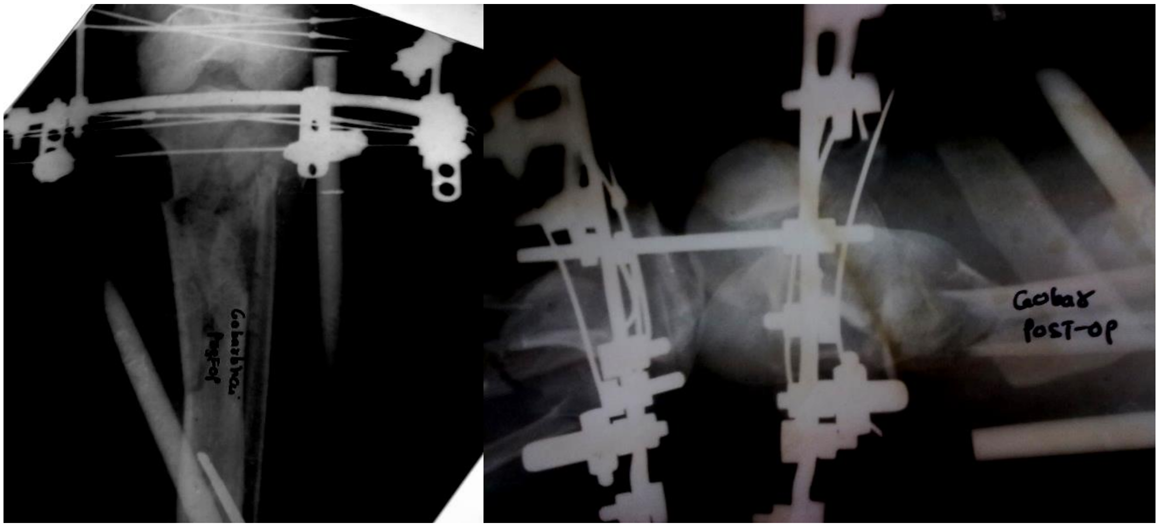
Follow-up after 6 month

Case III poor result

Type 2b

Pre-op

Immediate Post op



Follow –up after 6 month

Summary and Conclusion

In this series, a Total of 34 fractures in 30 patients were used prospectively studied in our series having varying degrees of open and closed floating knee injury.

There were 04 patients who died in the emergency department due to severe head injury, chest injury and abdominal injury and neurovascular injury.

The mean age in the present series is 38.43 years.

There are more male patients than female (male 33 and female02)

Road traffic injury is the most common cause mode of injury leading to a floating knee injury.

95 % of patients had open fractures.

80% of patients having a ligamentous injury.

The majority of patients were operated on within 72 hours of the injury.

85% of patients required secondary bony procedures like bone grafting like an autologous, artificial bone graft.

85 % of patients required secondary plastic surgery procedures like split-thickness graft and flaps and others like quadricepsplasty

60% of patients having post-traumatic chronic osteomyelitis with infection. The associated injuries and the type of fracture (open, intra-articular, comminution) were prognostic indicators in the Floating knee. Rehabilitation was very slow and loss of wages in terms of occupational disability was significantly reduced. Adequate debridement, judicious use of antibiotics and good post-operative care will decrease the rate of infection in open injuries

The co-operation of patients is essential for the good end result.

Most of the patients with instability had a rupture of the anterior cruciate ligament with or without damage to other ligaments. Studies concluded that knee ligament injury was more common with floating knee injuries than with isolated femoral fractures and advocated careful assessment of the knee in all cases of fractures of the femur and floating knee injuries. Other studies have shown that the incidence of knee ligament injuries in the floating knee was 50%, most of which were missed in the initial assessment and difficult to assess. Meticulous examination of the knee at the time of injury is strongly advocated although the practicality of this method is questionable. Our study showed a male predominance comparable to other studies.

Most of the studies showed road traffic accidents as the only mode of injury. In our study, the only common cause of injury was road traffic accidents. The classification used by us was the one that was proposed by Robert Blake. This was used as it took into account the injuries sustained at the hip or ankle of the affected side and helps one in planning the surgical procedure. The other classification system advocated by Fraser includes intra-articular fractures at the knee but does not mention injuries to the ipsilateral hip or ankle both of which can have implications on the surgical management of the Floating Knee. Our management consisted of treating both the femoral and tibial fractures surgically, most of them by intramedullary nailing using an interlocking nail. With this management, we found the fracture union time and functional recovery were better than the other surgical modalities. This was in accordance with studies by Gregory and Ostrum RF who had excellent results with fixation of both fractures by intramedullary nailing. Both these authors used retrograde nailing for the femur although in our study all the nailing was antegrade. Though no knee problems have been found when a single incision technique is used we feel that antegrade nailing allowed easier knee ligament reconstruction if needed as the femoral nail inserted retrograde would make knee ligament reconstruction technically difficult.

*Intra-articular involvement of the fractures, higher skeletal injury scores and severity of soft tissue injuries are significant indicators of poor outcome results. Hee suggested a preoperative scoring system that took into consideration the age, smoking status at the time of injury, injury severity scores, open fractures, segmental fractures and comminution to prognosticate the final outcome of these fractures. The best results were seen when both fractures were treated by intramedullary nailing. We found that these patients returned to their normal level of activity earlier than when the fractures were treated with other modalities. Tibia fractures treated with external fixation had a longer union time probably related to the soft tissue injury and comminution at the initial injury. The 3 patients who had a poor outcome in our study were 2 patients with tibia plateau fractures who had knee stiffness and persisting pain in the knee while the other patient had a Grade 3B open tibia fracture treated by external fixation. This shows that the poor prognostic factors were related to the type of fracture (open or closed, intra-articular fractures, severe comminution). The associated injuries played a major role in the initial outcome of patients in our study with regards to delay in the initial surgery, prolonged duration of surgery, anesthetic exposure and delay in rehabilitation. From our study, we found Floating knee injuries to be a group of complex injuries that needed careful assessment to detect poor prognostic factors (open, intra-articular, comminuted fractures) and associated injuries, surgical fixation of the fractures with thorough planning of surgeries and prolonged rehabilitation. A combination of all these would determine the ultimate outcome of these patients. So the injury depends upon the Grading of fractures, Surgical wound, surgical time, intraarticular involvement. Those are the main predictors of outcome.

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