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“  
A STUDY OF THE PATTERN  
AND MANAGEMENT OF  
INTRA- ARTICULAR FRACTURES  
OF THE KNEE AS SEEN IN  
KENYATTA NATIONAL HOSPITAL”

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DISSERTATION  
MChB (UoN) MMED (SURG)  
2007*

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A DISSERTATION SUBMITTED IN PART  
FULFILMENT FOR THE AWARD OF MASTER OF  
MEDICINE DEGREE IN SURGERY OF THE  
UNIVERSITY OF NAIROBI.

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**2007**



**DECLARATION**

I declare that this dissertation is my original work and that it has not been presented elsewhere for the award of a degree in any other university .

Candidate

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Signed.....


Date.....4/09/2007

This dissertation has been submitted for examination with my approval as a University of Nairobi supervisor.

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## **DEDICATION**

To my parents, Mr. Karanja and Mrs. Wanjiru for their priceless effort in nurturing me.

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## **ABBREVIATIONS**

1. D.C.P – Dynamic Condylar Plate
2. K-Urine – Kirschner wire
3. K.N.H – Kenyatta National Hospital
4. K.N.H – ERC – Kenyatta National Hospital Ethical and Research Committee
5. MM – Millimeters
6. ORIF - Open Reduction and Internal Fixation
7. POP – Plaster of Paris
8. RTA – Road Traffic Accidents
9. TBW – Tension Band wiring

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## **SUMMARY**

Intra articular fractures of the knee form a significant portion of patients with skeletal injuries. They mainly occur in the economically productive young population which leads to varied socio-economic implications to the society.

The broad objective of this study was to determine the pattern of intra-articular fractures of the knee and their management at Kenyatta National Hospital, the main teaching and referral hospital in Kenya. The goal was to assess the trend in management of these fractures and to provide data to health providers to improve patients care and their outcome.

The study was conducted between 25<sup>th</sup> August 2006 and 28<sup>th</sup> February 2007 and was a prospective cross-sectional study. A total of one hundred and one patients were recruited into the study and were followed up in the wards during their treatment period. Information about their demographic data, causes of injury and their pattern, management and anatomical reduction as assessed through radiography was obtained, processed and analysed.

## **Results**

The age distribution ranged from six years to ninety-five years with a median of 34 years and a mean of 36.1 years. The patients in the economically active population were 84.2% with a male to female ratio of 4:1.

The main cause of injury was road traffic accident (44.6%) followed by assault (28.0%) and falls (25.7%). However, 62.5% of patients sustaining patella fractures were caused by assault, majority being males.

There were more patients sustaining tibial plateau fractures as compared to the patella and distal femoral fractures (36.2%, 33.3% and 30.5% respectively).

Most patients with type B and C distal femoral fractures had open reduction and internal fixation (more than 80%) while those with type A were mostly managed conservatively.

Most patients with patella fractures had ORIF done (81.2%) and tension band wiring was used invariably. Only 44.2% of tibial plateau fractures had ORIF and the others were managed conservatively. Patient who had good or acceptable anatomical reduction were 92.4% in the three fracture categories.

## **CONCLUSION AND RECOMMENDATION**

Most patients had ORIF and the results were favourable. To have excellent results after intra-articular fractures of the knee ORIF is recommended to adequately reconstruct the joint surfaces.

## **INTRODUCTION**

The knee joint is the largest and most complex joint in the body subserving locomotive and stability functions in maintaining the upright posture.

Fractures in this region are not uncommon in our set up and require optimal reduction to prevent long term complications of osteoarthritis and knee stiffness among others.

Management of these fractures all aim to achieve as near anatomical reduction as possible and also to enhance early patient mobilization since most of these fractures occur in economically active patients and a portion among the elderly. It is difficult to reduce the femoral condylar fractures by closed manipulation and achieve anatomical reduction. In the patella, the action of the quadriceps retracts the proximal patella fragment upwards rendering closed reduction difficult. There is a potential for a step deformity when tibial plateau fractures are managed in POP cast. This may occur even after an acceptable anatomical reduction has been achieved by closed manipulation because these fractures are potentially unstable. Hence there is need to avoid prolonged immobilization on traction to reduce morbidity in the elderly patients or in plaster casts to allow the young and elderly patients alike regain their economical activities sooner.

This study is designed to asses the pattern of these fractures and their management options in our setup.

## **LITERATURE REVIEW**

Of all the joints in the body, the knee is the largest and most complex. It consists of 3 joints in one complex as a result of fusion of 3 parts. These are the lateral femoro-tibial, medial femoro-tibial and the femoro-patellar joints. It is formed from 3 bones – Distal femur, proximal tibia and posterior surface of the patella.

Movements at this joint are mainly flexion and extension, but has also limited movements in rotation and adduction. The bones of the tibio-femoral joint have little or no inherent stability [1,2,3]. Stability depends mainly on strong ligaments and muscles. These joint stabilizers are aptly divided into the static (ligaments), and dynamic stabilizers (muscles, tendons and aponeurosis).

The menisci provide stability in rotatory movements. Other functions include synovial fluid distribution, providing nutrition for the articular cartilage and in weight bearing [1]. In an intra-articular fracture, some of these stabilizers may be injured and need repair to maintain a stable joint. Due to its position, the wide range of movements and the weight bearing function, the knee joint is prone to a wide range of injuries [2,3,4,5].

In management of intra-articular fractures of the knee, as near anatomical reduction as possible should be aimed at to allow smooth articular surface hence reduce frictional forces [6]. This reduces pain during joint movement and retains and in some instances prevent occurrence of post-traumatic osteoarthritis. Fractures of the patella are more



prevalent in our set up, 68.3%, followed by tibial plateau fractures, 25%, and femoral condyles 1%. More males suffer fractures of the knee compared to the females [1].

### **FRACTURES OF THE PATELLA**

Patella is the largest sesamoid bone in the body [5,7]. It is held in position by the quadriceps tendon superiorly and patellar ligament inferiorly which is inserted into the proximal tibia [11]. Functions of the patella is to increase the efficiency of the quadriceps during extension [2,3,7]. Fracture patella constitutes 1% of all skeletal injuries [5,8]. Classification of patella fractures is by the anatomical disruption obtained [2].

### **CLASSIFICATION**

These can be displaced or undisplaced.

1. Transverse
2. Lower or upper pole/marginal
3. Comminuted
4. Vertical
5. Osteochondral.

In our set up transverse fractures are the most common, 81.6%, [1] with a higher male to female ratio 2.9:1. These fractures occur in young patients with a mean age of 36.8 years. Sixty two percent of the patients are in the range of 21-40 years.

Mechanism of injury is either through: -

- 1) Direct force as in road traffic accidents, assault and falls onto the knee.  
This causes undisplaced crack fractures or comminuted or stellate fractures without damage to the extensor mechanism [5].
- 2) Indirect force – occurs with forceful contraction of the quadriceps tendon in an extended knee principally occurring when a person tries to avoid falling when his or her foot is caught against a solid obstacle.

The most common causes of patella fractures are falls, road traffic accidents (RTA), assault and in sport injuries in descending order of frequency [1]. However, in western countries and in young people, sport injuries take a higher percentage in causing patella fractures [5,7].

### **Clinical Features**

The knee is swollen and painful and aspiration of the knee joint may reveal blood and fat droplets [3]. There may be an abrasion or bruising over the front of the joint. Patella defect may be present in fractures that are displaced or have retinacular tear. Inability to actively extend the knee indicates disruption of the extensor mechanism and torn retinaculum [7].

### **Investigations**

1. Plain X-rays – Antero-posterior (AP) and lateral views are standard. Tangential or merchants view is indicated for vertical fractures which may not be obvious on the traditional AP and lateral views. X-ray of the opposite knee is indicated to



compare the two knees in cases with bilateral bipartite patella [7,8,9], which occurs in 43% of the population who have bipartite patella.

2. CT scan – if no fractures are visible on a plain X-ray film, a CT scan may reveal some intra articular loose bodies.
3. Bone scan – useful in stress fractures especially in bipartite patella [7].

### Treatment

The goal of treatment is

- 1) To restore articular congruity
- 2) Repair extensor mechanism to allow early motion [7].

Conservative treatment with Brace or Plaster of Paris (POP) cast in extension or slight flexion for 4-6 weeks associated with partial weight bearing is indicated in patients with closed fractures with minimal displacement, no articular incongruity and intact extensor mechanism.

Bastrom, [10], suggested non-operative management if there is less than 3-4mm of fragment separation, and articular congruity (step deformity) of less than 2-3 mm. If these measurements are more than above indicated, operative management was suggested.

He showed that fractures treated non-operatively had the best overall results. Osteoarthritis is increased if there is a step of more than 2 mm [7]. Operative treatment include tension band wiring (TBW), screw fixation and partial or total patellectomies in fractures with extensive comminution.

Open fractures are treated as surgical emergencies with debridement and irrigation with early tissue coverage (within 5 days) to reduce the incidence of infection. In a local study by Meseve G. K. [1], 27 out of 71 patients who had patella fractures were treated conservatively with 3.7% of these having acceptable result and 7.4% having unacceptable results and 88.9% of the patients had no information available. Thirty six of the 71 patients had internal fixation of whom 8.3 % had acceptable results and 38.9% had unacceptable results, 6 patients underwent partial patellectomies and 1 had complete patellectomy.

Haxton [11] showed that the power of extension of the knee increases as the joint extends. Hence, need to repair extensor mechanism. Kauffer [12] showed that 15%-30% more quadriceps force is required to fully extend patellectomized knees compared to intact knees. The effect of patellectomy is eliminated by elevation of the tibial tubercle by about 1.5cm. Weakness in patellectomized patients occurs mostly on stair climbing.

The size of the retained fragment does not correlate with the result [5,11,13]. In patients with patella tendon injury, it has been shown that suturing the patella tendon close to the articular surface reduces the incidence of patello-femoral osteoarthritis [5].

### **Complications of Patella Fractures**

Stiffness of the knee is the most common complication. Others are wasting of the quadriceps muscles, sepsis (patella osteomyelitis, soft tissue infection and septic arthritis), non-union and mal-union..

### **INTRA ARTICULAR FRACTURES OF PROXIMAL TIBIA.**

These are also called tibia plateau fractures. They are more common in young active patients and in patient with osteoporotic bones [14,15].

The mean age is 39 years with 57.7% of patient between the ages of 21 to 40 years [1] with male preponderance. Male to female ratio was 3.3:1. Fractures of the lateral tibia condyle may be associated with injuries of the medial collateral ligament and so are fractures of the medial tibial condyle being associated with injuries to the lateral collateral ligament.

None of the tibial condylar fractures was associated with ipsilateral collateral ligament. Forty six percent of fractures were caused by road traffic accidents. Falls accounted for 34.6% and assault caused 11.5% of the fractures.

Schatzker [6] classified these fractures into 6 types

### **Type I – Pure cleavage**

Typical wedge shaped uncomminuted fragment which may be split off and displaced laterally and downwards. This fracture is common in young patients without osteoporotic bones [17]. Fracture is treated by fixation with 2 transverse cancellous screws.

### **Type II – Cleavage combined with depression.**

The lateral wedge is split off with depression of the articular surface into the metaphysis. Mostly occurs in older people. Instability is present if depression is more than 5-8 mm. Treatment is by open reduction, elevation of the depressed plateau, bone grafting of the epiphysis and fixation with cancellous screws and buttress plating of the lateral cortex.

### **Type III – Pure central depression.**

The articular surface is driven into the plateau. The lateral cortex is intact. Occurs mostly in osteoporotic bones. Treatment is by elevation of the articular fragments and bone grafting. The lateral cortex may be supported with a buttress plate.



#### **Type IV – Fractures of medial condyle**

The medial condyle is split off as a single wedge or can be comminuted and depressed. Treatment is by open reduction and internal fixation with a medial buttress plate and cancellous screws.

#### **Type V – Bicondylar fractures**

Both the tibial plateaus are split off. The metaphysis and diaphysis retain continuity. Treatment is by buttress plates with cancellous screws.

#### **Type VI – Plateau fractures with dissociation of metaphysis and diaphysis.**

A fracture of the proximal tibia is often present which can be transverse or oblique. It may be associated with fractures of one or both condyles and the articular surface. Treatment is by pin and wire fixation. External fixators have also been used with good results [17].

Goals of treatment-

- 1) Restoration of articular congruity.
- 2) Axial alignment.
- 3) Joint stability.
- 4) Functional motion.

Articular fractures are usually caused by high-energy mechanism and may be associated with neurovascular injuries, compartment syndrome, deep venous thrombosis, contusion or crush injuries to soft tissues or even open wounds. Peroneal nerve injury is twice as common in fracture dislocation pattern [2].

Complex knee trauma describe injuries associated with significant damage to 2 or more of the following components.-

- 1) Soft tissue envelope of knee.
- 2) Ligament stabilizers.
- 3) Bony structure of distal femur.
- 4) Proximal tibia.

Complex fractures involving both femoral and tibial articular surfaces have 25% incidence of vascular injuries and 2% of compartment syndrome. In severe soft tissue injuries, vascular injuries and compartment syndrome increases to about 31% and peroneal nerve injury is about 28% [2].

The most common fracture is of the lateral tibia condyle occurring in 51.9% [1], followed by the medial condyle- 22.2%. Bicondylar fractures occurs in 14.8%. Thirty percent of tibial condylar fractures are associated with ligament injuries. After articular surface of a joint is fractured, joint function is usually proportionate to the accuracy of reduction [15,18]. The degree of displacement and depression influences long-term results and hence treatment.

Most authors agree that if depression or displacement is more than 10mm, surgery is indicated to elevate and restore joint surface [17,19,20]. If depression is less than 5mm and fracture is stable, non-operative management with brace and early mobilization and delayed weight bearing may be indicated [2,3].

Long term follow up has shown that post traumatic osteoarthritis is associated with residual instability or axial malalignment and not the degree of articular depression [2]. Instability could result from ligament disruptions, osseous depression of articular surface or translational displacement of a fracture segment.

Major indication for surgery according to Rasmussen [15] is not the measure of depression but the presence of varus or valgus instability of  $10^{\circ}$  or more with the knee flexed at  $20^{\circ}$ .

The most common complications include knee stiffness, quadriceps wasting, valgus deformity and frequent pain in descending orders [1].



## **INTRA-ARTICULAR FRACTURES OF THE DISTAL FEMUR.**

Supracondylar and articular fractures of the distal femur have been difficult to treat historically. They are often unstable and comminuted [2,6]. They mostly occur in the elderly and multiply injured patients [19,21,22]. Regaining full knee movement is difficult. It is associated with high incidences of malunion, and high infection rates. A classification which determines treatment and prognosis based on the location and pattern of fracture has been developed by Muller et al [23].

Type A – Fracture of distal shaft only with varying degrees of comminution.

Types      B – condylar fractures

            B1 – sagittal split of lateral condyle

            B2 – sagittal split of medial condyle

            B3 – coronal plane fracture

Type      C – These are T or Y condylar fractures

            C1 - No comminution

            C2 – Comminuted shaft fractures with 2 principle articular fragments.

            C3 – Intra- articular comminution

Most of these fractures occurs as a result of road traffic accidents [18,24,25] with male preponderance [1,19,24,26]. In the 1960s, these fractures were treated by traction and cast bracing due to lack of adequate internal fixation devices [2].

Early mobilization was important in obtaining good results. In 1983, Healy & Broker [27] recommended operative procedures except in simple non-displaced fractures mainly with plate and screws. They obtained 81% of good function post-operatively with 35% good results for patients treated conservatively.

In 1989 Mize [25] reported 76% excellent results with blade plates. However, blade plates and condylar screws have been shown to be unsuitable for fracture with large amount of articular comminution and condylar buttress plate was commonly used with methyl methacrylate used to improve screw purchase in osteopenic bones [23,28].

Displaced fractures are treated by operative methods to obtain anatomical articular reconstruction – mostly with cancellous lag screws or a T buttress plate in osteoporotic bones [6,21]. Intercondylar fractures can be treated with a blade plate, dynamic condylar screw or a buttress plate if articular comminution is severe [6,21,29]. Double plate fixation in very low distal fracture with extensive articular and metaphyseal comminution has been advocated by Ziran et al [8].and Jazrawi et al [7] .

Others have used external fixation with good results in open fractures [6,24] and even in closed fractures [6,30] with proper healing and minimal loss of motion which can be resolved by rehabilitation procedures. External fixation is also useful in severe open distal femoral fractures with vascular injury as a temporary or definitive measure [2].

Various authors have shown good or excellent results of surgically treated intra-articular fractures of the distal femur ranging between 50-96% [16,18,19,21,31,32,33,34] according to the Neer Scoring System and others using the Ahlback score [9].

Patients with isolated fractures have good range of movements after fixation compared to those with multiple fractures. Maarten V. R. et al [21] concluded that knee function increases through time, though range of movement does not increase much after one year.

Siliski et al [18] concluded that rigid internal fixation permits early functional rehabilitation and reduce incidence of non-union and mal-union. Outcome is also affected by soft tissues injuries [24]. Complications associated with intra-articular fractures of distal femur includes reduced range of movement of knee, knee stiffness, malalignment either varus or valgus [21,35] and septic arthritis [8,15].

Shortening or lengthening especially in children [19,36] and secondary osteoarthritis have also been recorded [23]. Starr et al [31] concluded that even when intra articular fractures of distal femur is treated by experienced surgeons, one can expect development of secondary osteoarthritis in at least 30% of all the patients. Radiological signs for the development of secondary osteoarthritis are of little importance in surgically treated distal femoral fractures [37].

Other complications include quadriceps muscle wasting [24,38] and heterotopic knee ossification [39]. Hee T et al [8] showed that poor prognosis depends on increasing age of patients which is associated with delay in bony union. An increase in number of pack years smoked at time of injury predicted likelihood of knee stiffness and delayed full weight bearing activity.

Intra-articular fractures of distal femur are rare in children and may be associated with higher incidence of anterior cruciate ligament injuries, meniscal tears and osteochondral fractures [19]. Children with physeal injuries should be followed up until skeletal maturity is attained [36,40] because potential for shortening and angular deformity is high.



## **Statement of the research problem**

### **Justification of the study**

Fractures around the knee joint mostly occur in people in their most productive age [1,38]. Management is difficult especially in comminuted fractures. Management is also varied and often leads to post-traumatic joint stiffness and osteoarthritis of the knee. This may ultimately require total knee replacement [2,19,21], which in our current set up, is very expensive and hence unaffordable to a large proportion of patients and is not widely performed routinely.

This study is to provide data and management options in this institution hence provide a protocol for the management of the same to maximize patients care and reduce complications.

At Kenyatta National Hospital (KNH), no study on the intraarticular fractures of the knee has been done. In 1990, Dr. Museve G.K. carried out a retrospective study over a 5 year period on knee injuries and recommended a prospective study. This study is specific to intra-articular fractures and in effect, injuries impacting more force on the knee joint.

## **OBJECTIVES OF THE STUDY**

### **General objectives**

To determine the pattern and management of intra-articular fractures of the knee.

## **Specific objectives**

1. To determine the common causes of intra articular fractures of the knee in our set up.
2. To determine the age distribution.
3. To determine the most commonly fractured bone in knee injuries.
4. To determine the management options in this institution.

## **Study Variables**

The variables evaluated included :-

- The mechanism of injury.
- Bone fractured and its categorization into various classifications.
- Associated injuries.
- Radiological appearance after institution of management modalities.

## **METHODOLOGY**

### Study design and setting.

This was a prospective cross sectional study done over a period of six months between 25/08/2006 and 28/02/2007. It was conducted for patients at the Kenyatta National Hospital (KNH) orthopaedic wards namely: - ward 6A, 6B, 6C, and 6D, and those followed up in the fracture or orthopaedic clinic during the above duration.

### **Study population**

All patients diagnosed to have intra-articular fractures of the knee diagnosed radiologically and treated in KNH and satisfying the inclusion criteria below were recruited.

### **Minimization of errors and biases**

This was accomplished by adoption of and adherence to the inclusion and exclusion criteria.

### **Criteria for inclusion.**

1. Patients with intra-articular fractures of the knee admitted to the orthopaedic wards either from casualty or from the fracture or orthopaedic clinics.
2. Patients referred from other hospitals with intra-articular fractures of the knee.
3. Patients managed conservatively in the fracture clinic with intra-articular fractures of the knee.

### **Exclusion criteria**

1. Patients with healed intra-articular fractures admitted due to other orthopaedic conditions.
2. Patients admitted to amenity wards or to the orthopaedic wards from the amenity wards.



3. Patients unwilling to be recruited into the study by refusing to sign the informed consent.

### **Methods and materials**

Patients satisfying the inclusion criteria were sampled by the author.

Diagnosis of the intra-articular fracture of the knee was made from:-

- (a) Taking history from the patient or guardian if the patient was not able to give a comprehensive history as to the mechanism of injury.
- (b) Physical examination to assess knee injuries and any other associated injuries.
- (c) Radiography. X-ray of the knee joint was the minimum criteria for the diagnosis of intra-articular fractures of the knee. This assisted in the assessment of severity of bony injury and also grade the fracture accordingly. The author did not influence the management options offered to individual patients and completed the questionnaire only after definitive management had been offered. Anatomical reduction was assessed as good if there was a step deformity of 0 – 2.0 millimetres(mm), acceptable if it was between 2.0-5.0mm and poor if it was more than 5.0mm.

### Sample size

Required accuracy of 0.05 and 95% confidence interval was considered. The sample size was calculated using the formula for populations less than 10,000 thus;

$$nf = \frac{n}{1+n/N}$$

where nf = desired sample size (when population is less than 10,000

n = minimum desired sample size (when population is more than 10,000)

N = Estimate of the population size.

Statistics from the records department at KNH indicates there were 154 patients with intra-articular fractures of the knee in the year 2002 and 115 patients in 2003.

Therefore on average there were 135 patients per year admitted.

Calculation was done as follows;

$$n = \frac{(1.96)^2 \times 0.50 \times 0.50}{(0.050)^2}$$

Therefore n=384

$$nf = \frac{384}{1 + 384/135} = 384/3.84$$

= 100 (Minimum desired sample size)

## **DATA COLLECTION, PROCESSING AND ANALYSIS.**

### **Instruments**

Structured researcher administrated questionnaire.

### **Personnel**

The study was done by the author himself under the guidance of the supervisor.

### **Processing and analysis**

The necessary data was derived from the filled questionnaires, which was entered into a computer. Analysis using the 0.05-degree of accuracy and 95% confidence interval was carried out by SPSS version 10.0 to derive descriptive characteristics and frequency distribution of the study population. Statistical significance wherever appropriate was determined by use of the chi square analysis.

### **Presentation of results**

Following the analysis of the data, the results were presented in tabular and graphical forms with use of bar and pie charts.

## **RESULTS**

During the study period a total of one hundred and one patients (101) were recruited into the study.

### **DEMOGRAPHIC CHARACTERISTICS**

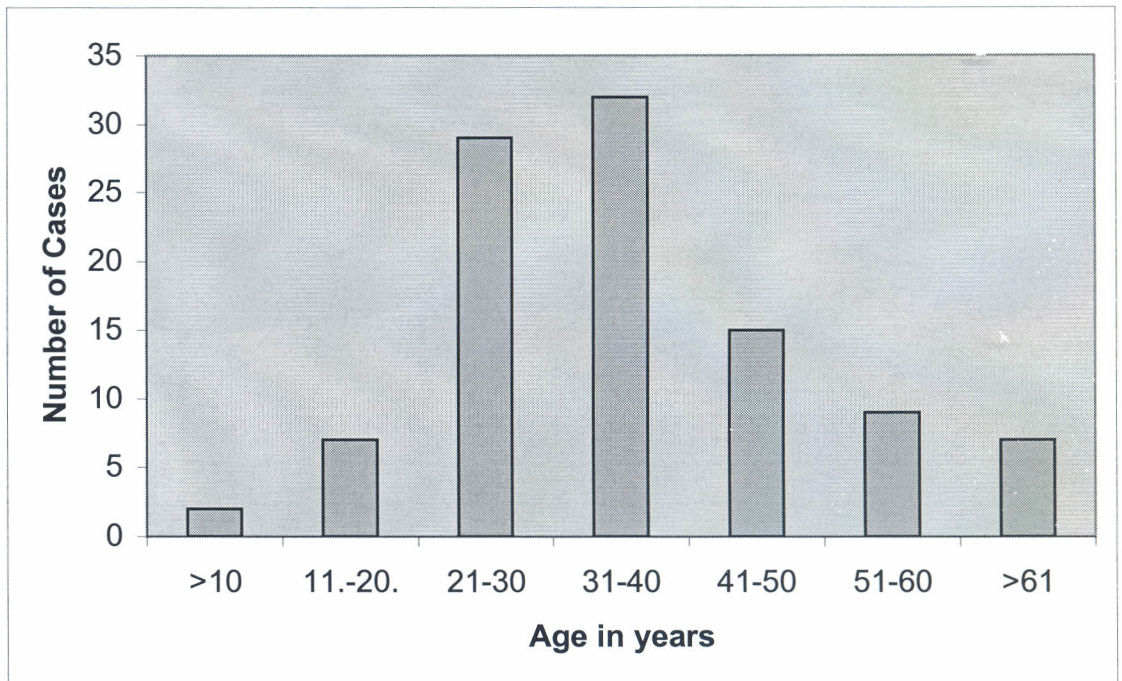
#### Age distribution

This ranged from six (6) years to ninety five (95) years. The median age was 34 years with a mean of 36.1 years.

The mean age for patients with intra articular fractures of the femur was 39.3 years, those of the patella was 34.1 yrs and for the tibial plateau fractures was 46.6 years with a median age of 34years, 34 years and 35 years respectively.



Figure 1. Age distribution of fractures.



Eighty five patients (84.2%) were in the economically active population between the ages of 21-60 years.

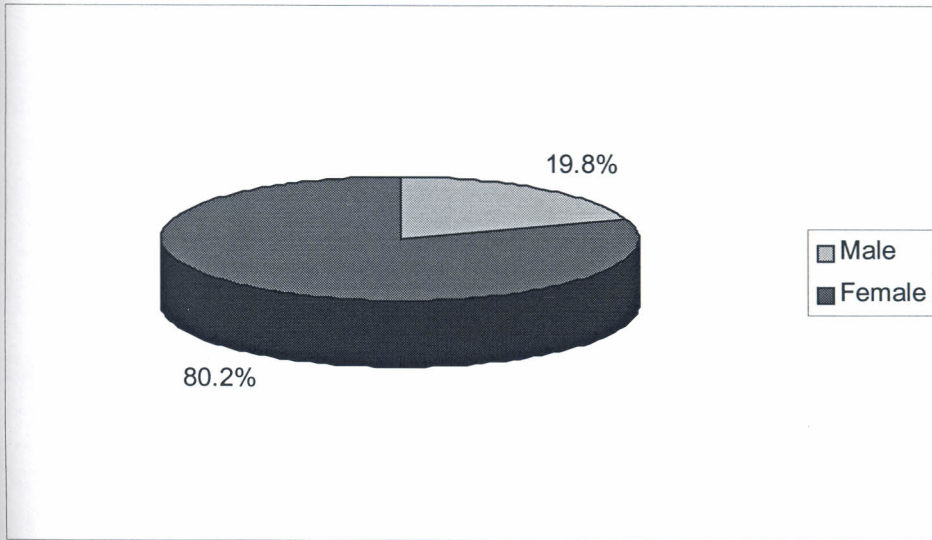
### **Sex distribution**

Eighty one males (80.2%) and twenty females (19.8%) were sampled.

The male to female ratio was 4:1



Figure 2: Sex distribution of intra articular fractures of the knee.

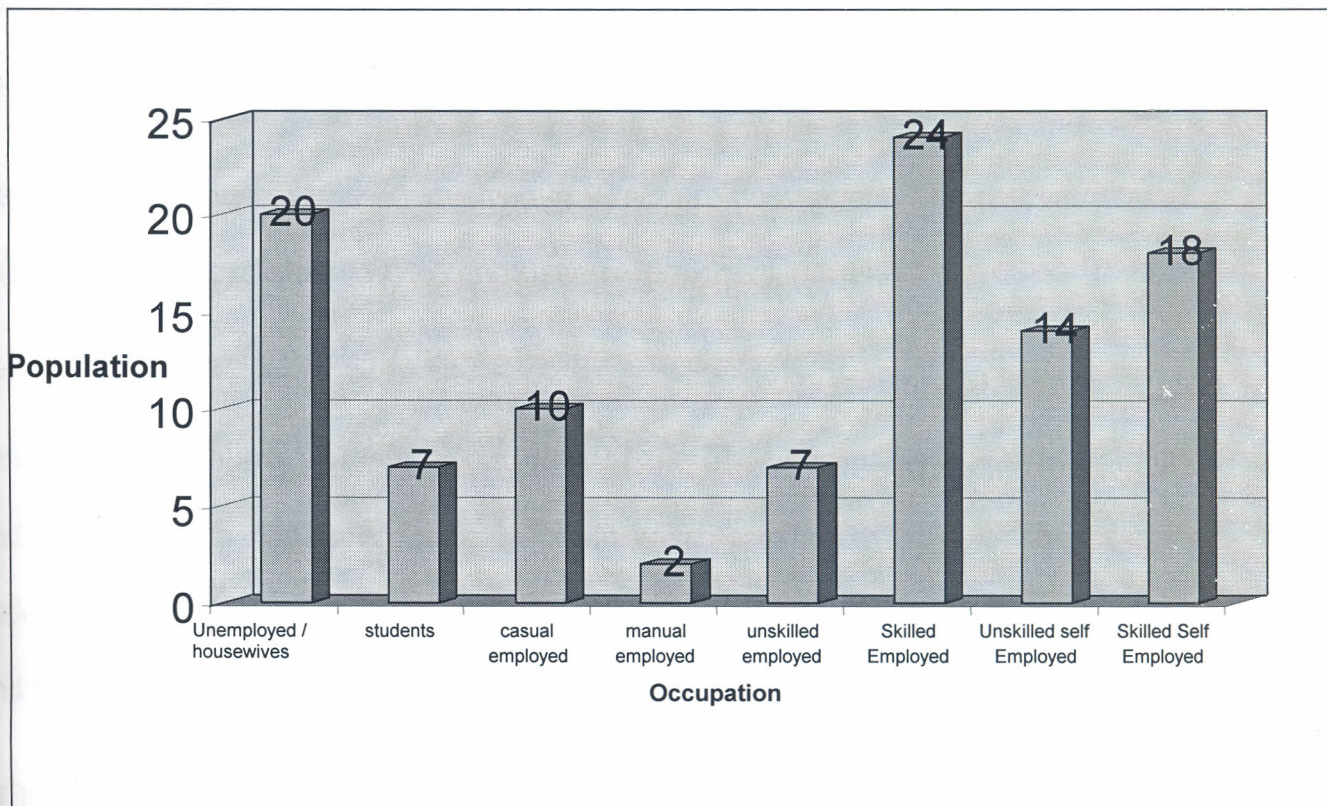


### **OCCUPATION**

Of the patients studied, twenty (19.8%) were unemployed or house wives and seven (6.9%) were students. Seventy four patients (73.3%) were in gainful employment. Of those employed, ten (9.9%) were casuals, two (2%) were manual workers, seven (6.9%) were unskilled and twenty four (23.8%) were skilled workers.

Thirty one patients (30.7%) were self employed. Of these, thirteen (12.9%) were unskilled and eighteen (17.8%) were skilled workers.

Figure 3. Various occupations of the study population.



### Causes of Injury

Road traffic accident (RTA) contributed most of the injuries sustained with forty five patients contributing about 44.6%.

Next was assault with twenty nine patients (28.7%) followed by falls with twenty six patients(25.7%). Only one patient(1%) sustained injuries as a result of sports.

Of the patients who were involved in RTA more than half of them were pedestrians (twenty four patients out of forty five), contributing 53.3%). This translated to about twenty four (24%) of the study population.

Eleven of the patients (10.9%) involved in RTA were passengers. The rest were cyclists 6 (5.9%), motor cyclists 3 (3.0%) and hand cart pushers 1(1.0%).

Of the patients sustaining fractures as a result of assault, twenty (19.8%) were as a result of blunt trauma. This is about 69% of the assaulted patients. Gunshot injuries and sharp injuries had three patients each which was about 10% of the assaulted patients. The other three remaining patients were pushed into a ditch, hit by a gate and the last one was assaulted by both blunt and sharp objects.

Of the twenty six patients who sustained fractures from falls while walking, twenty (76.9%) were due to falls while walking. These were either due to tripping onto a stone (3), while walking on uneven ground (11), falling onto a ditch (5) or slipping on a wet ground (1).

Three of the patients (11.5%) fell from a building while the rest sustained fractures when a trench collapsed (1) and the other patient fell onto a fork lift.



Figure 4.0 –Causes of injury

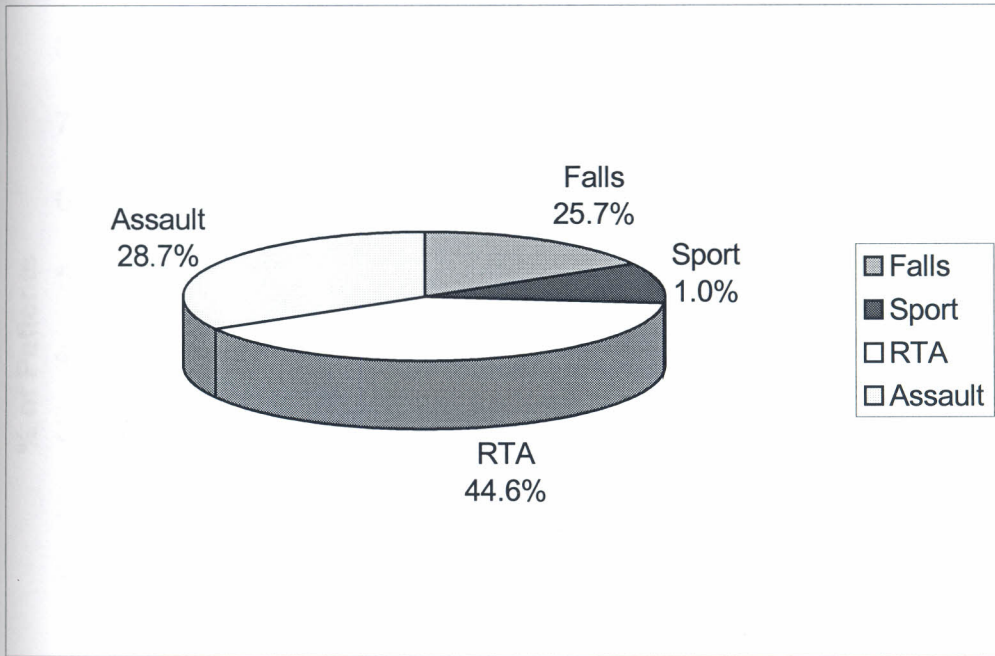


Figure 4.1 Distribution of injuries caused by RTA.

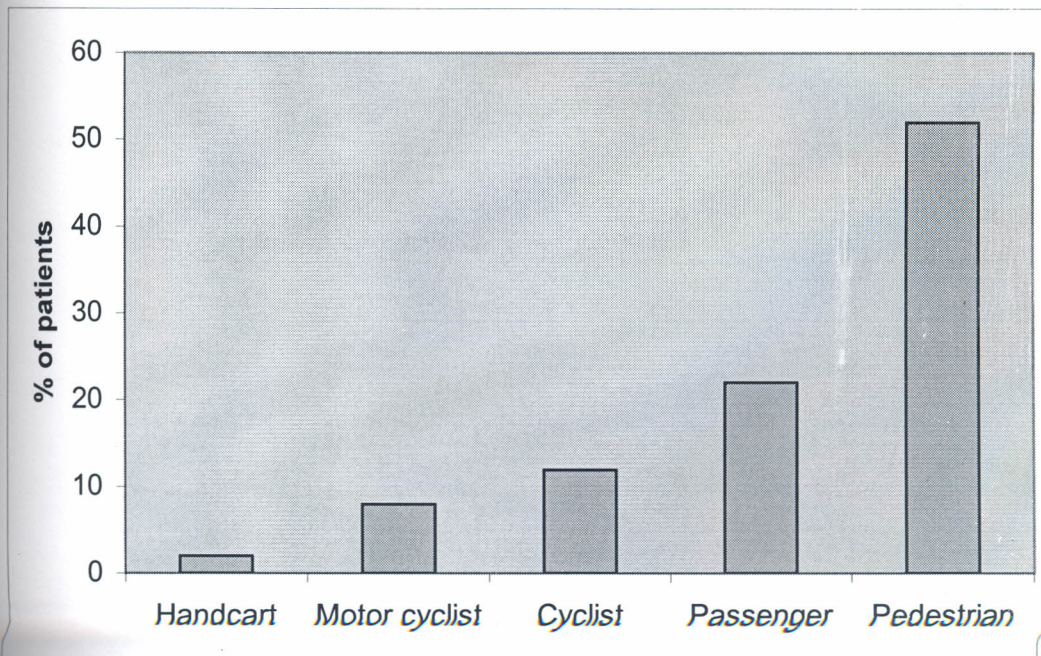


Figure 4.2 Distribution of injuries caused by assault.

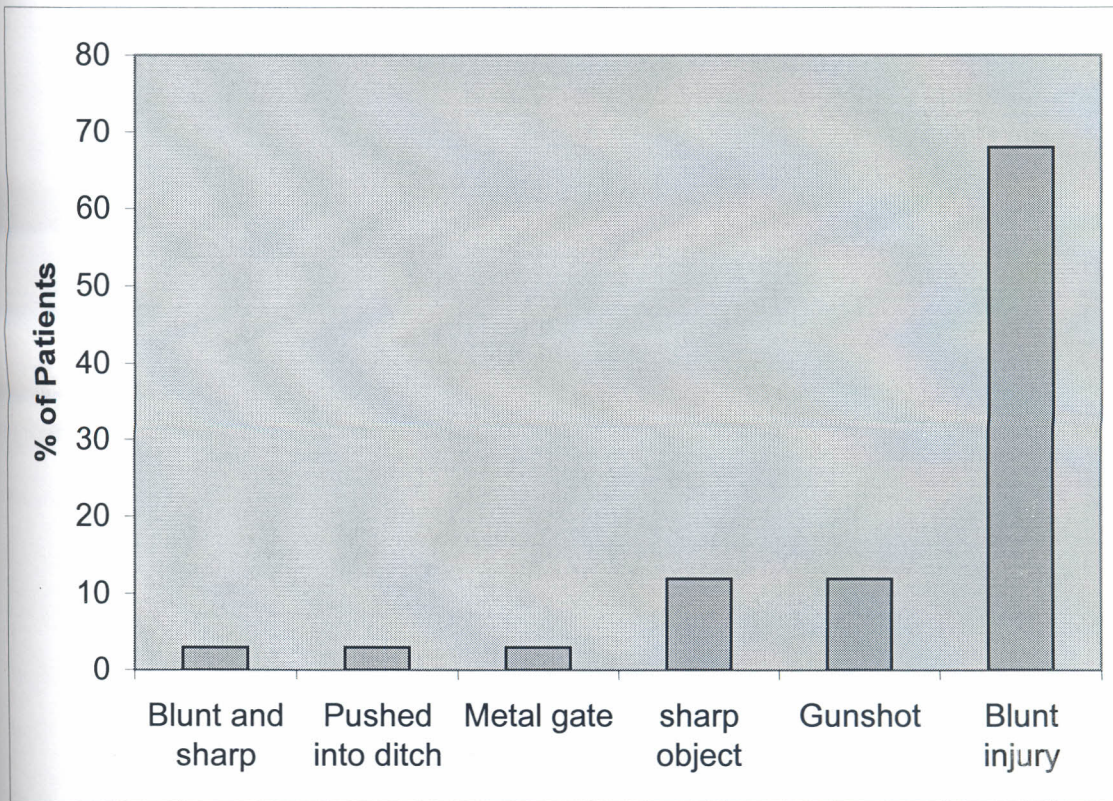




Figure 4.3 Distribution of injuries caused by falls

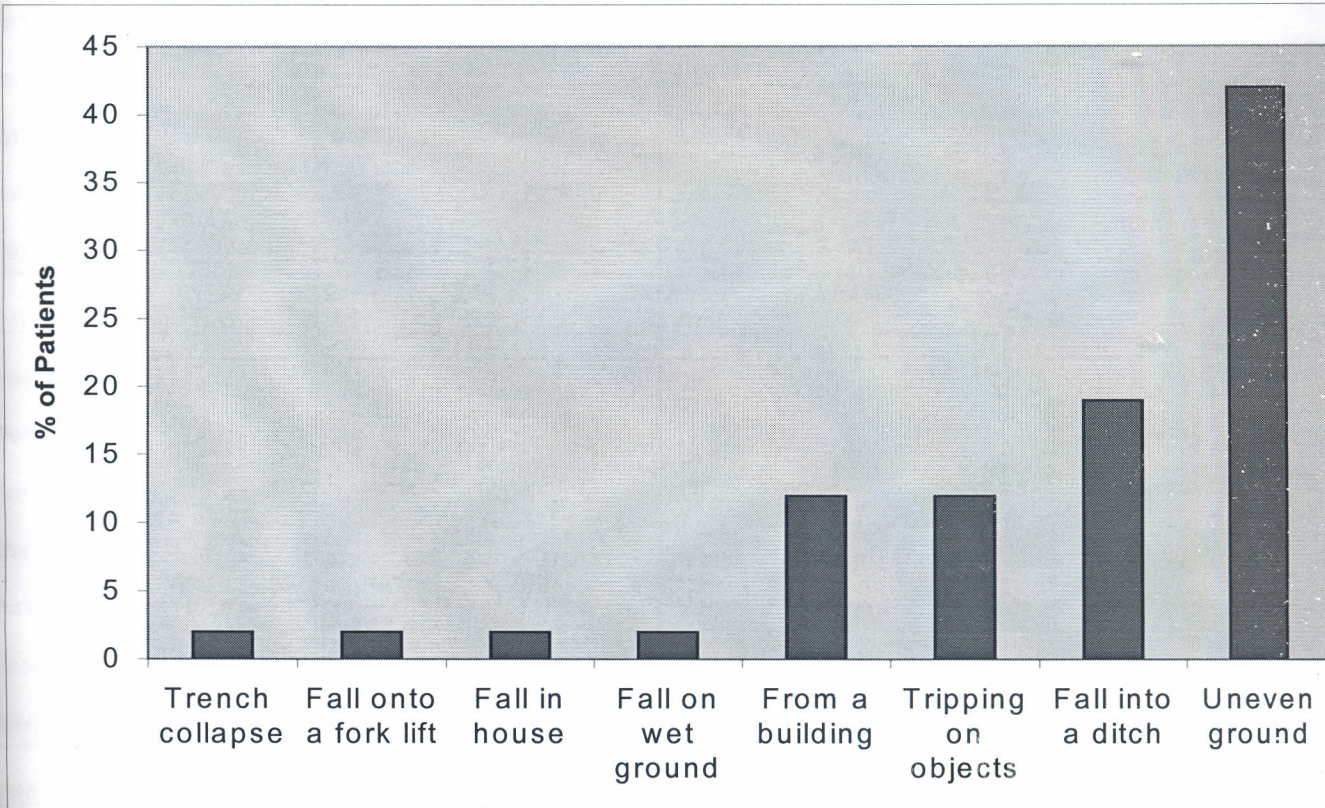


Table 1; Frequency of distribution of aetiological factors

AETIOLOGY	TOTAL NUMBER OF PATIENTS	% OF STUDY POPULATION	VALID PERCENTAGE
RTA			
Pedestrian	24	23.8	53.3
Passenger	11	10.9	24.4
Cyclist	6	5.9	13.3
Motor cyclist	3	3.0	6.7
Handcart pusher	1	1.0	2.2
<b>Total</b>	<b>45</b>	<b>44.6</b>	<b>100.0</b>
Assault			
Blunt trauma	20	19.8	69.0
Gun shot	3	3.0	10.3
Sharp trauma	3	3.0	10.3
Pushed into ditch	1	1.0	3.4
Hit with gate	1	1.0	3.4
Blunt and sharp	1	1.0	3.4
<b>Total</b>	<b>29</b>	<b>28.7</b>	<b>100.0</b>
Falls			
Uneven ground	11	10.9	42.3
Into a ditch	5	5.0	19.2
From building	3	3.0	11.5
Tripping on object	3	3.0	11.5
In the House	1	1.0	3.8
On wet ground	1	1.0	3.8
Trench collapse	1	1.0	3.8
Onto a fork lift	1	1.0	3.8
<b>Total</b>	<b>26</b>	<b>25.9</b>	<b>100.0</b>
Sports			
Soccer	1	1.0	100.0
<b>Total</b>	<b>1</b>	<b>1.0</b>	<b>100.0</b>
<b>GRAND TOTAL</b>	<b>101</b>	<b>100.0</b>	<b>100.0</b>

## FRACTURES SUSTAINED

The one hundred and one (101) patients sampled had one hundred and five (105) fractures.

Four of these patients had multiple fractures of the knee.

Most of the patients suffered proximal tibial fractures. These totalled to 38 patients (36.2%).

There were 35 patients (33.3%) with distal femoral fractures and those sustaining patella fractures were 32 (30.5).

Table 2. Distribution of fractures sustained against gender

Fracture	number			percentage		
	Male	Female	Total	Male	Female	Total
Distal femur	26	6	32	25.7	6.0	31.7%
Patella	26	3	29	25.7	3.0	28.7 %
Tibial Plateau	26	10	36	25.7	9.9	35.6%
Distal femur and patella	2	0	2	2.0	0.0	2.0 %
Distal femur and tibial plateau	0	1	1	0.0	1.0	1.0%
Patella and proximal tibia.	1	0	1	1.0	0.0	1.0%
Total	81	20	101	80.2%	19.8%	100%

## Distal Femoral Fractures

There were thirty five (37.3%) distal femoral fractures. Of these, ten (28.6%) were AO type A, eighteen (51.4%) were AO type B and seven (20%) were AO type C.

The left leg was involved in seventeen of the fractures and the right was involved in eighteen of the fractures. There were six open or compound fractures and the rest (twenty nine) were closed fractures.

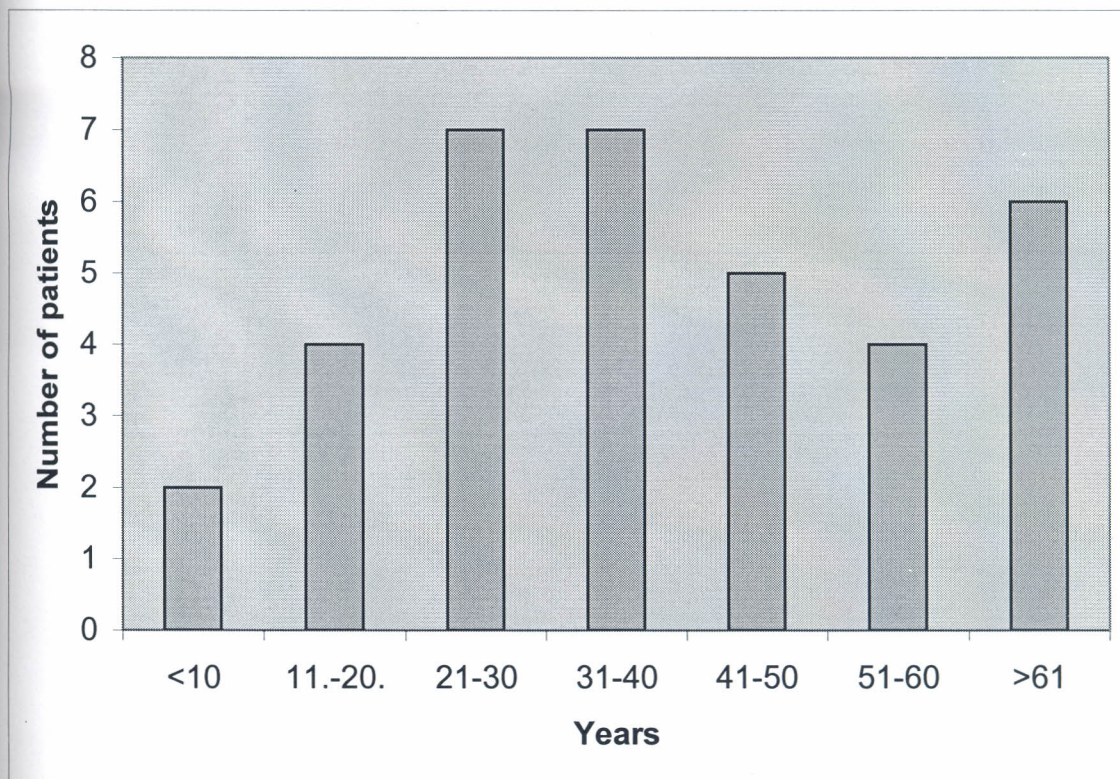
Table 3 depicts the distribution of the fractures and their gender prevalence.

LEG				NATURE OF FRACTURE		GENDER			
Fracture type	Right	Left	Total	Open	Closed	Total	M	F	Total
A	5	5	10	2	8	10	8	2	10
B	8	10	18	3	15	18	13	5	18
C	5	2	7	1	6	7	7	0	7
TOTAL	18	17	35	6	29	35	28	7	35

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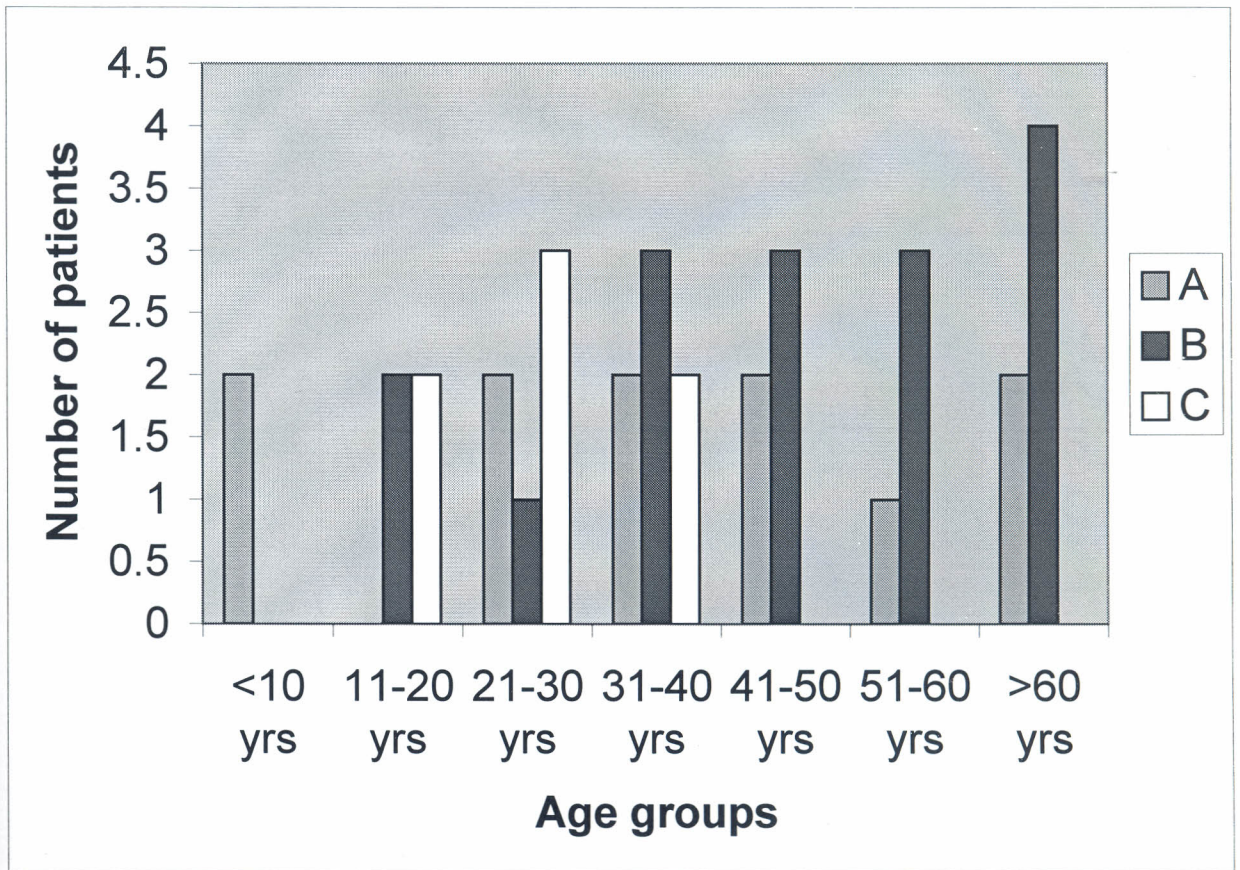
Figure 5.0 Distribution of distal femoral fractures according to age groups.



Twenty seven patients (77.1%) fall between the ages 21- 60years which is the most economically productive population. However a significant number were elderly patients who sustained the distal femoral fractures. There wee six patients (17.1%) in this category.

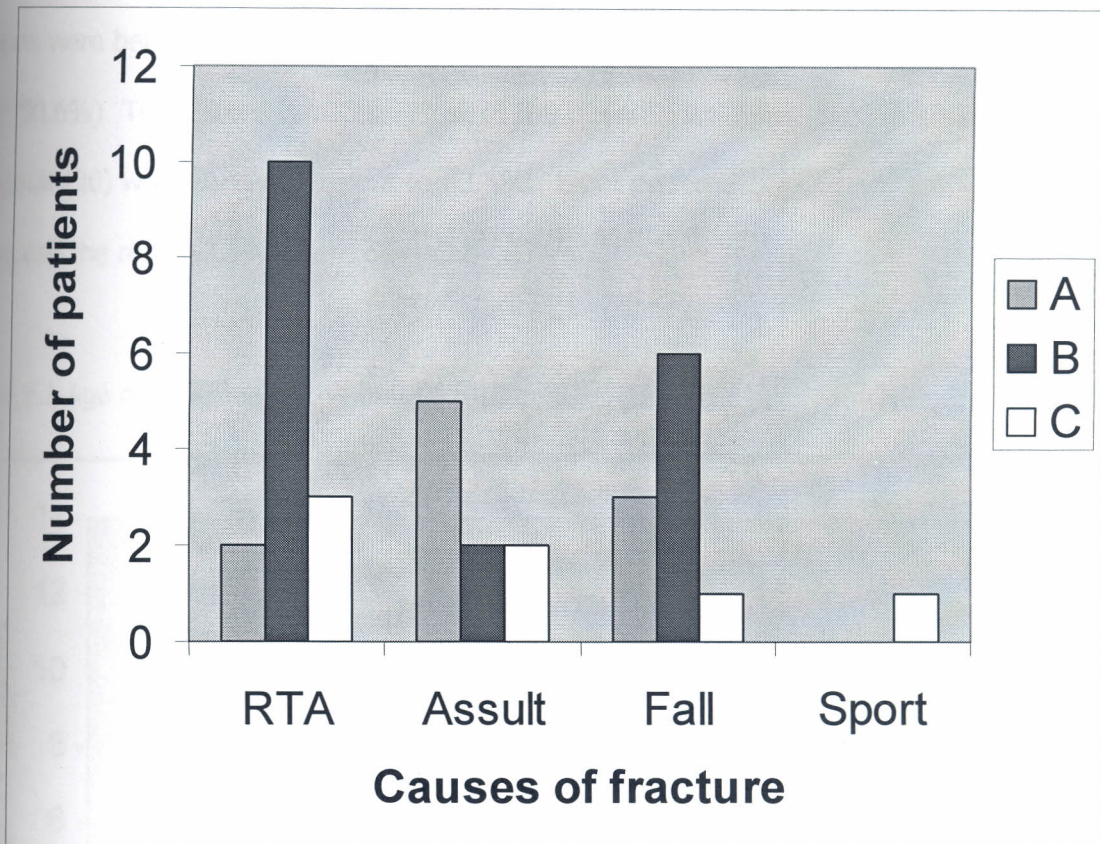


Figure 5.1 Distribution of the various fractures according to age group



Fracture type A is evenly distributed among the age groups, type B is more common in middle age group and above while type c occurs between the ages of 20-40 years.

Figure 5.2 Causes of injury according to their aetiology



There were three patients below seventeen years who sustained epiphyseal injuries of the distal femur. There were two gun shot injuries who sustained distal femoral fractures.



### Patella fracture.

There were thirty two (32) patella fractures all between the ages of 16-50 years. Majority of the patients were between 21-40 years. These were 24 (75%). Majority of the patients were males - 29 (90.6%) Three were females. Most of the patients sustained patella fractures as a result of assault (20) which was equivalent to 62.5%. Eight patients (25%) sustained fractures after falling and the rest (12.5%) were caused by RTA's.

Figure 6.1 Age distribution of the patella fractures.

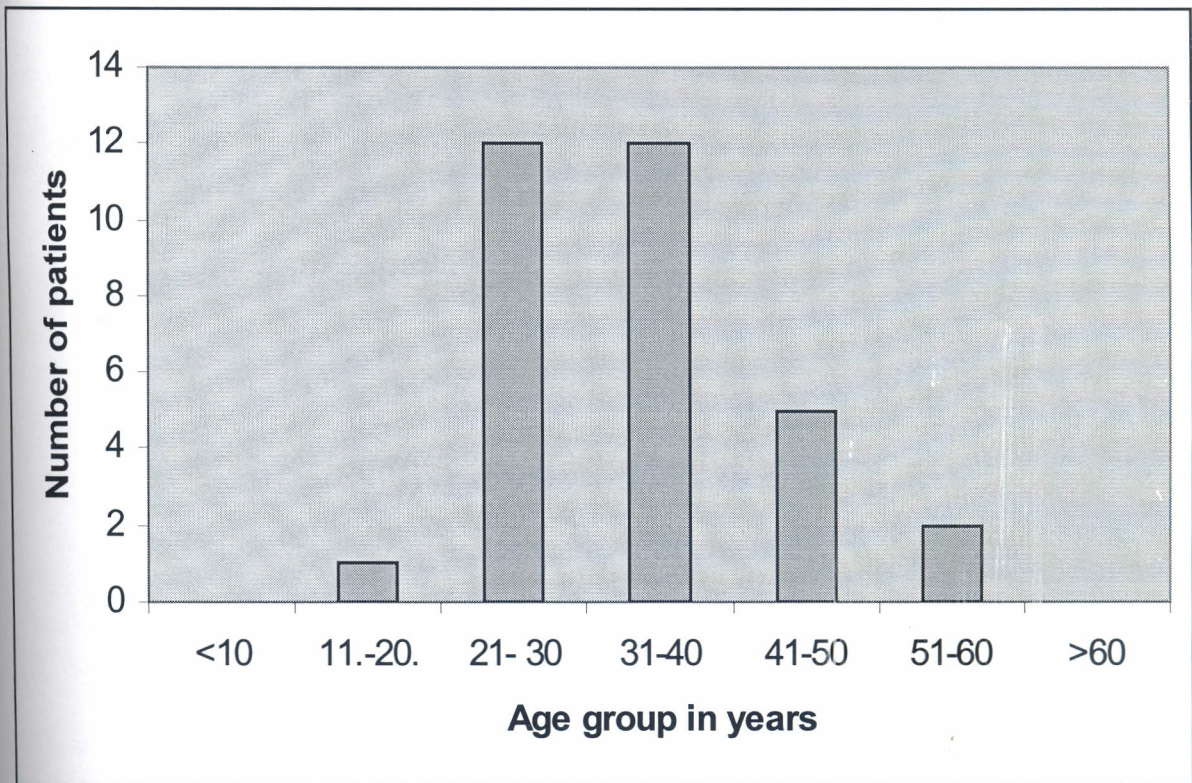


Figure 6.2. Mechanism of injury leading to the patella fractures.

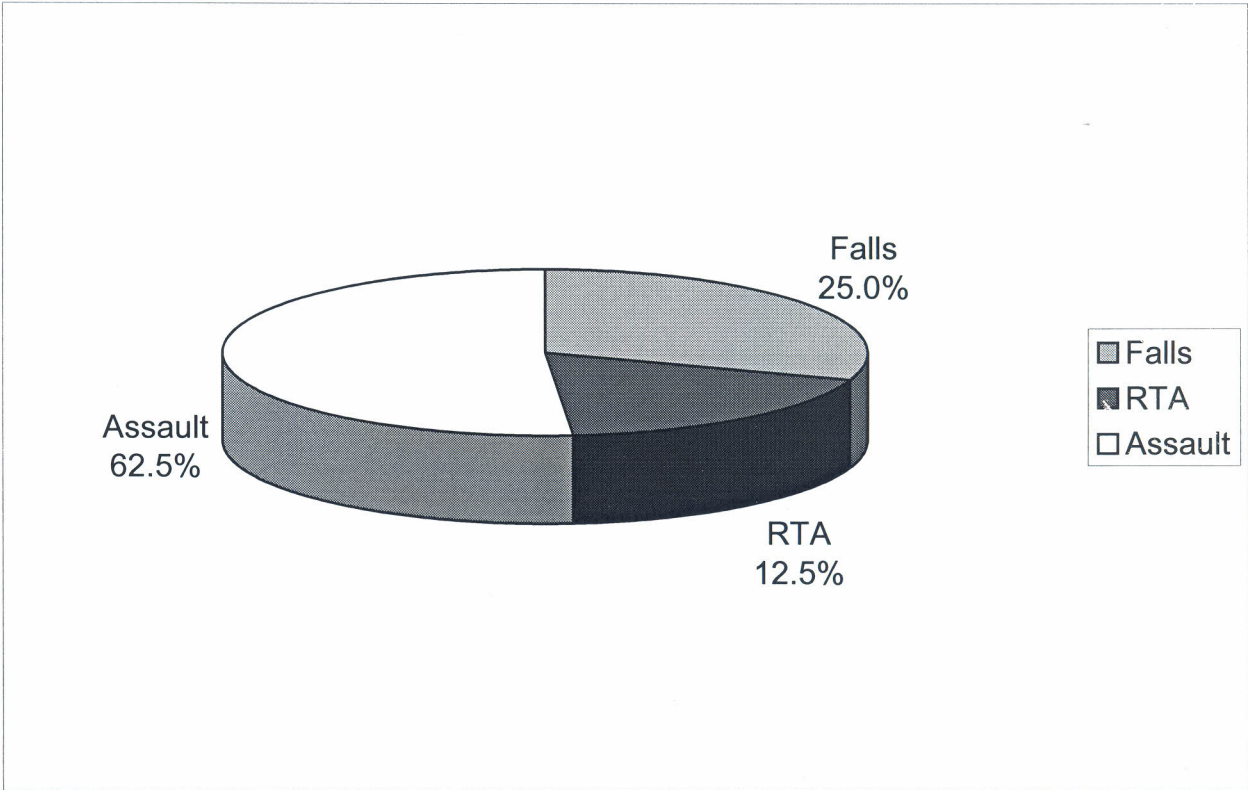




Table 4. Distribution of the various patella fractures sustained

Left leg				Right leg		Total	%
Fracture type		Open	closed	Open	Closed		
Transverse	displaced	0	5	2	6	13	40.6
	Undisplaced	0	1	1	1	13	9.4
Vertical	displaced	0	0	0	0	0	0.0
	undisplaced	0	2	0	0	2	6.3
Comminuted	displaced	3	1	0	3	7	21.8
	undisplaced	1	1	0	1	3	9.4
Marginal	displaced	0	1	0	3	4	12.5
	undisplaced	0	0	0	0	0	
TOTAL		4	11	3	14	32	100%

Half of the patients sampled sustained transverse fractures of the patella (16). There were ten patients (31.2%) with comminuted fractures. There was no much difference between left and right patella fracture (15 versus 17) involvement. There were seven compound fractures sustained; four on the left and three on the right patella. Most of the fractures were displaced. This accounted for 24 patients (75%). Only 25% of the patella fractures were undisplaced.

The compound fractures occurred as a result of gunshot injury ( one), and the others were due to trauma from sharp objects. No compound fracture occurred as a result of RTA. There was no incidence recorded of an osteochondral fracture.

### **Tibial plateau fractures**

There were thirty eight tibial plateau fractures. Eleven of these (28.9%) occurred in females while twenty seven (71.1%) were in males. Most of the fractures were caused by RTA. These were 27 in number (71.1%).

Assault contributed four fractures (10.5%) of which one was due to a gun shot. The other seven (18.4%) were sustained from falls.

Most of the fractures sustained were Schatzker VI. There were seventeen patients contributing 44.7%. This was followed by Schtzker I, 7 ( 18.4%); IV, 6 (15.8%); III, 5 (13.2%); II, 2 ( 5.3%); and Schatzer I had 1 patient contributing 2.6%.

Seventeen of the fractures involved the left leg (44.7%) while the other twenty one involved the right leg.

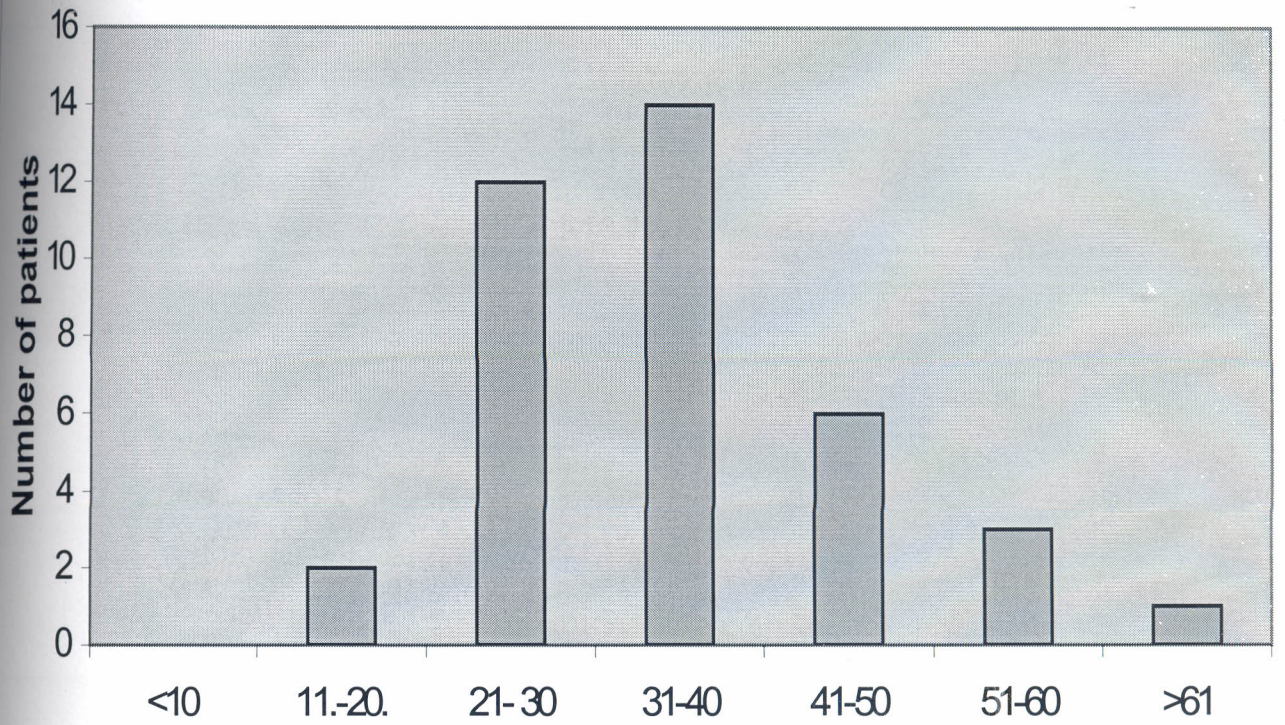
Table 5. Different types of patella fractures sustained.

Fracture Types	Left leg		Right Leg		Total	%
	Open	Closed	Open	Closed		
I	2	3	0	2	7	18.4%
II	0	1	0	1	2	5.3%
III	0	1	2	2	5	13.2%
IV	1	1	0	4	6	15.8%
V	0	0	0	1	1	2.6%
Vi	2	6	1	8	17	44.7%
Total	5	12	3	18	38	100%

In total there were eight compound fractures contributing 21.1% while the rest were closed fractures. Of the eight, five (5) were caused by RTA (62.5%), one was due to gun shot injury and the other two were due to assault.



Figure 7.1 Tibial plateau fractures sustained in the various age groups.



Most of the tibial plateau fractures occurred in the third and fourth decades of life (21 –40 years). Sixty eight point four percent of the fractures were in this population. On the whole, thirty five of the fractures contributing 92.1% occurred in the economically active population between the ages of 21-60 years.

Figure 7.2 Aetiological factors leading to the tibial plateau fractures.

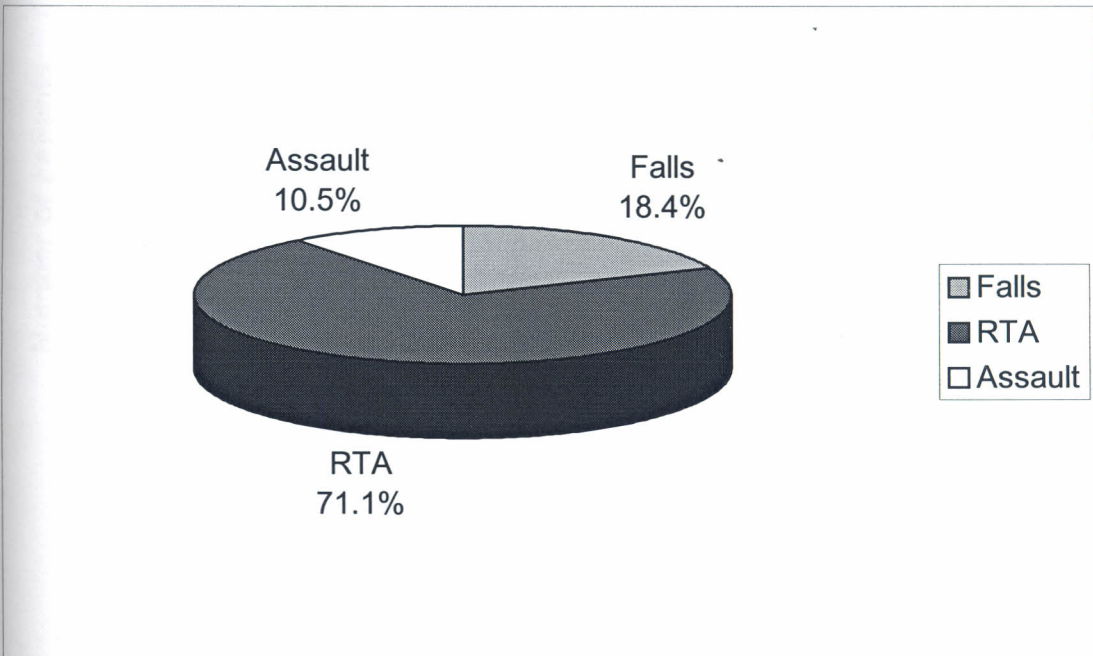
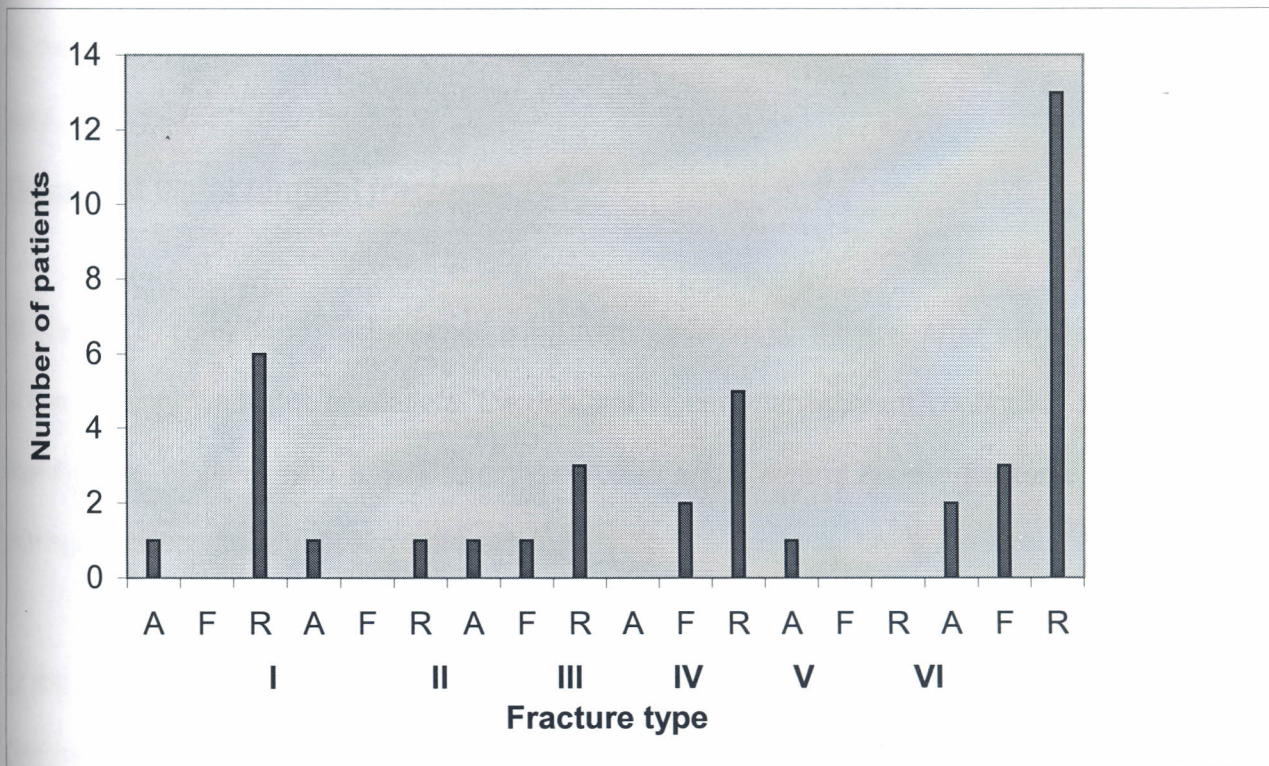


Figure 7.3 Fracture types caused by various aetiologies.



Key:- A- Assault  
 F- Falls  
 R- RTA



## **Management**

All the distal femoral fractures were initially immobilized on a Thomas splint before reaching the ward.

### **Compound distal femoral fractures**

All the six (6) compound fractures had surgical toilet in major theatre. After surgical toilet, four of the patients were put on skeletal traction and wound management continued. After wound healing, one of them with a Schatzker type A had angle plating for the fracture. Three were managed conservatively on skeletal traction.

Of the two patients not put on traction one had a back slab applied to immobilize the fracture. One had compound epiphyseal injury and the fracture was fixed by K-wires.

The other patient had full cast plaster of paris (POP) applied after wound healing. Hence only two patients sustaining compound distal femoral fractures had open reduction and internal fixation (ORIF) of their fractures (33.3%). The rest, (67.7%), had their fractures managed conservatively.



Table 6.1 Summary of the management of the compound distal femoral fractures.

Fracture Type	Surgical toilet	Skeletal tradition	POP	ORIF	Type of ORIF
A	2	2	0	1	Angle plate
B	3	1	2	1	K-wire
C	1	1	0	0	
Total	6	4	2	2	
Percentage Of total	100%	66.7%	33.3%	33.3%	

## Management of closed distal femoral fractures

There were twenty nine distal femoral fractures which were closed. All patients with Schatzker type A had traction applied as the initial management except for a ten year old patient with Salter Harris type I who had K-wire inserted. Of the remaining seven patients, four (50%) were managed on traction alone.

One patient aged 80 years died in this category due to comorbidities. She had a cardiovascular accident secondary to hypertension and diabetes mellitus. For the other three patients I had K wires applied (had epiphyseal injury type I), I had angle plating and the last one had POP after traction. Hence in type A`closed fractures, 3 patients underwent ORIF (37.5%). The rest of the patients 62.5% were management conservatively.

Of the fifteen patients with type B closed fractures, 3 patients (20%) were managed conservatively. One was a 95 years old male who had an old displaced fracture. Manipulation under sedation was attempted and a pop cast was applied.

The second had traction applied but due to comorbidities was discontinued and put on a POP cast. She was 65 years old. The last was a 40 years old whose fracture united in an acceptable alignment on traction. The other twelve patients (80%) had ORIF of whom 7 were initially managed on traction. Five were managed by a dynamic condylar plate, 2 by an angle plate, 2 by cancellous screws alone, 1 by a blade plate,

one by K wires ( epiphyseall injury type 1) and the last by a buttress plate with cancellous screws. The two patients who had ORIF with cancellous screws alone also had PCP cast applied afterwards.

Six patients had closed distal femoral fractures. Only one patient (16.7%) was managed on traction alone and the check x-ray was found to be acceptable. All the other patients (83.3%) had ORIF. One of them had traction applied before ORIF. Two patients had dynamic condylar plates, 2 had blade plates and cancellous screws were put for one patient and POP cast was later applied.

Table 6.2 Summary of the management of the closed distal femoral fractures.

Fracture type	Fraction+ ORIF	Traction alone +/- POP	DCP	Angle plate	Canc. screws	B/plate	K-wire	B/Plate + canc. screws	Total	% of total fracture
A	7	5	0	0	0	1	2	0	8	27.6
B	10	3	5	2	2	1	1	1	15	51.7
C	2	1	2	0	1	2	0	0	6	20.7
Total	19	9	7	2	3	4	3	1	29	100.0
Percentage	65.5	31.0	24.1	6.9	10.3	13.8	10.3	3.4		100.0

Key: Canc. Screws – Cancellous screws, B/plate – Blade plate

On average, 65.5% of patients with distal femoral fractures were put on traction. However, only 31.0% of the patients were managed on traction alone. The other 69% had ORIF done for the fractures. The most common ORIF device used was a DCP which accounted for 24.1% .

## **Management of Patella fractures**

### **Compound patella fractures**

There were seven compound fractures of the patella (21.9%). These fractures were cleaned and dressed in casualty and then they were splinted. Surgical toilet was later done in the major theatre. One patient, twenty eight years of age, who had been assaulted died after 5 days of admission due to other associated injuries. Surgical toilet for the wound had been done and a back slab applied for the fracture femur.

All the other patients had their fractures fixed by tension band wiring (TBW) during surgical toilet except in two patients, one of whom underwent delayed TBW after 5 days. This fracture had been caused by a gun shot injury. The other patient was managed conservatively on POP cast. She had compound undisplaced transverse patella fracture.

### **Closed Patella fractures**

There were 25 patients with closed patella fractures (78.1). Twenty one of these patients, (84%), underwent TBW for their fractures. The other patients (16%) were managed conservatively with POP cast. Three of these patients had marginal fractures and the other patient had comminuted undisplaced patella fracture secondary to assault.



Table 6.3 Summary of the management of the compound patella fractures.

Fracture type	Management		
	Surgical toilet	POP	TBW
Transverse – displaced	2	0	2
- undisplaced	1	1	0
Comminuted – displaced	3	1	2
- undisplaced	1	0	1
Total	7	2	5
Percentage	100%	28.6%	71.4%

Table 6.4 Summary of the management of the closed patella fractures

		MANAGEMENT	
Fracture type		POP	TBW
Transverse	- displaced	0	11
	- undisplaced	0	2
Vertical	-Displaced	0	0
	-undisplaced	0	2
Comminuted	-Displaced	0	4
	- undisplaced	1	1
Marginal	-displaced	3	1
	-Undisplaced	0	0
Total		4	21
%		16%	84%

## **Tibial plateau Fractures**

### **Compound tibial plateau fractures**

Of the thirty-eight tibial plateau fractures sampled, eight of them were compound fractures. Initial management included dressing in the casualty department. On admission, all of them were taken to theatre for surgical toilet. One patient who had Schatzker VI compound fracture due to a gun shot injury had an external fixator put during the initial surgical toilet. The other patients were put on back slabs.

Three patients were later put on external fixators. Hence of the compound fractures of tibial plateau, 4 of them (50%) had external fixation. The other fifty percent were put on POP. None underwent an ORIF procedure.

**Table 6.5 Summary of the management of compound tibial plateau fractures.**

Fracture type	MANAGEMENT			
	Surgical toilet	POP	External fixation	Total patients
I	2	2	0	2
II	0	0	0	0
III	2	1	1	2
IV	1	0	1	1
V	0	0	0	0
VI	3	1	2	3
Total	8	4	4	8
%	100%	50%	50%	100%



## Management of closed tibial fractures

Thirty patients had closed tibial plateau fractures (78.9%). These patients were initially managed from the casualty department by immobilization using Braun's splints. Thirteen of these patients were managed conservatively (43.3%). The rest were managed by ORIF.

Of these patients managed conservatively two had extensive compound comminuted fractures involving the ipsilateral tibia and fibula . One patient declined to have ORIF done. The other patients either had comminuted or their fractures were not severely comminuted.

Most of the operative procedures were done using cancellous screws. These amounted to ten patients (33.3%), two of whom had in addition a blade plate fixed

Table 6.6 Summary of the management of closed fractures of the tibial plateau.

Fracture Type	MANAGEMENT					Total
	POP	Cancellous Screws	Buttress Plate	Blade plate	Blade plate plus Cancellous screws	
I	3	2	0	0	0	5
II	0	2	0	0	0	2
III	3	0	0	0	0	3
IV	2	2	1	0	0	5
V	1	0	0	0	0	1
VI	4	2	5	1	2	14
TOTAL	13	8	6	1	2	30
%	43.3%	26.7%	20.0%	3.3%	6.7%	100.0

## **ASSOCIATED INJURIES.**

Of the thirty five distal femoral fractures, nine were due to assault (25.7%). Only one patient in this category did not have an associated injury (11.1%). The others had head injuries in three patients (33.3%), upper limb fractures in two patients and one had soft tissue injuries. One patient had tibia and fibula fractures and one had torn ligaments. Only one patient had more than two associated injuries. Four out of sixteen patients who had distal femoral fractures due to RTA had no associated injuries (25%).

Four of the patients had associated femoral fractures, four had head injuries, four had fractures of the upper limbs, three had tibia and fibula fractures with associated fractured pelvis and neurovascular injury in one patient. In all, ten patients (62.5%) had more than two associated injuries.

All the patients who sustained injuries secondary to a fall had no associated injuries. Of the 32 patella fractures, twenty were due to assault (62.5%). Out of the twenty, eleven patients (55.0%) had no associated injuries. Three patients had only one associated injury. These had soft tissue injuries and head injury in two patients respectively.

The other six patients had multiple injuries. These included femoral fractures, upper limb fractures and tibia and fibula fractures. In total, all patients who had head injuries associated with patella fractures due to assault were six (30%).

Four patients had fractured patella due to RTA. One patient had no associated injury (25%). One had one associated injury (25%) -tibia and fibula fractures. The other two patients (50%) had multiple injuries. These were tibia and fibula fractures, head injury and fracture femur. Of the eight patients who sustained patella fractures due to falls seven had no associated injuries (87.5%). The remaining patients had soft tissue injuries (12.5%).

Four patients had tibial plateau fractures due to assault. One patient had no other associated injuries (25%), one had one associated injury (25%) which was a fractured femur. The other two patients had more than two injuries. These were fractured femur and head injuries.

Twenty seven patients sustained tibial plateau fracture as a result of RTA. Five patients had no associated injuries (17.2%). Twenty patients had one associated injury (75%). These were six head injuries, four soft tissue injuries, four fracture femur, six fracture tibia and fibula and one each had fracture tibia and fracture pelvis.

Two patients had multiple injuries. These were fracture femur associated with fractures of the upper limbs and head injuries (7.4%). Seven patients sustained tibial plateau fractures secondary to falls. All had no associated injuries.

Table 7 Associated injuries.

	Distal Femoral Fractures			Patella Fractures			Tibial Plateau Fractures			Total
	No Injury	1 injury	>1 injury	No injury	1 injury	>1 Injury	No injury	1 Injury	>1 Injury	
Assault	1	7	1	11	3	6	1	1	2	33
RTA	4	2	10	1	1	2	5	20	2	47
Falls	10	0	0	7	1	0	7	0	0	25
Total	15	9	11	19	5	8	13	21	4	105
%	14.3	8.6	10.5	18.1	4.8	7.6	12.4	20.0	3.8	100%

### **Anatomical reduction achieved**

Thirteen patients with distal femoral fractures were managed conservatively. The other twenty two patients had ORIF done for their fractures. Two patients managed conservatively died. One of the patients died of septicaemia due to compound fracture. He was also diabetic. The other patient had cormobidities and developed a cerebrovascular accident.

Only one patient had good anatomical reduction on conservative management. Eight patients had acceptable reduction and two patients had poor reduction. These were not operated on due to cormorbidites. Of the twenty two patients who had ORIF done, sixteen patients (72.7%)



had good anatomical reduction achieved. Five patients (22.7%) had acceptable reduction achieved. One patient had poor reduction and ORIF was repeated and reduction became acceptable.

Table 8.1 Reduction achieved in patients with distal femoral fractures.

	ORIF		CONSERVATIVE MANAGEMENT		TOTAL	
	number	%	Number	%	Number	%
Anatomical reduction						
Good	16	72.7	1	7.7	17	48.6
Acceptable	5	22.7	8	61.5	13	37.1
Poor	1	4.6	4	30.8	5	14.3
Total	22	100.0	13	100.0	35	100.0

Thirty two patients had patella fractures. Six patients were managed conservatively on POP. The other twenty six patients had TBW done. Of the patients managed conservatively, one patient who had compound patella fracture and other associated injuries died due to head injury. The other five patients had good anatomical reduction. Twenty-four patients done ORIF had good anatomical reduction.

Table. 8.2. Gives a summary of the anatomical reduction achieved

Anatomical reduction	ORIF		CONSERVATIVE MANAGEMENT		TOTAL	
	Number	%	Number	%	Number	%
Good	24	92.3	5	83.3	29	90.6
Acceptable	2	7.7	0	0.0	2	6.3
Poor	0	0.0	1	16.7	1	3.1
Total	26	100.0	6	100.0	32	100.0

Seventeen patients out of thirty eight with tibial plateau fractures were managed conservatively with POP. The other twenty one had ORIF done of whom four had external fixation. All patients who had external fixation had acceptable reduction. Eight patients had good anatomical reduction after ORIF and the other nine had acceptable reduction.

Of the patients managed conservatively, four had good anatomical reduction, eleven had acceptable reduction and two had poor anatomical reduction. One patient with poor anatomical reduction declined to have ORIF. The other patient had compound fracture with sepsis. No patient with tibial plateau fracture died.

Table 8.3 gives a summary of the anatomical reduction achieved in tibial plateau fractures.

Anatomical reduction	ORIF		CONSERVATIVE MANAGEMENT		TOTAL	
	Number	%	Number	%	Number	%
Good	8	38.1	4	23.5	12	31.5
Acceptable	13	61.9	11	64.7	24	63.2
Poor	0	0.0	2	11.8	2	5.3
Total	21	100.0	17	100.0	38	100.0

Table 8.4 gives a summary of the anatomical reduction achieved in all the fractures.

Anatomical reduction	Distal femoral fractures	Patella	Tibial Plateau	Total	%
Good	17	29	12	58	55.2
Acceptable	13	2	24	39	37.1
Poor	5	1	2	8	7.7
Total	35	32	38	105	100.0%

## DISCUSSION

Intra-articular fractures of the knee affects the younger population. It may also occur in the elderly due to osteoporotic bones. In this study the age ranged from six years to ninety five years with a mean age of 36.1 years.

The mean age for fracture of the distal intra articular femur is 39.3 years, for patella it is 34.1 years and 46.6 years for the tibial plateau fractures. This concurs with Museve's result [1] which showed a mean age of 36.8 years for the patella and 39 years for the tibial plateau fractures. *This is the economically active population and hence the economical burden to the society is high.*

More males sustain intra articular fractures of the knee than females with a male to female ratio of 4:1. This could be due to men taking more risky jobs like in building and construction industry and also travelling more. Men are also at a higher risk of being assaulted than are females.

Seventy four patients were in gainful employment (73.3%). This contrasts a study done by Oduor P.O. [38] who showed that only 39% of the population was in gainful employment. Road traffic accidents was the highest cause of intra articular fractures of the knee. This accounted for 44.6%. This was followed by assault (28.7%) and falls (25.7%). Only 1% had sports associated injury.

Pedestrians contributed 53.3% of patients involved in RTA. RTA caused 42.8% of the distal femoral fractures, 12.5% of patella fractures and 71.1% of the tibial plateau fractures. 62.5% of patella fractures were caused by assault.



This contrasts to Museve [1] who showed that most patella fractures were sustained from falls, RTA's and assault in descending order. For the distal femoral fractures, this study agrees with Oduor P.O (38) who showed that RTA contributed 42% of the fractures.

In this study only 1% of the injuries was related to sports unlike in western countries where sports related injuries are higher [5,7]. This could be due to limited sporting activities in our setup. We also have limited sports variety.

A significant finding in this study is the high number of patients sustaining injuries as a result of assault. This was 28.7% of the study population and contributed 62.5% of the patella fractures.

Carpenter J.E et al [5] showed that most patella fractures occurs as a result of falls and road traffic accidents.

The distribution of the knee fractures was almost uniform in the distal femur, patella and proximal tibia with a preponderance for the tibial plateau fractures (36.2%). Distal femoral fractures were 33.3% and patella fractures were 30.5%. This contrasts with Museve's study which had shown patella fractures to be more common at 68.3%, tibial plateau fractures at 25% and distal femoral fractures at 1%.

In patients sustaining distal femoral fractures 77.1% were between the ages of 21-60 years (economically productive age group). Seventeen point one percent were elderly patients above the age of 60 years. This could be due to the older population suffering from osteoporosis. Most of these fractures are caused by minor trauma like falling while walking [6,21,38] which is depicted in this study.

This agrees with various authors who have shown a higher incidence of these fractures in the elderly and multiply injured patients [19,21,22]. All type C fractures of the distal femur occurred

in patients between the ages of 20-40 years and most of these were as a result of road traffic accidents. Hence a significant force is required to produce these fractures.

Fracture type A was evenly distributed while fracture type B mostly occurred in the middle age group and above. All patella fractures occurred between 16-50 years of age and 75% of them were between 21-40 years. Majority of them (90.0%) being males. This indicates that young population is more prone to assaults as this was the leading cause of these fractures.

Majority of the fractures were transverse (50%) in contrast to a study done earlier which had shown transverse fractures to be 81.6% [1]. Comminuted fractures also had a higher proportion (31.2%), suggesting the mechanism of injury to be severe trauma [5]. Patients who had compound fractures of patella were 20.6% which is also an indicator of more severe trauma. There was no incidence of osteochondral fracture. Though rare, osteochondral fractures are also hard to diagnose by plain radiography. This may lead to some of these fractures being missed [7,8].

Tibial plateau fractures are caused by high energy trauma. In this study 71.1% of the fractures were caused by RTA and 1% by gun shot injuries. 21.1% of these fractures were compound. All these factors suggest the mechanism of injury to be high energy trauma. Majority of the patients (44.7%) had Schatzker IV fractures and most of these were caused by RTAs. Most of these fractures also occurred in young patients between 21-40 years (68.4%). Studies done elsewhere agrees with these findings [1,14,15].

All patients with compound fractures had surgical toilet done in major theatres.

In patients who had distal femoral fractures which were compound, ORIF was done in only 33.3%, the rest were managed conservatively. In type A closed fractures 37.5% had ORIF while in type B, 80% had ORIF and 83.3% in type C had ORIF.

Hence most patients in Type B and C had surgical intervention. The most commonly used ORIF device was DCP (24.1%). Blade plates were used in 17.2% of patients. Buttress plate was used in 13.8% of patients.

The ideal ORIF device in intra articular fracture is contentious. Healy and Broker [27] recommended DCP while Mize [25] recommended blade plates unless there is articular comminution where he recommended a buttress plate. Other authors have used cancellous lag screws or a T-buttress plate in osteoporotic bones [6,21]. Ziran et al [12] and Jazrawi et al [7] have used double plate fixation. No external fixation was used as recommended by other authors in compound fracture [17,24,30] of the distal femur.

Tension band wiring was done in 71.4% of patients who had compound patella fractures while it was done in 84% of those with closed fractures.

Only four patients (12.5%) with displaced patella fractures were managed conservatively one of whom died and the other three had marginal displaced fractures. Two patients with undisplaced fractures (6.3%) were managed conservatively. All the other patients (81.5%) had TBW done.



Displaced patella fracture should be treated by operative management [7,10]. In a local study done, 27 of 71 patella fractures were treated conservatively [1] with only about 50% undergoing operative management.

This suggests that more proactive patient management has been undertaken in this institution compared to earlier years. There were no cases of patellectomies done. Of the patients who had compound tibial plateau fractures, 50% had external fixation done and the rest were managed conservatively.

For those with closed tibial plateau fractures, 56.7% had ORIF done. ORIF devices most commonly used were cancellour screws and buttress plates. As for the distal femoral fractures, external fixation of open fractures is recommended to give access to the wound for dressing [24,30]. Due to the cost of the external fixators, some of the patients cannot afford to buy the device and hence management is sub optimal in our setup.

To reconstruct the proximal tibial articular surface, operative management is advocated by many authors especially if the depression is significant (more than 5mm) [17,19,20]. With lesser depressions, conservative management can suffice. Rasmussen et al [15] advocated operative management depending on the varus or valgus deformity of more than  $10^0$  and not due to depression of the fractured fragment.

Associated injuries were more common in patients who had sustained fractures from assault and road traffic accidents (60.6% and 78.7%) respectively. Of the assaulted patients 27.3% had multiple injuries and about 20% of patients involved in road traffic accident had multiple injuries. Most of the injuries sustained were *soft tissue injuries, head injuries, and fracture of the upper and lower limbs.*



Though most of the associated injuries were minor, assault is emerging as one of the major causes of injuries in our set up and this is mostly directed to the young population.

This accounted for 92.4%. For the patients who had poor outcomes 3 died, 1 refused an operation, 1 had re-operation, 2 had cormorbidities and 1 patient had severe sepsis of the compound fracture. The best anatomical reductions were achieved in the patella where there were 29 out of 32 (90.6%) good reductions and worst in the tibial plateau fractures where only 12 out of 38 ( 31.6%) had good results.

In the local study done earlier 3.7% of patients with patella fractures treated conservatively had acceptable results. For those who had internal fixation 8.3% had acceptable results.

Bostron [10] showed patients treated conservatively having the best results but only if the displacement was less than 3-4mm

Many studies reports various degrees of success in both conservative and operative treatment [25,27]. However most agree that surgically treated intra articular fractures of the knee gives *good or excellent results ranging between 50-96% for the distal femur.*(16,18,19,21,31,32,33,34)

## **CONCLUSIONS.**

The following conclusion can be deduced from this study.

Most of the intra articular fractures of the knee occurs in people in their most productive years economically with 84.2% between the ages 21-60 years. 73.3% of the study population are in gainful employment.

More males are affected as compared to females with a male to female ratio of 4:1

Though RTA accounts for majority of the aetiological factors for these fractures (44.6%), patella fractures are commonly due to assault. 62.5% of patella fractures were caused by assault. Therefore assault is increasingly becoming a major cause of injuries in our society.

Pedestrians are more likely to suffer knee fractures as compared to other road users. They comprised 53.3% of patients sustaining fractures as a result of RTA.

The most commonly fractured bone is the tibial plateau which comprised 36.2% and type VI is the most common. Transverse patella fractures are the commonest patella fractures accounting 50%. Distal femoral fractures type A commonly occur in older people while type C occurs in younger people.

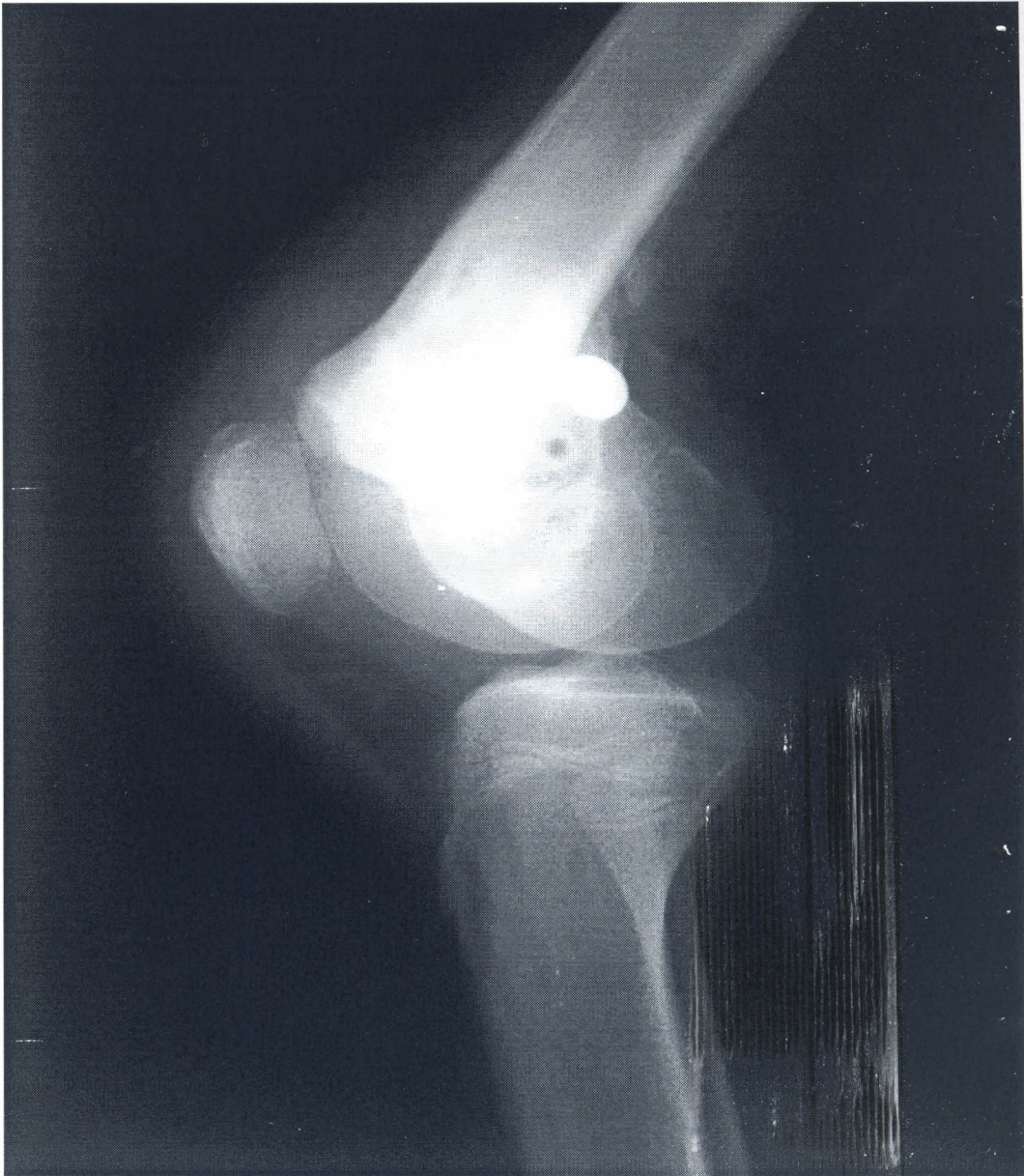
Fractures caused by RTA and assault are more likely to have other associate injuries.

## RECOMMENDATIONS

1. Measures to curb road carnage especially education to the public should be instituted to reduce RTA.
2. Crime prevention to reduce cases of assault. This should include education and measures to curb the high rate of unemployment. Creation of more employment opportunities in the society.
3. Operative treatment is indicated in most of the intra articular fractures of the knee to achieve good anatomical reduction. This will reduce the hospital stay and reduce the economic burden associated with prolonged hospital stay.
4. A study to assess the :-
  - (i) Long term clinical outcome of patients with intra articular fractures of the knee.
  - (ii) Most appropriate device to use in each of the fractures is highly recommended.



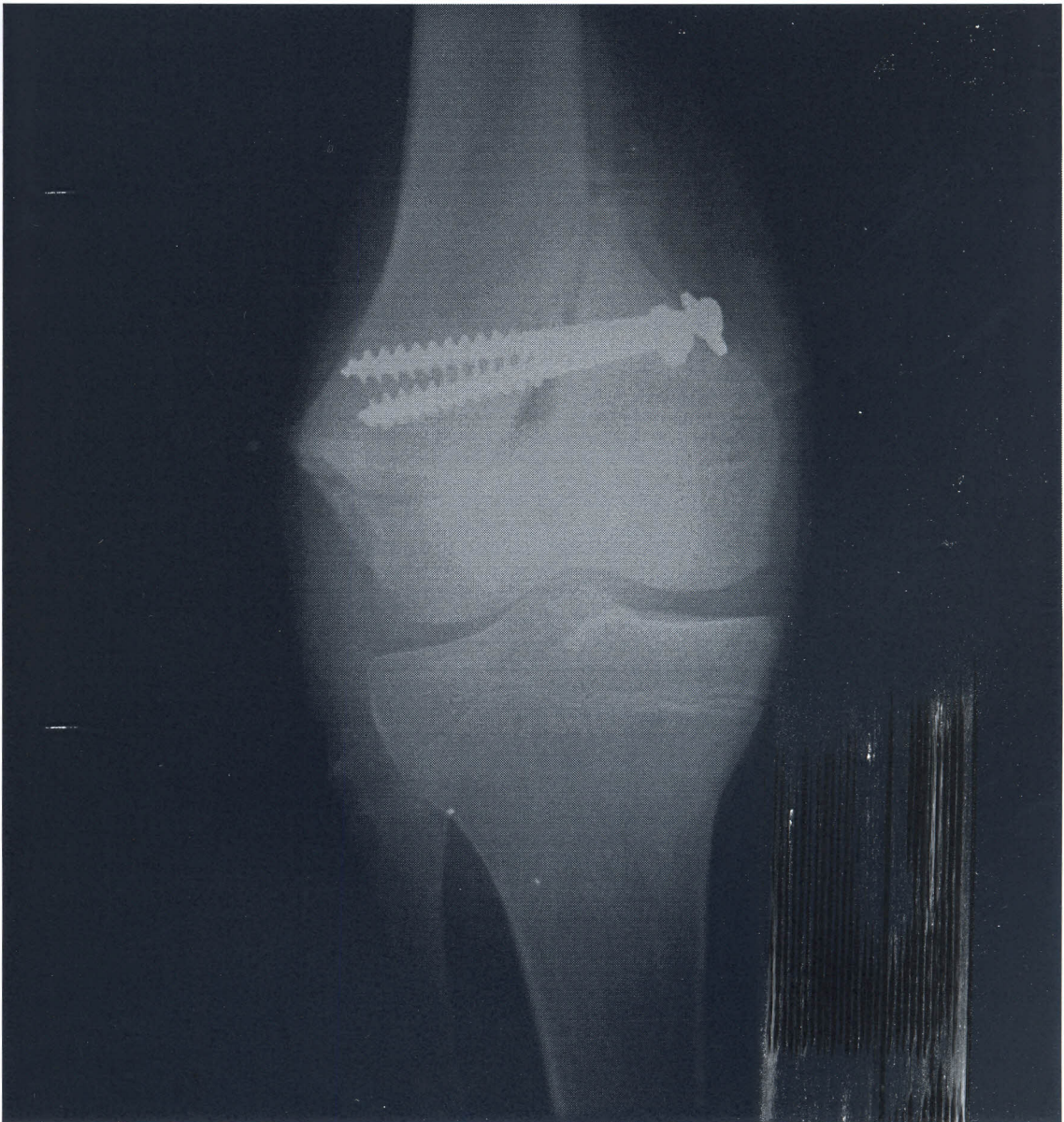
**X-ray film 1A**



**Lateral view of femoral condylar fracture schatzker type B managed by two cancellous screws.**



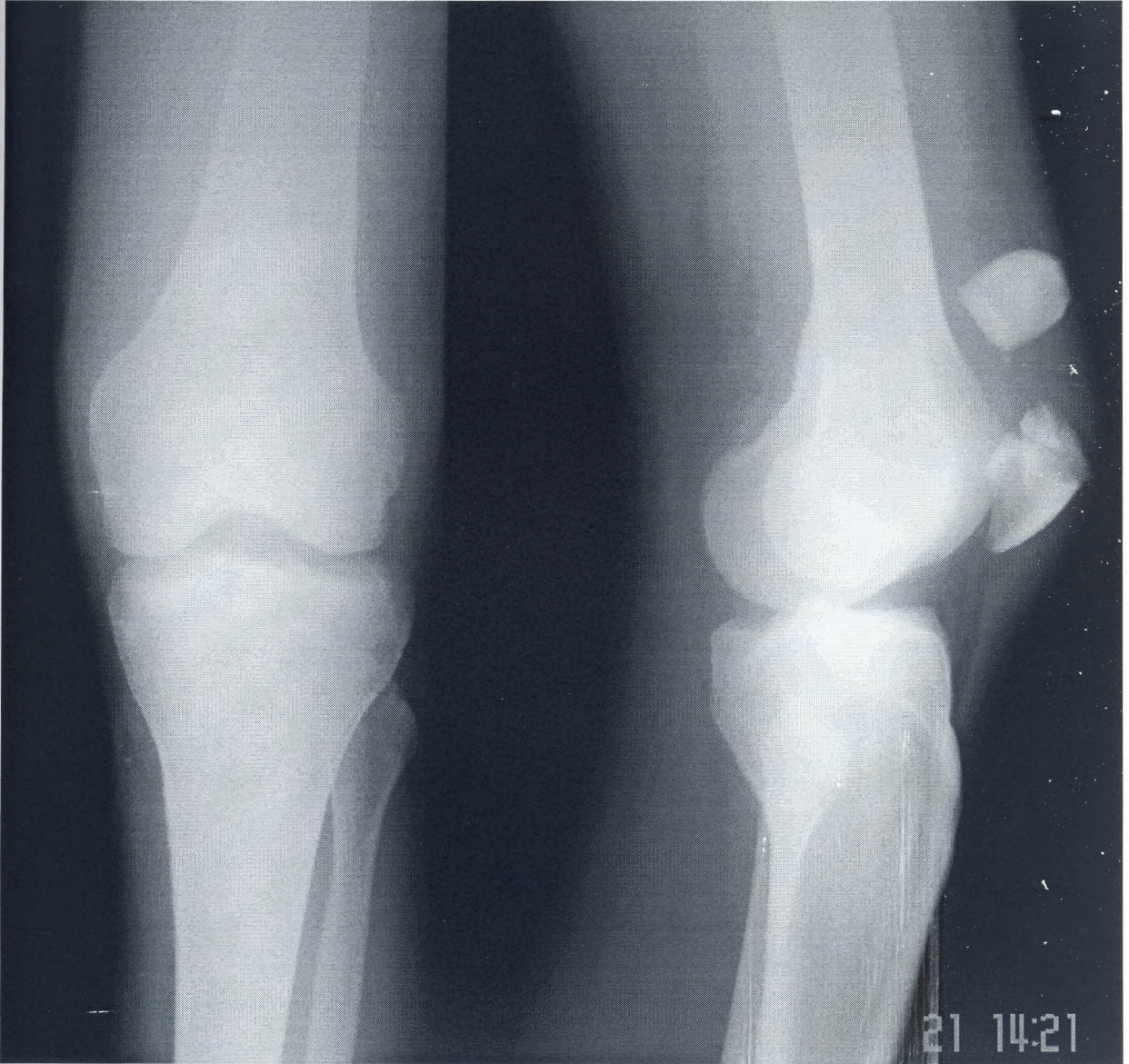
**X-ray film 1B**



**Antero-posterior( AP) view of femoral condylar fracture schatzker type B managed by two cancellous screws. Anatomical reduction is not perfect but acceptable.**

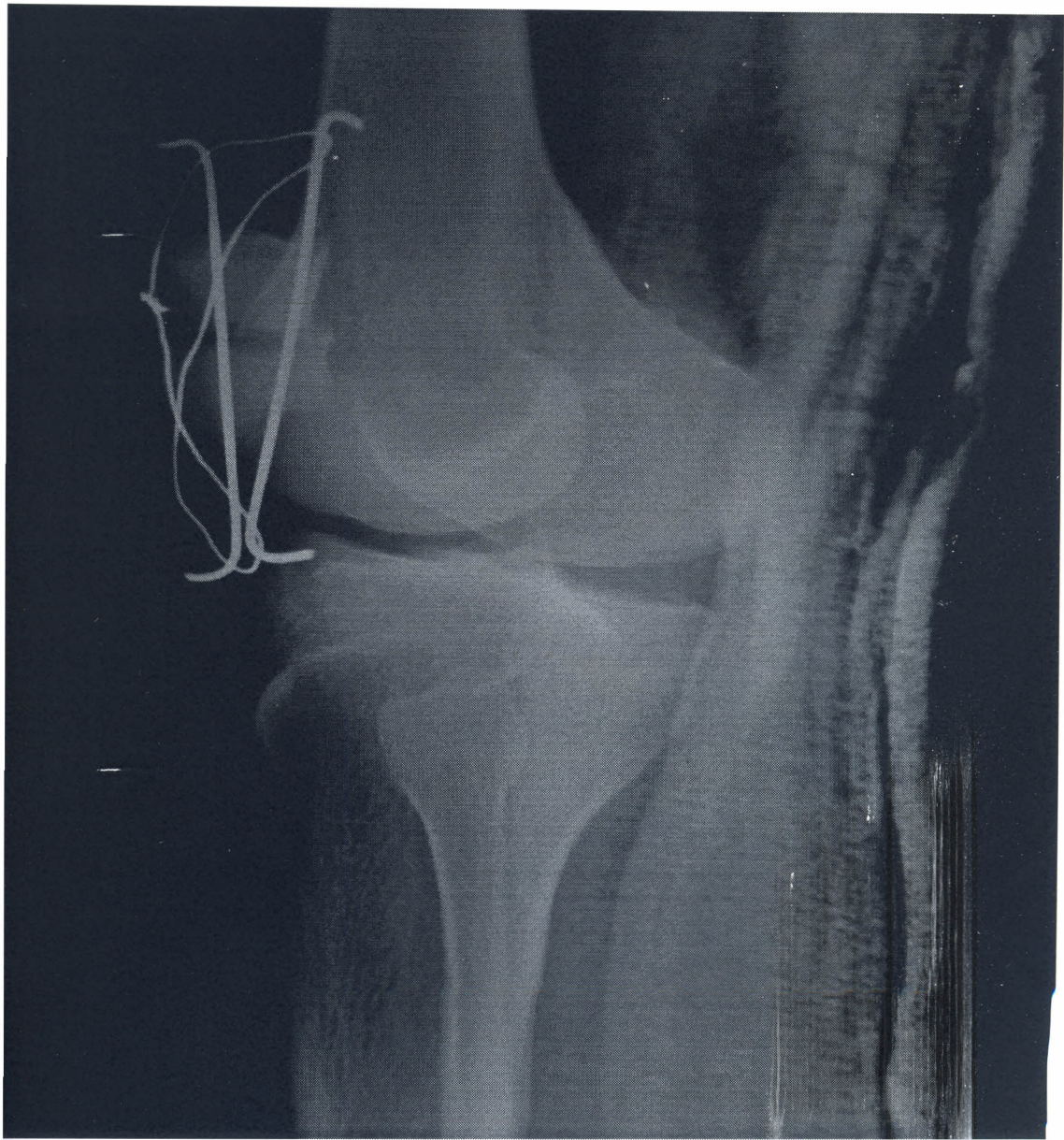


**X-ray film 2A**



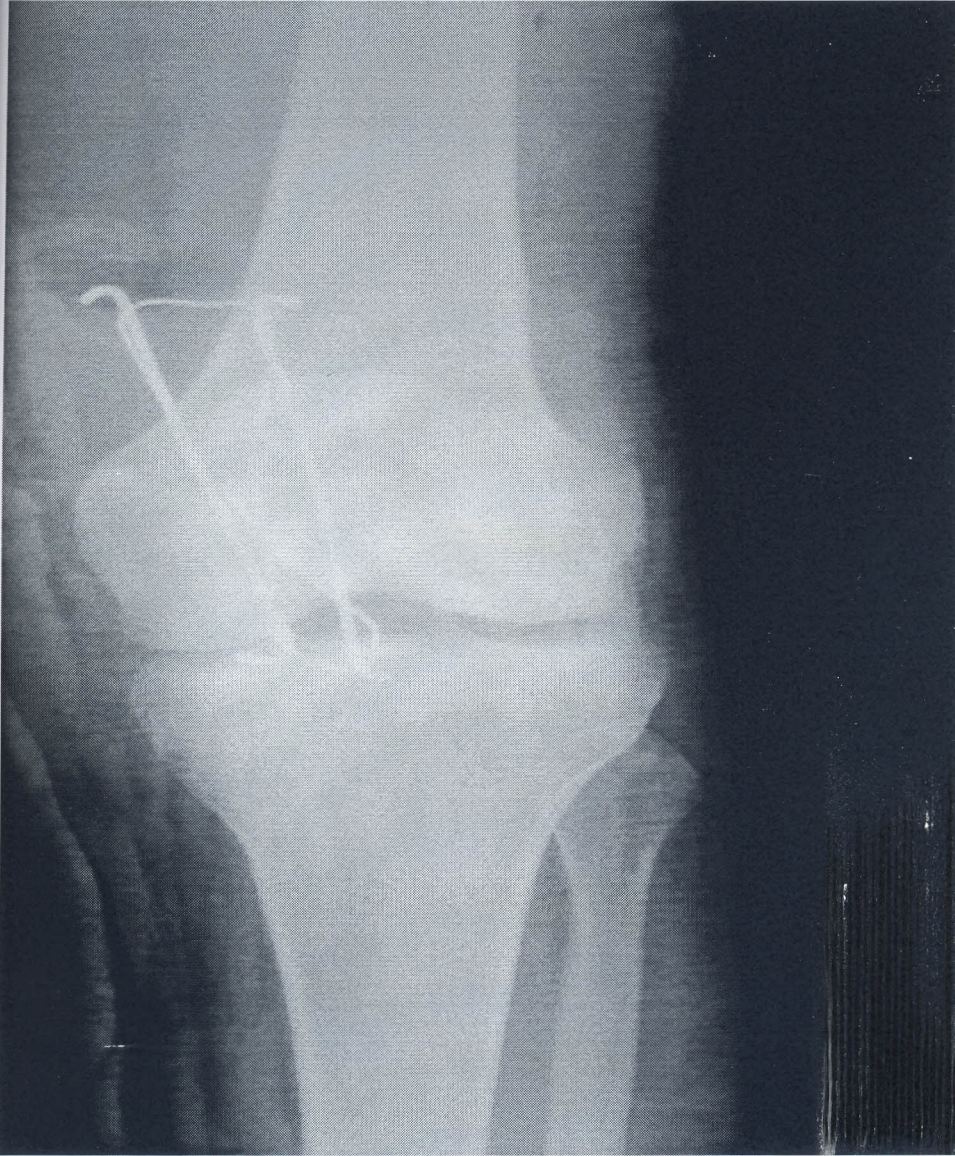
**These are AP and lateral views of a transverse displaced fracture of the patella sustained after assault.**





**This is a lateral view of a displaced transverse patella fracture fixed by TBW.  
Anatomical reduction not perfect but acceptable result achieved**

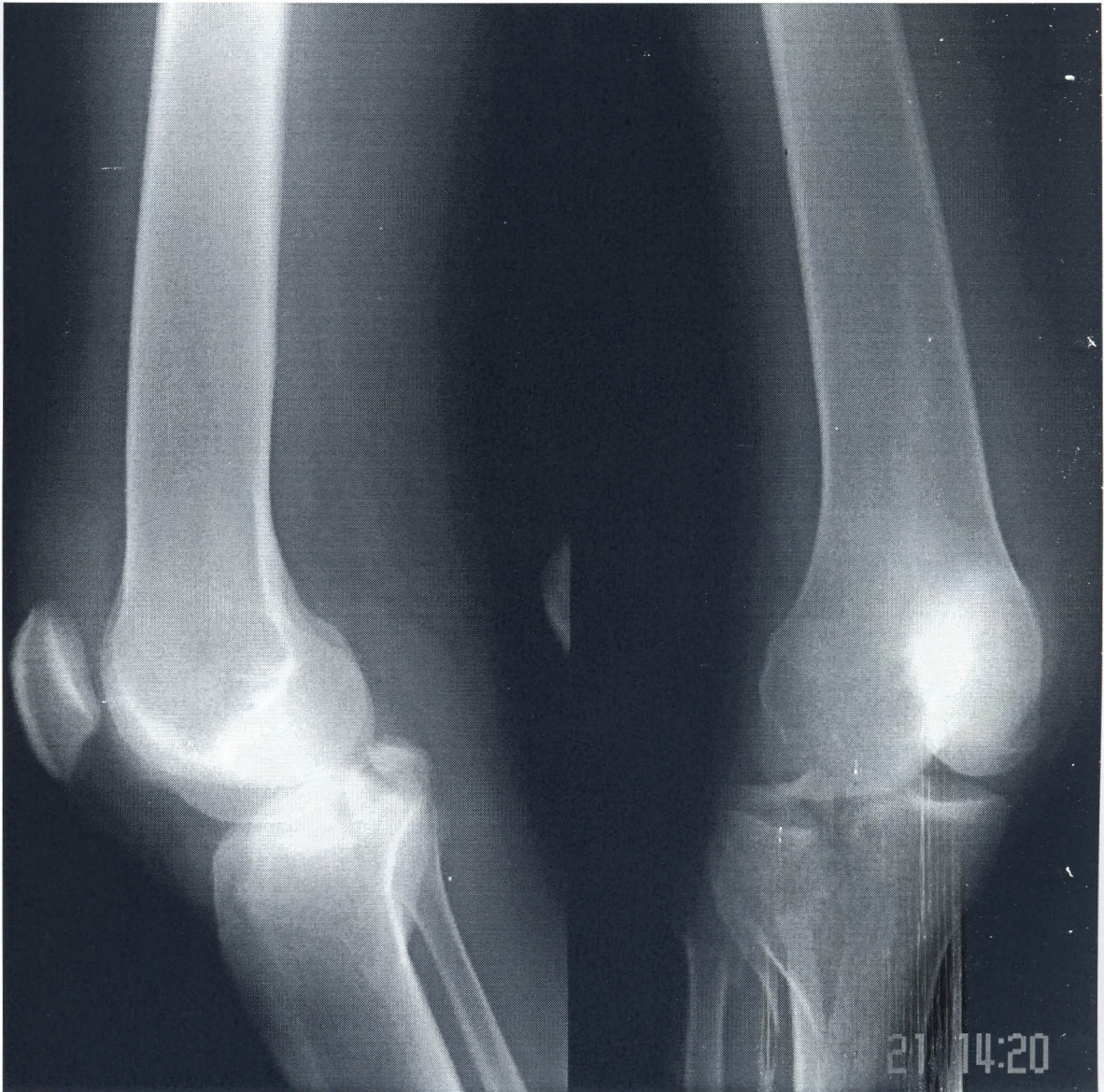




**AP view of a displaced transverse patella fracture fixed by TBW.**



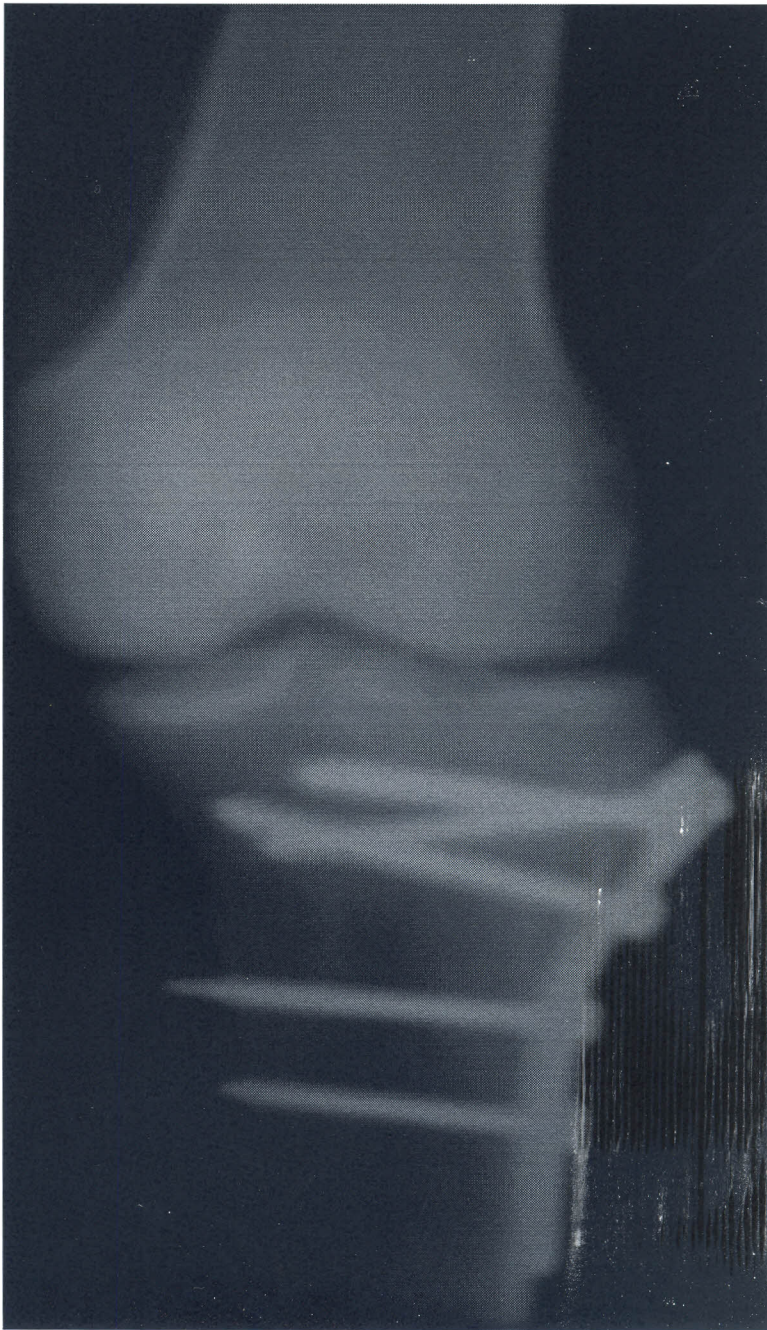
**X-ray 3A**



**Lateral and AP view of a tibial plateau fracture- Schatzker type II**

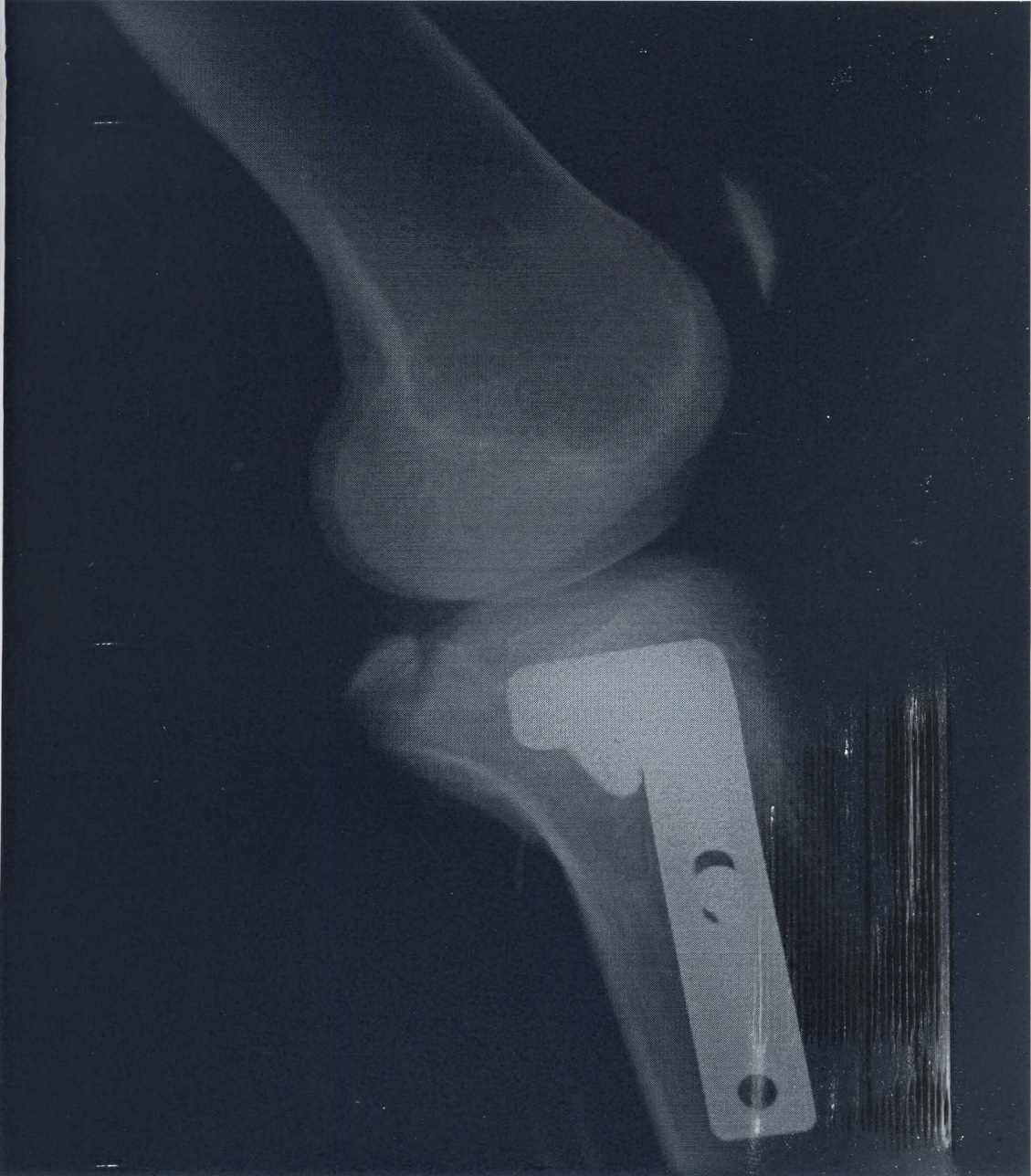


**X-ray 3B**



**AP view of a tibial plateau fracture- Schatzker type II managed by condylar plate with screws.**

**X-ray 3C**



**Lateral view of a tibial plateau fracture- Schatzker type II managed by a condylar plate with screws.**



## REFERENCES

1. Museve G.K. A study of knee injuries at Kenyatta National Hospital over a 5 year period ( June 1985 – May 1990).
2. Campbells operative orthopaedic Vol 3. 9 Ed Chapter 47 pp 1454-70
3. .Appley's system of orthopaedic and fractures. Eighth Edition. 2001.pp 701-724.
4. Bailey and Love's Short practice of surgery 23<sup>rd</sup> Edition. 2000 .pp 383 –386.
5. Carpenter J.E; Arbor A; Kasman R; Fractures of the patella . Journal of Bone and Joint Surg.Am 1993 75 (10) 1550 – 60.
6. Stover M; Distal femoral fractures. Current treatment results and problems . J . Injury 2001 Dec (32) Sc – 3 – 13.
7. Jazrawi LM ; Kummer K.J; Simon J.A; et al al ;. New technique of unstable distal femoral fracture by locked double plating . J trauma 2000 Jan 48 (1) 87 – 90.
8. Hee H.T; Tan B.P; Wong H.P; surgical results of intercondylar fractures of the adult femur. J. Injury 2003 (34) 135 – 140.
9. Ahlback S; Rydberg J; X-ray classification and examination technique in gonarthrosis 1980, (77), 2091 – 2093.
10. Bostron A, Fractures of the patella . A study of 422 patella fractures acta orthop scand suppl:1996, (4), 1576-84.



11. Haxton H.A ; The function of the patella and the effects of its excision . Surg. Gynaecol and obstet 1945 (80): 359-370.
12. Kauffer H; Mechanical function of the patella . Journal of bone and joint surgery. 1975 (53A) 1551 – 71.
13. Kreggor P.J; Stannard J; Zlowodzki M; et al ; Distal femoral fractures fixation utilizing the less invasive stabilization technique and early results. J Injury 2001, (32 suppl 3) sc 32 – sc 47.
14. Prokop A ; Fischbach R; Burger C; et al ; . Diagnosis of intra articular fractures of the head of tibia . A prospective comparative study. Unfall chirug 2001 Feb 1 04 (2) 131 – 7.
15. Rasmussen P.S ; . Tibial condylar fractures – impairment of knee joint stability as an indication for surgical treatment. Journal of Bone and Joint surgery: 1973 vol 559( A7) 1331 – 50.
16. Schatzker J; Lambert D.C; . Supracondylar fractures of the femur Clin Orthop 1979 (138) 77 – 83.
17. Deszczynski J; Szczensay A; Karpinski J; Use of Dynastab K. (knee) external fixator technique for functional treatment of intra and periarticular fractures of the knee joint. Chir Nazadao. Ruchu Ortop Pol 2000. 64 (4) 409-15.

- 18 Siliski J.M; Mahring M; Hofer P; Supracondylar-intercondylar fractures of femur. Treatment by internal fixation .Journal of Bone and Joint surgery: Jan 1989 Vol. 71 – (1) 95 – 104 .
- 19 Vanquero J; Vidal C; Cubillo A; Intra- articular traumatic disorders of the knees in children and adolescents. Clin orthop and relat. Research 2005 Mar (432) 97- 106.
20. Hohl Mason ; Tibial condylar fractures. Journal of Bone and Joint.. Surgery Vol Oct 1967 49 A (7) 1455 – 17.
- 21 Maarten V.R; Gino M.N; Inger N.S; et al Intra articular fractures of distal femur. A long term follow up of surgically treated patients. J. orthop trauma 2004: (18): 213 – 219.
- 22 Sferopoulous N.K;. Concomitant physeal fractures of distal femur and proximal tibia. Skeletal radiol. 2005 Feb. (16) 415-22.
23. Muller M.E; Allgower M; Wellington H;. Technique of internal fixation of fractures. Segmuller G ed. Springer 1965.
- 24 Huston J.J; ,Zych G.A ; Treatment of comminuted intra articular fractures with limited internal and external tensioned wire fixation . J. orthop Trauma 2000;(14):405 – 413.
- 25 Mize R.D; Buchlz R.W; Grogan D.P ; Surgical treatment of displaced comminuted fractures of the distal end of the femur. An extensive approach . Journal of Bone and Joint:July 1982 (Surgery Vol. 64 – A) 6871 – 79.

## **CONSENT INFORMATION**

My name is Dr. Njoroge Joseph K. Silas. I am doing my Master degree in surgery. As part of the course, I am conducting a study on the pattern and management of fractures around the knee joint.

This mostly will entail the demographic data and the management instituted to treat these fractures in this institution. The purpose of the study is to analyze by age, the common fractures around the knee and the management options offered at Kenyatta National Hospital.

I will also assess the joint function after treatment to analyze the effectiveness of the treatment.

The study has been vetted by the Research and Ethical Committee of Kenyatta National Hospital and passed.

Participation in the study is purely voluntary and will in no way affect the treatment offered to the patient. Data collected will be used solely for the disclosed purpose and patients identity will not be disclosed.

For further information please contact me on mobile number 0722-895642.

Thank you in advance.



**INFORMED CONSENT**

**A STUDY OF THE PATTERN AND MANAGEMENT OF INTRA-ARTICULAR FRACTURES OF THE KNEE AS SEEN IN KENYATTA NATIONAL HOSPITAL.**

I ..... (subject name) having full capacity to consent for myself/my child have ascertained to participate in the research study mentioned above.

I have the full knowledge that the investigator namely **NJOROGE J.K. SILAS** is conducting a study on the pattern and management of intra articular fractures of the knee at Kenyatta National Hospital.

I voluntarily agree to participate in the study. Participation or lack of participation will in no way interfere with my treatment.

I have also been informed that all the information obtained will be treated with utmost confidentiality. If I decide to withdraw from the study, this will in no way affect my treatment.

**SUBJECT'S NAME.....**

**SUBJECT'S SIGN.....**

**CODE NUMBER.....**

**DATE.....**

**WITNESS.....**

# QUESTIONNAIRE

Serial NO.....

## 1. Patients Details.

Name..... IP

No.....

Age..... Sex..... DOA.....

## 2. Occupation.

Unemployed.....

Employed: -

Casual.....

Manual: - Skilled..... Unskilled.....

Self-employed:- Skilled..... Unskilled.....

Others (specify) .....

## 3. Cause of injury.

(a) RTA – Passenger..... Pedestrian .....

Cyclist ..... Motorcyclist .....

Others (specify).....

(b) Assault – Gunshot..... Blunt .....

Sharp..... Others (specify).....

(c) Falls - building..... Walking/running .....

Tree..... Others(specify).....

(d) Sports - Athletics..... Soccer.....

Rugby.....Others (specify).....

#### 4. Fractures sustained

	TYPE	LEFT LEG		RIGHT LEG	
		Open	closed	open	closed
<b>a) Distal femur</b>	A				
	B				
	C				
<b>b) Patella</b>	(i) Transverse- displaced - undisplaced				
	(ii) Vertical – displaced - undisplaced				
	(iii) comminuted- displaced -undiplaced				
	(iv) Osteochondral				
	(v) Marginal				
<b>c) Proximal tibia</b>	I				
	II				
	III				
	IV				
	V				
	VI				
<b>5 Management</b>					
	- Skeletal/skin traction				
	- Cast bracing				
	<b><u>ORIF device</u></b>				
	- Cancellous screws				
	- External fixation				
	- Buttress plate				
	- Blade plate				
	- Dynamic condylar plate				
	- T B W				
	- Partial patellectomy				
- Total patellectomy					
- Others (specify)					

#### 6. Other Associated injuries



	LEFT	RIGHT
a) Knee—Ligaments -Dislocation	----- -----	----- -----
b) Fracture femur	-----	-----
c) Fracture Tibia/fibula	-----	-----
d) Fracture pelvis	-----	-----
e) Upper limbs	-----	-----
f) Ribs	-----	-----
g) Head injury	-----	-----
h) Others specify	-----	-----

7. Radiological appearance after management

Anatomical reduction – Good

- Acceptable

- Poor



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**Date: 18th August 2006**

**Ref: KNH-ERC/ 01/ 3693**

Dr. Njoroge J. K. Silas  
Dept. of Surgery  
Faculty of Medicine  
University of Nairobi

Dear Dr. Njoroge

**RESEARCH PROPOSAL: "PATTERN AND MANAGEMENT OF INTRA ARTICULAR FRACTURE OF THE KNEE AS SEEN IN KENYATTA N. HOSPITAL."(P72/4/2006)**

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** revised version of your above cited research proposal for the period 18th August 2006 – 17<sup>th</sup> August 2007.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

**PROF A N GUANTAI**  
**SECRETARY, KNH-ERC**

c.c. Prof. K.M.Bhatt, Chairperson, KNH-ERC  
The Deputy Director CS, KNH  
The Dean, Faculty of Medicine, UON  
The Chairman, Dept. of Surgery , UON  
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