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A COMPARATIVE STUDY OF RETROGRADE NAILING Vs ANATOMICAL LATERAL DISTAL FEMORAL LOCKING PLATE IN PATIENTS WITH DISTAL FEMORAL FRACTURE

Orthopaedics

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ABSTRACT

AIM: The aim of the study was to determine the functional outcome retrograde nailing vs anatomical lateral distal femoral locking plate in patients with distal femoral fracture.

PATIENTS AND METHODS: Patients were either treated with retrograde nailing or anatomical distal femur locked plating from February 2013 to August 2014 at our institution.All patients were followed up for 6 months.The patients were evaluated clinically by Knee society score and radiologically for outcomes. Outcome were compared in both groups in terms of knee society score at 3 months and 6months,union rate,infection rate, implant failure.

RESULTS: In our study 27 supracondylar femoral fractures were treated.13 were treated with retrograde nailing and 14 were treated with locking plate.All cases were fresh.17 were males and 10 patients were females.The median age was 51.37 years ranging from 20-75 years.15 of the fractures were road traffic accidents and 12 were due to trivial fall.24 patients were presented with closed fractures and 3 with open fractures.17 patients were with fracture on right side and 10 on left side. Mean knee society score at 3months for nailing was 100.0(97-107) and plating 102(99.50-108.25) and at 6months for nailing was 149.0(145.5-155.5) and plating 148.5(145-155.25).All fractures united both in nailing and plating group.

There was 1(7.6%)patient in nailing group and 2(14.3%) patient in plating group who had superficial infection.No cases had implant failure in both the groups.There were no significant difference between two groups in terms of knee society score at 3 months($p<0.406$) and 6 months($p<0.827$),union rate ($p<1.00$),infection rate($p<0.815$),implant failure($p<1.00$).

CONCLUSION: Both retrograde nailing and locked plating may be adequate treatment options for supracondylar femur fractures. No differences in outcome between implants regarding fracture healing, non-union and infection were found. However, both systems require precise preperative planning and advanced surgical experience to reduce the risk of revision surgery. Clinical outcome may largely depend on surgical technique rather than on the choice of implant

KEYWORDS

INTRODUCTION

Fractures of distal femur reportedly account for less than 1% of all fractures and 4%-6% of all femoral fractures. Supracondylar femur fractures occur typically due to two discrete mechanisms of injury and in two separate populations. Periprosthetic fractures of distal femur proximal to a previous total knee arthroplasty or distal to a total hip arthroplasty is distinguished as the third common population. They are a part of polytrauma in 30% of cases. Open fractures comprise 27% of cases and 58% have intra-articular extensions.

The management of supracondylar femoral fractures has evolved from traditional treatment along the principles of W.Jones(4) and J.Charnley(5) which composed of skeletal traction,manipulation of fracture and immobilisation with casts and braces.After the recent advances in techniques and implants, nonsurgical methods have largely fallen out of favour. With the advent of minimally invasive approaches to honor the concept of biological osteosynthesis, complication rates have declined. Locking plates employ a minimally invasive biologically friendly insertion technique with minimal soft issue stripping securing the blood supply as well as the fracture haematoma. A major headway in the management of these fractures came in 1988 with the arrival of intramedullary nail put in a retrograde fashion which shares many of the assets of locking plate and have been claimed to have high healing rates.Good and excellent results were being obtained with modalities like AO blade plate,dynamic condylar screw,intramedullary supracondylar nail and locking compression plates.The blade plate introduced by AO group in Switzerland was one of the first plate and screw devices to gain wide acceptance in the treatment.

A less demanding alternative to condylar blade plate is the Dynamic condylar screw.The important disadvantage of this device is that its insertion requires removal of large amount of bone which makes revision more difficult Locking compression plate has the added combination of conventional compression plating and locked plating techniques which is of great advantage in the plate osteosynthesis. Anatomically precontoured plates decreases soft tissue problems and serves as internal external fixator.In addition to this a locking compression plate has got unique advantages of unicortical fixation and least chance of plate back out as the screw gets locked to the plate and acts as a stable construct.

Despite the universal use of both the techniques, only a few studies are accessible to contrast them.In this randomized prospective study, we compared and assessed the radiological and functional outcomes of extra articular distal femur fractures stabilized with a Retrograde Nail or a Locking Plate using LISS techniques.The purpose of this study is to establish any superiority of one implant over other by comparing the clinico-radiological outcome of supracondylar femur fractures treated by use of Retrograde nailing Vs Anatomical distal femoral locking plate.

AIMS AND OBJECTIVES:

The present study was undertaken with following aims and objectives

AIMS

The aim of the study was to determine the functional outcome retrograde nailing vs anatomical lateral distal femoral locking plate in patients with distal femoral fracture

OBJECTIVES

- To study clinical and radiological outcomes of supracondylar femoral fracture in patients undergone retrograde nailing or anatomical distal femoral locking plate.
- To compare clinical and radiological outcomes of supracondylar femoral fracture in patients undergone retrograde nailing or anatomical distal femoral locking plate

METHODOLOGY

This is a comparative clinical study conducted in department of

Orthopaedics ,Guntur Govt. Hospital,Guntur ,India from July 2012 to August 2014.

Sample size-33 patients. Two patients died before intervention,four had incomplete follow-up and were excluded from the study leaving 27 patients in the study.

Informed consent: Informed consent was obtained from all the patients after explaining them the study protocol in their own language.

Inclusion criteria:

a) Adult patients(>18 years)
b) Type A1,A2 distal femur fracture(OTA classification)
c) Closed or type ½ open fractures(Gustilo and Anderson classification) with wound healed within 2weeks of trauma.

Exclusion criteria:

a) Patients with pathological fracture except osteoporosis
b) Patients not fit for surgery due to other comorbidities
c) Existing deformity in the affected limb that would complicate IM nailing and plating
d) Ipsilateral tibia fracture(floating knee)or proximal femur fracture of segmental femur fracture.
e) Patients unable to comply with postoperative rehabilitation protocols or instructions.

(eg. Head injury with low Glasgow coma score <7,or mentally impaired) Surgical technique for retrograde IM nailing The distal femur fractures were temporarily immobilized by using plaster of Paris slab or by using upper tibial skeletal traction in elevation with Bohler Braun splint. Intraarticular anterior approach for retrograde nailing. Lateral approach for locking compression plating. All the surgeries were conducted in the same centre by orthopaedic surgeons who were trained in both the procedures.

The implant used was supracondylar nail system with instrumentation set. The nails are available with outer diameter of 9, 10, 11 and 12 mm and lengths of 150,200, 250,300 mm. The distal end is expanded to outer diameter of 13 mm. There is 5 degree anterior bend and an anterior bow for anatomic fit. All sized nails have five interlocking holes in entire length, two proximal and three distal holes, which accept interlocking screws of 4.9 mm and 6.5 mm thread diameter respectively. The interlocking holes are directed laterally to medially. The interlocking screws have self-tapping tip trocar tip and are fully threaded. The nails are manufactured from 316 L stainless steel alloy with gun drilling.

All aseptic precautions were adhered to. After painting and draping a midline incision of 4 cm was taken from inferior pole of patella up to tibial tuberosity. The Parthenon over patellar tendon was sharply incised and patellar tendon was split in the midline along the direction of its fibres.A straight bone awl was inserted into the jointthrough the split tendon and positioned against the inter-condylar notch. The femoral attachment ofPosterior Cruciate Ligament was palpated and thebone awl was kept just anterior to the PosteriorCruciate Ligament attachment. The position of bone awl was checked under image intensifier inantero-posterior and lateral position. An entry pointwas made above the blumescant line in lateral view under c-arm. The bone awl was then removed and guide wire passed through the entry point.

The fracture was reduced under image intensifier control and guide wire passed in proximal fragment. The distal fragment was then reamed with cannulated reamer.

The predetermined nail of adequate diameter and length was then loaded over the jig with the help of conical bolt. The nail was then inserted over the guide wire through the entry point made previously through distal and then proximal fragment. Its position was confirmed on image intensifier and then depending on the length of the nail, the proximal holes were locked with the help of corresponding markings on the jig. After taking stab incision over the corresponding lateral skin, the soft tissues were separated by blunt dissection with the help of hemostat and drill sleeveand drill guide for 4.5 mm drill bit were inserted through the fenestrations provided over the jig, through the stab incision flush with the lateralcortex. The lateral and medial cortex was drilled with 4.5 mm drill bit. The required length oflocking bolt was measured with the help of depth gauge and self-tapping interlocking bolt of 4.9 mmthread diameter passed from lateral to medial cortex engaging the locking hole in the nail. Either single or both holes were locked proximally and distally. The jig was then disengaged, the joint was washed thoroughly to remove the debris, hemostasis was achieved and incision was closed in layers. Particular attention was paid to repair paratenon of patellar tendon.

Post operative management:

The patients were followed up until union was achieved or was categorized as delayed union (>20 weeks). Each case was reviewed clinically and radiologically during the follow up period every month. Suture removal was done on 11th postoperative day. Before discharge, patients were given crutch training and were made ambulatory on bilateral axillary crutches/walking frames without weight bearing. Toe touch walking was allowed by the 6th week.

Further, weight bearing was allowed depending on the clinical and radiological picture.At each follow-up patient was assessed regarding clinico-radiological union in the form of pain,thickening, warmth at fracture site, radiographic alignment, evidence of callus, range of motion,extensor lag and shortening.Clinically, fracture was considered to be united when there was no pain on palpation and no discomfort on weight bearing.

Locking Compression Plating

The plate and screws are manufactured from 316Lstainless alloy with gundrilling technique The locking compression plates are available from 4 holed to 14 holed, with 4.5 mm thickness plate for lower end of femur. Anatomically precontoured plate head with soft edges. Locking screws in the head of the plate for a secure support. The head of the locking screw is threaded which gets locked to the plate as it is tightened. LCP combi-holes in the plate shaft – Intraoperative choice between angular stability and/ or compression.

Surgical procedure:

Under appropriate anaesthesia, we used the standard lateral approach to distal femur, with patient in supine position and a sand bag was kept below the operating knee and one below the ipsilateral hip. Skin and subcutaneous tissue were cut, superior geniculate artery was identified and ligated. Care was taken not to incise the lateral meniscus at the lateral joint margin. The vastus lateralis muscle was carefully elevated from intermuscular septum and retracted anteriorly and medially.

Operative steps

The articular fragments were temporarily secured with pointed reduction forceps and/or K wires. If a posterior Hoffa fragment was present, it was reduced and provisionally stabilized with K wire inserted from anterior to posterior. The condyles were secured with 6.5 mm cancellous screws. A condylar plate guide was held laterally on the condyle to select an area, where screws would not interfere with plate placement. A K-wire was placed across the femoral condyle, at the level of the knee, to indicate the joint axis and a second K wire was placed across the patellofemoral joint on the trochlear surface. Using anatomic landmarks and C – arm imaging, the plate was mounted on the intact / reconstructed condyle without attempting to reduce the proximal portion of the fracture. The wire guides werethreaded into the plate prior to placing the plate on the bone. The guide wire inserted in through the central hole should be parallel to both distal femoral joint axis and patello femoral joint. Screwswere inserted starting from central hole in the condylar portion and checked under image control. The plate shaft may be fixed with appropriate cortical screws after confirming final reduction of the fractures.

Postoperative management:

Quadriceps strengthening and hamstring stretching exercises were encouraged.Gentle hip and ankle mobilization exercises were continued. Non –weight bearing with crutches or walker support was initiated in 1st week if fixation was stable. Sutures were removed between 10th - 12th postoperativedays. Continued isometric quadriceps exercises, active and passive range motion exercises, seated knee extension procedures were encouraged. Partial weight bearing was allowed after 3rd week. Full weight bearing was allowed after radiological evidence of healing. (6- 12 weeks). Patients with inter condylar fractures (AO types B and C fractures) were not allowed full weight bearing for at least 12 weeks.

Periodic monitoring of knee flexion at end of 1st, 2nd, 3rd, week and after completion of therapy, with concomitant isometric quadriceps exercises and knee mobilization exercises was done.

Neer's score takes into account functional (70 points) and anatomical aspects (20 points). The functional scoring includes pain scoring, walking capacity and degree of possible flexion. The anatomical scoring includes assessment of gross anatomy and roentgenograms. The scoring is Excellent (> 85 points), Good (70 to 84 points), Fair (55 to 69 points) and Poor (< 55points).

Retrospective group:

11 out of 33 patients were included retrospectively in the study operated within one year of the comnmencement of the study i.e. supracondylar femur fractures operated with either retrograde nailing (5) or distal femoral locked plating (6).These patients were assessed for their knee society score at 3 and 6 months.X rays were retrieved from the patients for the union status of the fracture.

Method of analysis:

Analysis was performed using statistical analysis software SPSS version 20.Subject baseline charecteristics were summarized using frequency percentage.All continuous variables which followed Gaussian distribution were represented as mean +_ SD and those that followed Non-Gaussian distribution were represented as median and inter Quartile range.Chi square test was used to compare the categorical data.After checking for normality of the distribution,appropriate tests were used for comparison of 2 groups continuous data that followed Gaussian distribution were compared by using independent sample test and data that followed Non-Gaussian distribution were compared using Mann Whitney U test.All statistically analysis was carried out at 5% level of significance and the p value of <0.05 was considered as significant.

OBSERVATION AND RESULTS:

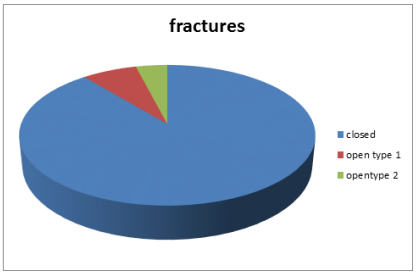
A total of 33 patients with supracondylar femur fractures were included in the study after satisfying the inclusion and exclusion criteria during the study period between July 2012 and August 2014.2 patients died before intervention,4 had incomplete follow-up and were excluded from the study leaving 27 patients in the study.

Patient and demographic characteristics:

27 patients with supracondylar femur fractures comprised the study group.In present study, the youngest patient was 20 years and the oldest patient was 75 years.(age range:20-75 years).Mean age was 51.37 years.Seventeen patients (62.96%)were male and ten(37.03%) were female patients.

Characteristics	Value
Total number of patients	27
Age range	20-75 years
Mean age	51.37 years
Gender distribution(n=27)	17 male/10 female(1.7:1)

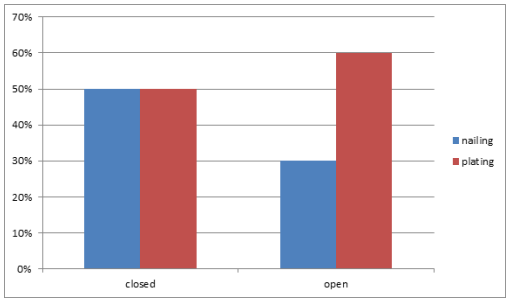
Of the 27 patients with supracondylar femur fractures,24(88.9%) patients had closed fractures and 3(11.1%) patients had open fractures,out of which 2(7.4%) patients had Gustillo Anderson type 1 open fractures and 1(3.7%) patients had Gustillo Anderson type 2 open fractures.



15 patients with supracondylar femur fractures had high velocity injuries due to road traffic accidents and 12 patients were due to trivial trauma Age distribution of patients versus treatment options

Age group distribution of patients	Treatment with nailing No.(%)	Treatment with plating No.(%)	Total No.(%)
20-29 years	3(42.9%)	2(57.1%)	5(100%)
30-39 years	1(66.7%)	3(33.3%)	4(100%)
40-49 years	1(60%)	1(40%)	2(100%)
50-59 years	1(33.3%)	2(66.7%)	3(100%)
60-69 years	4(44.4%)	5(55.6%)	9(100%)
>or=70 years	3(75%)	1(25%)	4(100%)
Total	13	14	27

Of the 24 closed fractures,12(50%) underwent nailing and 12(50%) underwent plating.Of the 3 open supracondylar femur fractures,1(33.3%) underwent nailing and2(66.7%) underwent plating.There is uniform distribution of closed and open fractures in the two treatment groups as inferred from the Chi-Square test.

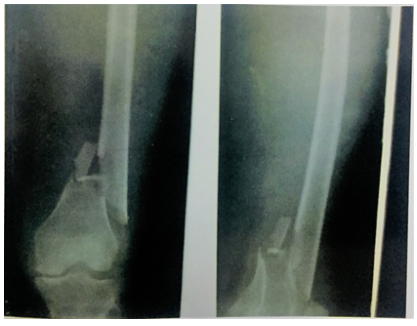


Type of Fracture

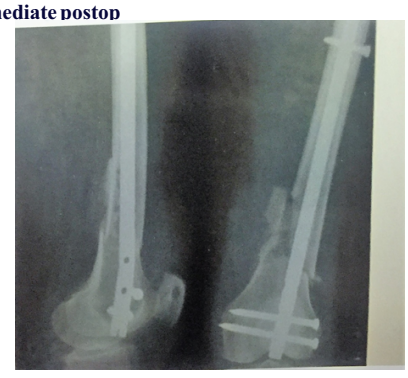
Union and Non-union in two treatment groups

	NAILING NO.(%)	PLATING NO.(%)	TOTAL NO.(%)	P VALUE
UNION	13 OF 13(100%)	14 OF 14(100%)	27 OF 27(100%)	1.000
NON UNION	0	0	0 OF 36(0%)	

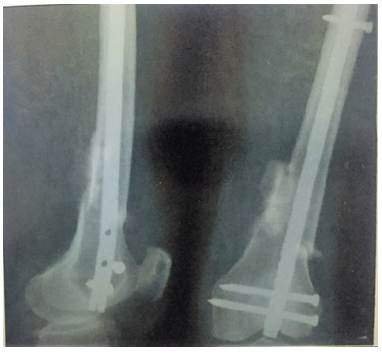
RADIOLOGICAL AND CLINICAL PHOTOGRAPHS RETROGRADE NAILING:



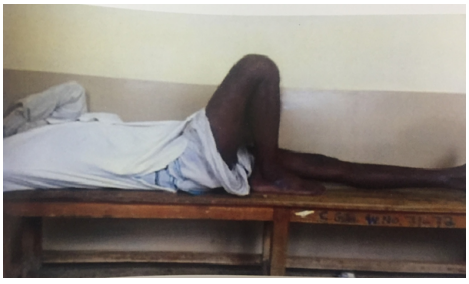
Preop immediate postop



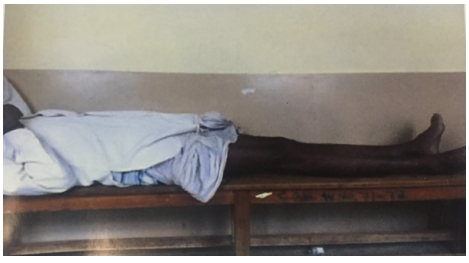
12 Weeks postop



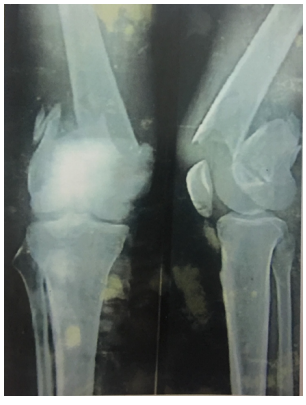
Knee Flexion



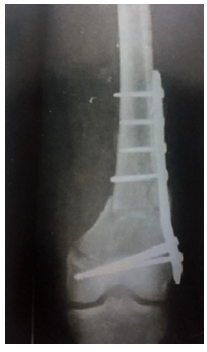
Knee Extension



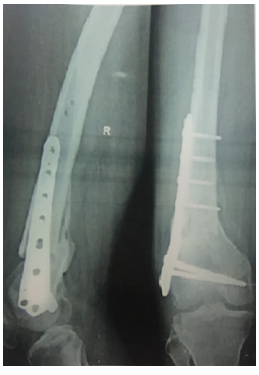
LOCKED PLATING
Pre op



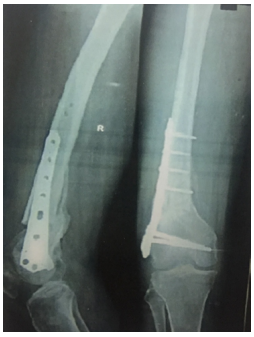
Immediate postop



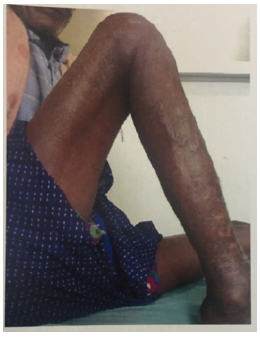
6 Weeks Postop



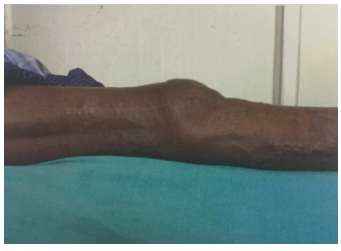
12 Weeks Postop



Flexion



Extension



DISCUSSION

In the present study we compared the outcome of supracondylar femur fractures treated with retrograde nailing and distal femur locking plate.There is a paucity of literature comparing the outcome of these two devices in the management of supracondylar femur fractures.

RETROGRADE NAILING:

Intramedullary nailing of supracondylar femur fractures offers the benefit of load sharing of the extra osseous blood supply and avoidance of additional soft tissue dissection in a vulnerable injury zone.

Union:

High union rates from 90%-100% have been reported in various studies in intramedullary nailing of supracondylar femur fractures .In the present study all patients treated with retrograde nailing united and union rates were comparable to other studies on retrograde intramedullary nailing in supracondylar femur fractures.

Infection:

Low infection rates 2% to 9% have been reported in various studies in retrograde nailing in both closed and open supracondylar femur fractures.In present study,infection rate(7.6%)is comparable to the other studies.

Fuctional outcome:

Seifert et al and Gellmann et al using lower extremity functional scoring reported an average good to excellent result in >90% of the patients score.In the present study,the median knee society score is 150(maximum-200).Good and comparable functional outcomes have occurred in the above 3 studies.

STUDY	Lucas SM et al	Gellman et al	Janzing et al	Bel JC et al	Seifert et al	Present study
Year	1995	1996	1998	2001	2003	2014
Number of patient	25	24	24	33	48	13

Union	96%	100%	95.8%	100%	100%	100%
Non-Union	4%	0	4.2%	0	0	0
Infection	4%	8.3%	4.2%	3.1%	2.1%	7.6%

LOCKED COMPRESSION PLATING:

Plate osteosynthesis of supracondylar femur fractures can be done using lateral buttress plate,95 degree angled blade plate,dynamic condylar screw,locking compression plates.Plate osteosynthesis van be performed by direct open reduction and internal fixation or percutaneous indirect reduction and fixation In the present study,we used anatomical lateral distal femur locking plate for open reduction and internal fixation of supracondylar femur fractures.

Union :

A Systematic review by Zlowodzki et al(2006) average union rate was 94.5%(92%-100%).Non-union was 5.5%(0%-9%).In present study the union rate and non-union is comparable to the previous studies.

Infection:

A Systematic review by Zlowodzki et al(2006) average infection rate was found to be 2.1%(1%-5%). In present study the infection rate was 11.6%(2 patients).Both patients were open cases on presentation and within 2 weeks was converted to internal fixation from external fixation.

Functional outcome:

Functional outcome was assessed in very few studies.Good to excellent score was present in >90% of patients.In present study the median knee society score was 150.0. Good and comparable outcome occurred in previous studies.

There is no significant difference in the functional outcome in patients treated with intramedullary nailing and plating osteosynthesis ,as determined by the Knee society score at 3months(p value=0.406) and at 6 months(p value= 0.827).

There were no significant differences in the other parameters like union(p value= 1.00),infection (p value=0.869),implant failure(p value=1.00).Results were comparable to the study done by Markmiller et al(61),Hierholzer et al(62) and Gupta SKV et al(66).The limitation of the study is that the patients were not randomized to each group which were operated earlier.Also to strengthen the significance of difference in the above parameters the number of patients should have been higher.

Both intramedullary nailing and plate osteosynthesis can be used in the treatment of supracondylar femur fractures with good clinical outcome.

CONCLUSION:

Both retrograde IM nailing and LCP plating may be adequate treatment options for supracondylar femur fractures No differences in outcome between implants regarding fracture healing,non-union and infection were found. Intramedullary nailing may provide favourable intramedullary stability and stable callus ,and may be successfully implanted in bilateral or segmental fractures of the lower extremity.Persistent knee pain and inability to use in type C fractures are the main limiting factors of retrograde nail. Locked plating may be utilised for all distal femur fractures including complex type C fractures,periprosthetic as well as osteoporotic fractures. However , both systems require precise preoperative planning and advanced surgical experience to reduce the risk of revision surgery.

Clinical outcome may largely depend on surgical technique rather than on the choice of implant.

SUMMARY :

The results are summarized as follows:

1. Total follow up was 6months for all patients
2. Average age group of the patients was 51.37years
3. Males were affected most commonly
4. Predominantly right side was involved
5. Road traffic accidents were the common mode of injury in young patients and trivial fall in old age group
6. Few(11.11%)were open fractures.Among them 3.7% were Gustilo type 1 and 7.4% were Gustilo type2
7. There was no significant difference in both the groups in clinical outcome as judged by the knee society score at 3months as well as 6months
8. Final range of motion for all fractures was more than 90 degrees and extension lag < 5.There was no significant difference between two groups for range of motion and extension lag achieved.
9. All fractures united in both groups.There were no cases of malunion or non-union.
10. Infection rate 11.11% was not significantly different in the two groups.
11. There were no cases of implant failure in both the groups

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