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RESEARCH ARTICLE

BIOLOGICAL PLATING OSTEOSYNTHESIS IN COMMUNUTED SUBTROCHANTERIC FRACTURES WITH DYNAMIC HIP SCREW

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Abstract

Background: Comminuted subtrochanteric fractures represent a challenge for trauma surgeons. Fractures in the subtrochanteric region present challenges to achieving stable fixation and appropriate reduction because the subtrochanteric region of the femur is one of the highest stressed zones in the human skeleton where tensile or compressive stresses can exceed several multiples of body weight.

Aim: The aim of this study is to observe the results of biological DHS fixation in the management of comminuted subtrochanteric fractures of femur in adults.

Method: A prospective study was conducted on a group of 25 patients in the Postgraduate Department of Orthopaedics, Government Medical College, Srinagar. In all the patients along with personal data, mode of trauma, type of fracture, intra-operative & post-operative complications, follow up examination including hip joint examination, duration of full weight bearing was considered. Patients were assessed clinically for pain, hip and knee range of motion, angular and rotational deformities and leg-length discrepancy. Union was assessed radiographically.

Results: Majority of the patients had trauma due to RTA (76%), fall from height/stairs/standing position (20%), and direct impact (4%). There were 5 type 3A, 6 type 3B, 8 type 4 and 6 type 5 fractures according to Seinsheimer classification. According to criteria laid by Trauma hip rating scale, excellent results were achieved in 16 patients, good in 8 patients and poor in 1 patient. However, no case of failure was reported. Union occurred in all cases. None of the patients had clinical pain or dysfunction.

Conclusion: Biological DHS is an effective and reliable option in the treatment of comminuted subtrochanteric fractures as, DHS allows good fixation of a fracture that extends into piriformis fossa (type 5). This procedure offers the significant advantage of being less technically demanding, simple and familiar to most surgeons and Leads to less blood loss.

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Introduction:-

Population of senior citizens is increasing as longevity increases day by day.[1] Hip fractures are the second most common cause of hospitalization in elderly patients.[2] In-hospital mortality of 6.3% and 30.8% in one year have been reported³, with men's mortality rate double that of women's.[3-7] Subtrochanteric fractures typically occur in the proximal femur between the inferior aspect of the lesser trochanter upto a distance of about 5 cm distally. These fractures have a bimodal age distribution. These fractures occur in the young by high-energy trauma, often polytraumatized population and in the elderly osteopenic population typically resulting from a low-energy fall from a standing height.[8,9]

Implant used for fixation of subtrochanteric fracture should provide necessary mechanical strength while maintaining functional mobility of the limb until bony union is achieved. Extramedullary as well as intramedullary fixation techniques have been used to fix such fractures. Intramedullary devices have allowed surgeons to treat these complex fractures less invasively. The best treatment for such kind of fractures is biological indirect reduction and splinting by a new generation of intramedullary nails, yet it is technically demanding.[10,11,12]

Extramedullary fixation devices are used for more than a century but they have been associated with extensive surgical dissection, periosteum and soft tissue damage. The sliding hip screw is used to stabilize a variety of subtrochanteric fracture patterns. It provides a firm upper anchorage with a 12.5 mm lag screw in the femoral head proximally and a long side plate (up to 260 mm in length) securely fixed in the femoral shaft distally. But it requires large exposures. The technique of biological internal fixation avoids extensive bone exposure and reduces surgical trauma.

Material and Methods:-

The study was carried out in the post graduate department of Orthopaedics, Bone and Joints Hospital, Barzulla Srinagar. The study consisted of a total 25 adult patients of subtrochanteric fractures of femur satisfying the inclusion criteria, who were treated with biological DHS fixation.

In all the patients along with personal data, mode of trauma, type of fracture, intra-operative & post-operative complications, follow up examination including hip joint examination, duration of full weight bearing was considered.

Evaluation:

On admission a detailed general physical examination followed by local relevant examination was done and life-threatening injuries were treated on priority.

The clinical examination was followed by radiological examination of the part which included an antero-posterior X-ray of pelvis with both hips and lateral radiograph of affected hip with femur to assess the fracture geometry.

The following investigations were routinely done in the patients: Haemogram, Serum Biochemistry (Blood sugar, Serum urea, Serum creatinine, Serum electrolytes), X- ray chest PA view, ECG, Blood Grouping and Serology.

The patients were then assessed medically and fitness for anesthesia was sought. Initially all patients were put on skeletal traction with Upper TibialSteinmann Pin if a delay of more than 48 hours was expected for surgery. DVT prophylaxis in the form of subcutaneous heparin twice daily was started right from day of admission. On the pre-operation day PAC was sought and any medical issues were pursued. Heparin was stopped 24 hours before surgery. Blood was arranged as per the patient's hemoglobin status. Patient was asked to bring the implant and the implant was sent for autoclave after checking it. The patient's part was prepared, scrub was given and the patient was given a theatre dress to put on. Patient was kept fasting for at least 8 hours. On the operation day, the patient was given prophylactic antibiotics (IV Cefuroxime 1.5g) half an hour before the surgery. The surgery was then commenced, preferably under spinal anesthesia.

Surgical technique:**DHS fixation:****Patient Positioning**

Patient was positioned on a fracture table with a perineal post. The unaffected leg was abducted as far as possible and placed on a leg support, so that it does allow free fluoroscopic examinations.

**Fracture Reduction**

Closed reduction of fracture was performed using the fracture table utilizing skeletal traction. Focus was given on obtaining the length, mechanical and rotational alignments. The correct alignment and rotation was checked intraoperatively clinically and using X-ray guidance.

Surgical Approach

Two separate incisions were made.

**Proximal Incision:**

This incision was begun at the vastus ridge and carried distally. Dissection was then continued through the iliotibial band and the fascia of the vastuslateralis was split longitudinally.

The vastuslateralis was elevated anteriorly off the lateral intermuscular septum while coagulating branches of the profundafemoris artery as they were encountered.

The exposure was completed by sharply incising the origin of the vastuslateralis to allow retraction and subsequent plate placement.

DHS Screw Placement:

A guide pin was inserted through the angled guide into the center-center position within the femoral head up to approximately 5 mm from the articular surface and measured.

A triple reamer was set 5 mm less than the above measurement and reaming was done. It was made sure that the guide pin did not advance into the pelvis while reaming. A tap was used in patients with good bone quality.

A lag screw of the same length as the measurement obtained from the triple reamer was selected.

Using the insertion wrench, the lag screw was inserted to the appropriate depth and the wrench was kept parallel to the femur.

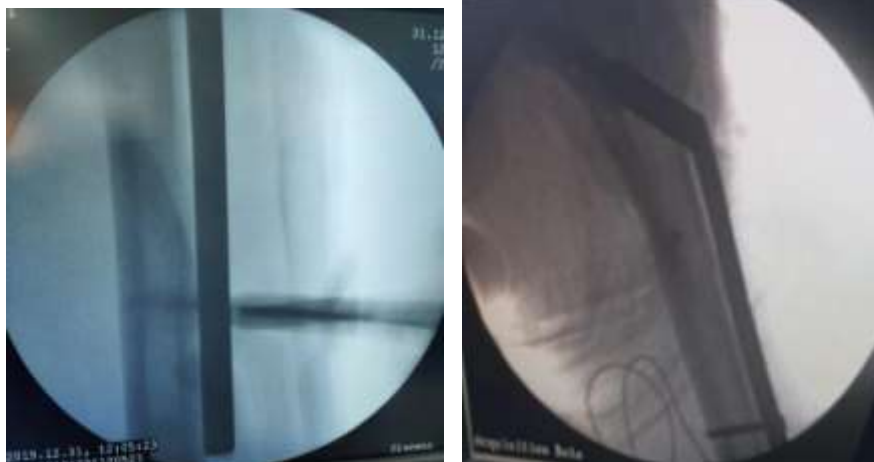
Plate Placement

From the proximal incision the plate was slid across the fracture extraperiosteally with the barrel facing laterally. Once the plate reached the proper length it was rotated 180 deg and the barrel was slid over the lag screw.

**Distal Incision**

The distal end of the plate was exposed by a second incision.

After proper positioning the plate was fixed to the bone by cortical screws.



The fracture was not exposed during the whole procedure. The incisions were closed over a suction drain.

After treatment**Zero Post-op day:**

Patient was kept in the recovery ward under close observation. Vital signs were monitored. In case of spinal anesthesia, orals were resumed as soon as the patient regained neurological function. Patient was not allowed to use

a pillow or hot water bottles. In case general anesthesia was used, the patient was kept fasting for 6 hours after which orals were started. Patient was given I/V antibiotics, I/V fluids, analgesics and blood as per need.

1st postoperative day:

Patient was sent to general ward, Post-operative X-rays were taken. Sequential quadriceps exercises/Ankle pumps were started

2nd post-op day:

Patient mobilized on a walker with toe-touch. ROM knee/ankle



3rd post-op day:

Patient discharged on I/V antibiotics for two more days followed by oral antibiotics for five days along with analgesics and proton pump inhibitors.

Advise on discharge:

Antiseptic dressing on alternate days, ROM exercises (SQE, Ankle pumps), Crutch Walking with touchdown weight bearing. Oral antibiotics (Tab. Cefuroxime 500mg bid) Analgesics.

The patients thus treated were called for regular follow-up at 2 weeks, 4 weeks, 6 weeks, 3 months, 6 months, 9 months and finally at 1 year. They were examined clinically and radiographically. Clinically the following things will be checked:

1. Local condition of wound
2. Limb length discrepancy (if any).

Radiologically:

Radiologically the following observations were made:

1. Position of implant.
2. Fracture alignment.
3. Neck shaft angle

Radiological Pictures Were Taken AT:

2nd check X-ray at the end of 2nd week, 3rd check X-ray at the end of 6th week, 4th check X-ray at the end of 3rd month, 5th check X-ray at the end of 6th month, 6th check X-ray at the end of 9th month, Final check X-ray at the end of 1 year. Final assessment was done at 1 year follow up.



Postoperative AP view



Post-operative lateral view



Final follow up AP and lateral views (case 1)



Post operative AP and Lateral views



Final follow up AP



Final follow up lateral (case 2)



Non union

Traumatic hip rating scale scoring system was used at the end of 1 year to assess the clinicoradiological outcome and patient satisfaction.

Conflict of interest:

Nil.

Funding:

Nil.

Results:-

We had 25 patients, of whom 20 (80%) patients were male and 5 (20%) females. Their mean age was 43 years

(range: 20 to 70; SD: 12.8). Majority of the patients had involvement on the right side (60%) as compared to the left side (40%).

Road traffic accidents were the most common mode of injury in our study (76%) followed by fall from height in the form of fall from the stairs, walls, trees (20%) (Table 1).

Table 1:- Mode of Injury.

Mode of Injury	No. of patients	Percentage
Road traffic accidents	19	76
Fall from height	5	20
Direct impact	1	04

The majority of fractures in our study were comminuted four part fractures (SS Type 3) (32%) (Table 2).

Table-2:- Seinsheimer Fracture Type.

Seinsheimer Fracture Type	No. of patients	Percentage
3A	5	20
3B	6	24
4	8	32
5	6	24

Average partial weight bearing time was 7.84 weeks and average full weight bearing time was 19 weeks (Table 3).

Table 3:- Start of Partial Weight Bearing (PWB).

Partial Weight Bearing (PWB)	No of cases	Percentage
4weeks	02	8
6weeks	09	36
8weeks	07	28
10weeks	04	16
12 weeks	02	8
14 weeks	01	4

Fracture union was defined as radiological evidence of bridging cortical bone on at-least three cortices on two orthogonal radiological views, with no tenderness to palpation and patients' ability to bear full weight on the extremity. The mean duration of radiological union was 20 weeks, though it ranged from 10 to 24 weeks. However, among 25 patients one patient developed nonunion (fig 1).

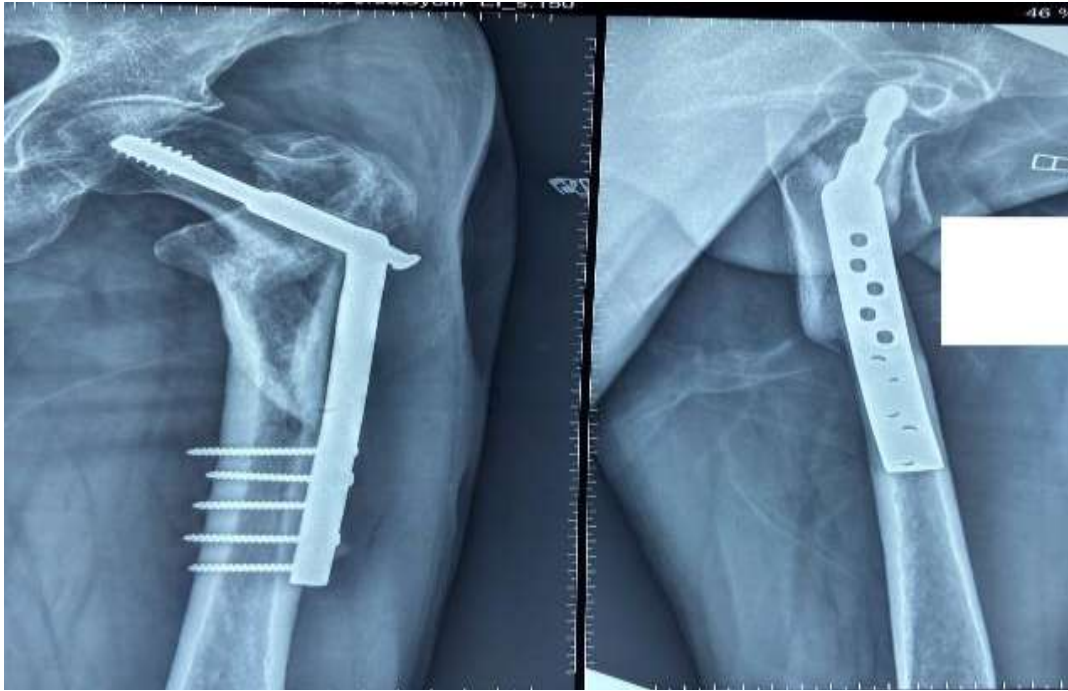


Fig 1:- AP and Lateral Radiograph at 16 weeks after nailing showing fracture union.

The Limb Length discrepancy among the study population was 1-2cms in 6 (24%) patients and >2 in 1 (4%) patients (fig2)

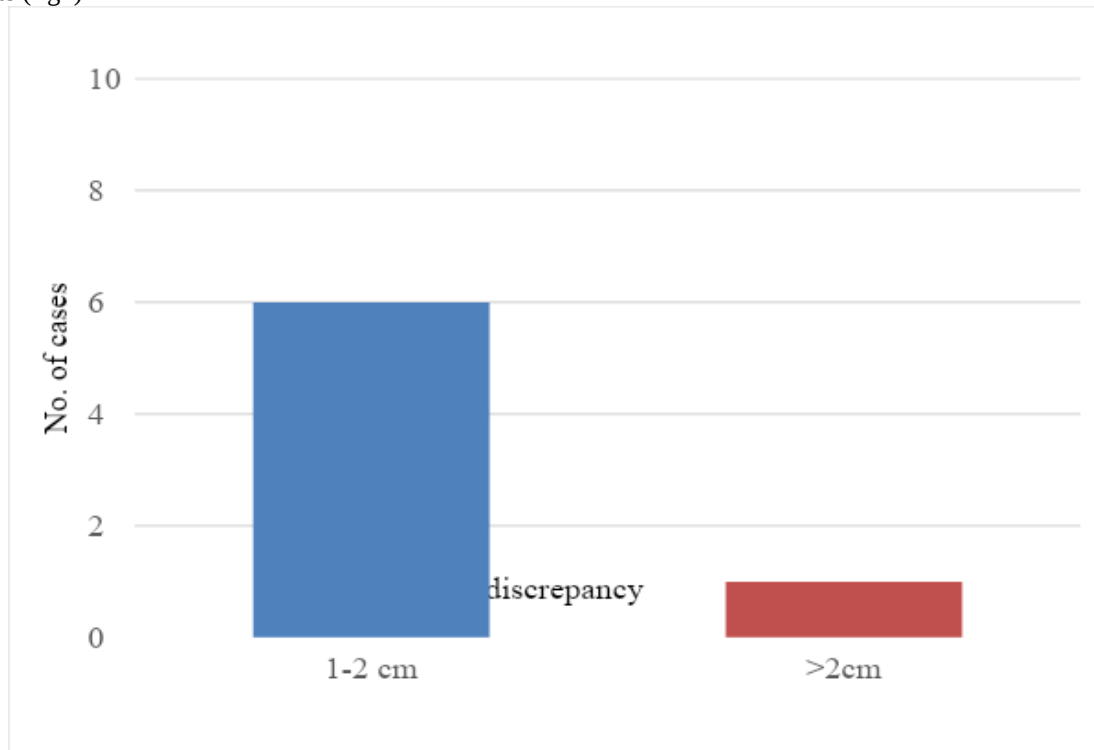
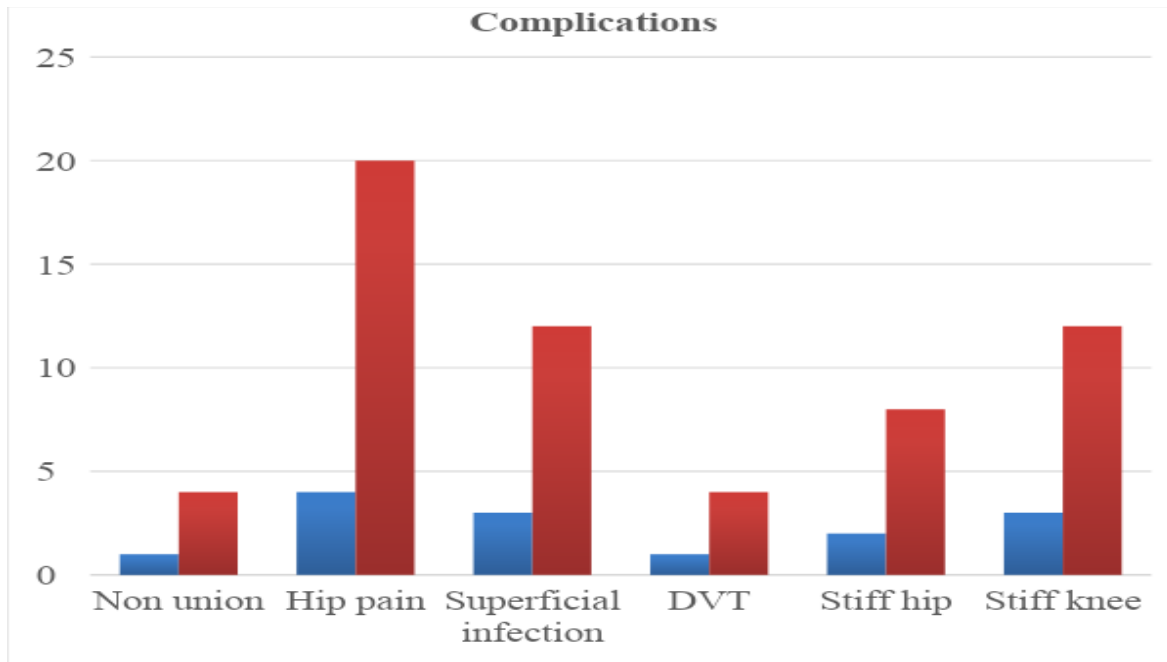


Fig 2:-

Superficial wound infection was found in 12%, deep venous thrombosis in 4%, Hip pain 16%, stiffness –hip 8%, stiffness-knee 12% and Non –union in 4% of patients among the study population (fig 3).



Discussion:-

Subtrochanteric femoral fractures constitute 34% of proximal femoral fractures. Fractures occurring in young individuals usually result from high-energy trauma and often show significant comminution.

Options for surgical treatment of subtrochanteric femur fractures include conventional open reduction with rigid internal fixation, intramedullary fixation, external fixation and biological internal fixation. We used biological internal fixation in this series.

Fixation of the comminuted subtrochanteric fractures presents a challenging problem for orthopedic surgeons. No single treatment option has generally been accepted as the method of choice. The fracture must be fixed with sufficient strength to allow early mobilization, and at the same time, to maintain good vascularity of the fragments, leaving the soft tissues and fracture hematoma undisturbed to optimize bone healing potential.

The underlying premise of this study was to evaluate the use of a commonly available extramedullary device for comminuted and extensive subtrochanteric fractures, combined with the bridge or so-called biological plating technique. The DHS was chosen because it is an easier and safer fixation procedure than the dynamic condylar screw and the angle blade plate.

In our study among 25 patients 15 (60%) had right side and 10(40%) had left side involvement. This was comparable to the study conducted by Celebi et al (2005).[13]

In the present study the predominant mode of trauma was RTA which was comparable with the study by Khallaf et al (1998).[14]

In our study the most common type of fracture was 4 which was comparable with the study of Mehrpour et al (2012).[15]

In our study operative time ranged from 50-150 minutes with an average of 86 minutes. The results were comparable to results of Mehrpour et al's study which had an average of 80 minutes.

Partial weight bearing time in our study ranged from 4-14 weeks in our study which is comparable to the results of other studies.

Average time of full weight bearing in our study was 19 weeks which is comparable with the results of other studies. However, in one of our patients weight bearing was delayed beyond 24 weeks in view of delayed union which is comparable to the study by Po cheng lee et al (2002).[16]

In a present study of 25 patients, hip pain was the chief complaint seen in 4 patients. These results were comparable to the studies of Lee et al(2002) and Kayali et al (2008).[17]

Three patients developed superficial wound infection which healed without any complication which is similar to studies conducted by Lee et al (2002) and Kayali et al (2008).[17]

One of our patients developed calf DVT which resolved on conservative management without any complications.

LLD of more than 2cm was reported in one of our patients. These results, however, are similar to that reported by Celebi et al (2005) [13] and Emad et al (2010), [18] and better than those reported by Kayali et al (2008).[17]

One patient in our study developed nonunion. The patient was managed with bone grafting. This complication is comparable to what is reported by Khallaf et al (1998).[19]

Only one of our patients had significant hip and knee stiffness of > 20 degrees. These results, however, are similar to that reported by Celebi et al (2005) [13] and Mehrpour et al (2012),[15] and better than those reported by Kayali et al (2008).[17]

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