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Original Research Paper

Comparative analysis of outcome of different treatment modalities in surgical management of subtrochanteric fractures

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ABSTRACT:

INTRODUCTION: Sub-trochanteric fractures have evolved as one of the most important causes of morbidity and mortality in elderly patients. They account for approximately 10-30% of peritrochanteric fractures. Early surgical intervention is needed in majority of the patients to avoid the major complications that can occur due to long term immobilization which include deep vein thrombosis, thrombophlebitis, urinary and lung infections and ulcers. This pattern of fracture is associated with higher rates of malunion and non-union than any other femoral fractures. A number of modalities of management exists for this pattern of fracture. **AIM OF THE STUDY**: Our aim of study is comparative analysis of outcome of different treatment modalities in surgical management of subtrochanteric fractures. **MATERIALS AND METHODS:** Comparative analysis of outcome of different treatment modalities in surgical management of subtrochanteric fractures at SMIMER. **RESULT AND CONCLUSION:** All PFN, DCS are effective in the management of subtrochanteric fractures. Subtrochanteric fractures are fractures which take a longer time for union. Advantages of PFN over DCS are decreased blood loss, decreased duration of surgery and less devascularisation of the fracture fragments, with less disturbance of fracture hematoma increased chances of closed reduction in PFN over DCS.

KEYWORDS: Subtrochanteric fractures, Proximal femoral nail, Dynamic condylar screw

INTRODUCTION:

SUBTROCHANTERIC REGION OF THE FEMUR is the region between lesser trochanter and junction of proximal and middle thirds of femur. It is defined as a zone extending from the lesser trochanter of the femur to 5cm distal to the lesser trochanter. This area is subjected to higher stresses and compressive forces anatomically. Anatomically this part of the femur is prone for nonunion and slow healing. Due to the predominance of cortical bone in this area and decreased vascularity to the cortical bone, healing capacity is impaired. A large amount of significant weight transmission occurs to this area. Subtrochanteric fractures were initially grouped under comminuted intertrochanteric factures. Boyd and Griffin initially considered them as a variant of intertrochanteric fractures. At least 15 different classification systems has been devised for subtrochanteric fractures. Out of them most widely used classification systems are the Russel and Taylor Classification, Fielding Classification, Seinsheimer and AO classification.

RUSSEL TAYLOR classification:

This classification is based on current techniques and principals of closed intramedullary nailing and continuity of lesser trochanter and extension of fracture lines into greater trochanter (or) posteriorly into pyriform fossa. It disregards the degree of comminution.

Type I: Fracture does not extend into pyriform fossa.

Type IA: Comminution and fracture line extend from below lesser trochanter to femoral isthmus

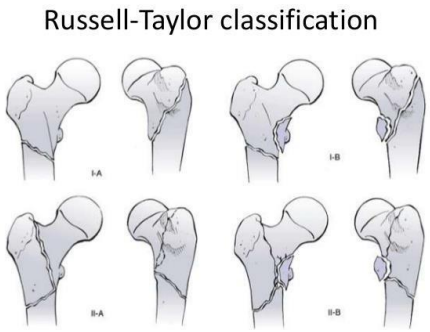
Type IB: Fracture line and comminution involve area of lesser trochanter to isthmus.

Type II: Fracture extends into Pyriform fossa.

Type IIA. No significant comminution (or) fracture of lesser trochanter is seen.

Type IIB. Comminution of medial cortex and loss of continuity

According to the Russel and Taylor Classification,initially for Type I fractures where the pyriformis fossa is not involved can be treated with Ist generation intramedullary nails and for Type II fractures extramedullary implants are used.But with the development of newer generation nails, this classification system has lost its popularity and importance.



MATERIALS AND METHODS:

The study was conducted in 50 patients with subtrochanteric fractures admitted in the emergency department. Out of the 50 cases, 30 cases were treated by proximal femur nail, 20 cases were treated by dynamic condylar screw. The duration of study was May 2022 to January 2023.

INCLUSION CRITERIA:

1. Patients admitted in our hospital with subtrochanteric fractures
2. Skeletally mature patients.
3. Injury within 2 weeks.

EXCLUSION CRITERIA:

1. Patients with pathological subtrochanteric fractures.
2. Patients in whom surgery was contraindicated due to systemic Diseases.
3. Immature Skeleton.
4. Open fractures.
5. Injury more than 3 weeks

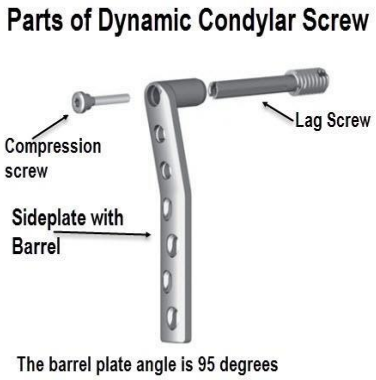
The cases were studied on the basis of the mechanism of injury, classification and their functional outcomes were assessed with or without residual complications.

Our aim of the study: was to do Comparative analysis of outcome of different treatment modalities in surgical management of subtrochanteric fractures In our study majority of the cases were classified under Russel Taylor Type IB subtrochanteric fractures, a study by French et al observed 45 cases of Russel Taylor Type IB subtrochanteric fractures. In our study 20% of cases was reduced by closed reduction.

IMPLANTS USED:

[1] PFN : PROXIMAL FEMORAL NAIL

[2] DCS : DYNAMIC CONDYLAR SCREW



PRE OPERATIVE MANAGEMENT:

All routine investigations were done

- Hemoglobin level
- Bleeding time, clotting time
- Random blood sugar level
- Blood grouping, Rh typing
- HIV, HCV, HbSAg
- Serum urea, creatinine
- Serum electrolytes
- Chest xray
- ECG

POST OPERATIVE MANAGEMENT:

Post operatively patient was managed with IV third generation cephalosporin and aminoglycosides. Oral antibiotics started from 3rd day onwards. Parentral

analgesics were given for the first 2 days depending upon the tolerance level of pain by the patient. Bedside Static and quadriceps strengthening exercises and physiotherapy started on 2nd day. Non weight-bearing walking was started on 3rd day with walker. Sutures removed on 15th postoperative day. Radiological evaluation was done on 8th week and then every month until evidence of union followed by at 6 months and 1 year. Further weight bearing and rehabilitation of the patients were decided based on radiological evidence of callus formation and union.

RESULTS:

CLASSIFICATION:
In our study most of the cases were Russell Taylor type IB. 7 cases were classified under Russell Taylor type IA & 7 cases were classified under IIB .

METHOD OF REDUCTION:
In our study of 50 cases all patients of DCS reduced by open reduction and out of 30 cases of PFN 21 cases were reduced by closed reduction and rest 9 cases were reduced by open reduction.

AGE:
In our study the average age of patients where PFN was used was found to be 47 and average age of patients where DCS used was 58. p-value 0.024, we observed that when the method of reduction was compared in PFN with DCS group 70% cases managed by PFN reduction could be achieved by closed method and this is a significant difference in the method of reduction as compared to DCS group.

- The average operating time in PFN was 80 minutes, in DCS 96 minutes.
- The average blood loss in PFN was 80 ml, DCS was 170 ml.
- The average follow up with PFN was 10 months, for DCS 12 months.
- The average time for union in weeks for cases managed with PFN was found to be 16 weeks, in case of DCS it was 18 weeks.

HARRIS HIP SCORE:

In our study of 50 patients, 74% that is 37 patients had an excellent to good Harris hip score. Out of 37 cases with excellent to good Harris hip score 23 cases were managed by PFN and 14 case was managed by DCS. 4 cases that is 8% of cases had a poor outcome and those 4 cases with poor outcome, 2 were managed by DCS and 2 were managed by PFN.
Patients with Harris Hip Score was categorized as follows:
Excellent: 90 - 100
Good: 80 - 90
Fair: 70-80
Poor: less than 70

LATE COMPLICATIONS:

NON-UNION:
Out of 50 cases, 5 cases went for non-union. Among 5 cases, 3 were treated with DCS. 2 among those 3 cases 1 case went for revision surgery by means of PFN. p-value on comparing the union rate of both groups was found to be 0.079 and it means there is not much statistical difference in union rates between 2 implants.

VARUS COLLAPSE:
In our study of 50 cases varus collapse was seen in 3 patients among which 3 case is of PFN operated case, 2 patients of DCS.

SHORTENING:
Among 50 cases in our study, shortening was observed in 6 cases, out of which 2 cases were seen in PFN group, 4 cases in DCS group. 3 cm shortening seen in 1 case rest all are less than 3 cm.

Interpretation of p-value: p-value > 0.05 no significance,
< 0.05 is significant and < 0.01 highly significant

In our study on comparing the operating time and blood loss in PFN and DCS, we observed that the differences were highly significant and the method of reduction when compared to PFN with DCS group is also of significant. This indicates that there is highly significant decrease in the average blood loss and operating time in cases treated by PFN where compared to DCS group. Also closed reduction is seen more with cases managed by PFN when compared to DCS group.

CASE:
67 years old male presented with history of trauma after RTA. He had a left subtrochanteric femur fracture type IB managed with proximal femur nail.

Physiotherapy and mobilization started from post-operative Day-1.

PRE OP

POST OP

16 WEEKS

6 MONTHS

1 YEAR

COMPLICATIONS OF PFN:

NAIL AND LOCKING BOLT BREAKAGE

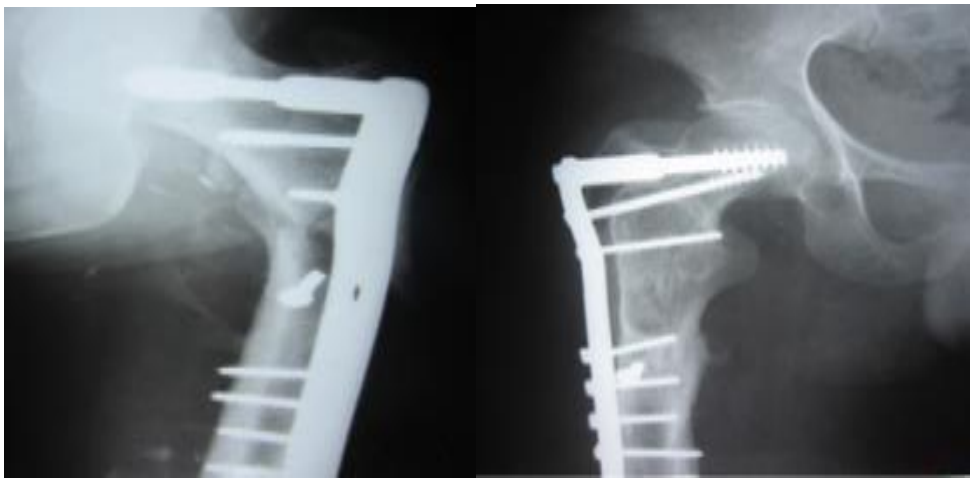
HYPERTROPHIC NON UNION

DEROTATION SCREW BREAKAGE

MYOSITIS OSSIFICANS

COMPLICATIONS OF DCS:

- MALALIGNMENT, LOSS OF REDUCTION
- VARUS MALUNION
- SCREW BACKOUT
- INFECTION WITH IMPLANT IN SITU



DISCUSSION:

In subtrochanteric fractures deforming forces are difficult to curtail and these fractures take a longer time to unite. Hence it is a great challenge for treating orthopaedicians. It still remains a controversial topic as to which is the best implant. The main system of implants widely used now are the intramedullary hip screw system, intramedullary interlocking nails and the plate screw systems each with its own advantages and disadvantages. In our study of 50 patients the mean age was 52 years, which was similar to a study conducted by[1] Lei-Sheng Jiang et al where the average age of patients was 53 years. In our study there was a male predominance and 80% of the patients were males with only 20% females. In a study conducted by [2] Wei Ting Lee et al, also a male preponderance was seen with 24 men out of 30 total cases. The higher incidence in males may be due to increased activity among males. We observed in our study that the mode of trauma in majority our patients was following high velocity injury with 72 % of cases sustained fractures and 28% of cases following low velocity injury, a study conducted by [3]Subramanyam Yadlapalli et al also showed similar results. In our study majority of the cases were classified under Russel Taylor Type IB subtrochanteric fractures, a study by [4] French et al observed 45 cases of Russel Taylor Type IB subtrochanteric fractures. In our study 42% of cases was reduced by closed reduction. In a study by [5]Wen Yue Wang et al 80 % of cases were reduced by closed reduction. In a study by [6]N Tzachev et al 60% cases were reduced by closed reduction and 40% cases by open reduction. All cases treated DCS we had to do an open reduction in order to achieve good anatomical fracture reduction, whereas 60% of cases managed by PFN we could achieve open reduction without disturbing the fracture haematoma. The average blood loss in PFN was 80ml , there is a significant difference in the amount of blood loss in PFN groups when compared to the DCS group where average blood loss in DCS was 170 ml. The average operating time also was significantly lower for PFN group when compared to the DCS group. Majority of the cases of PFN, reduction was also achieved easily when compared to the DCS group. A study conducted by [7]Sadowski et al observed mean duration of surgery 82 min for PFN, in our study mean duration of surgery was 80 min for PFN. The mean duration of surgery for DCS in our study was 96 min. a study by Shazly S. Mousa showed the operating time of 45 minutes for DCS. In studies all around the world, the duration of surgery highly varies. The duration of surgery is largely dependent on the skill and experience of the operating surgeon as well as the nature of fracture pattern. We had a very good union rate in our cases with 96% union rate for cases treated with PFN, with 2 cases went for nonunion. Other studies also showed almost similar union rates When in DCS out of 20 patients 3 went for nonunion so 94% union was achieved which is comparable to study by Emrah Kemal Sahin et al. In our study we observed that cases treated with PFN union was achieved in a mean of 16 weeks

which was almost similar to many studies like [1]JIANG et al – 17 weeks, [8]GURINDER GOSAL et al – 14 weeks. Where in case of DCS average union time was 18 weeks in our study whereas in study by Emrah Kemal Sahin et al. union time was 22 weeks. In case of PFN Full weight bearing was started based on radiological evidence of callus formation. Non weight bearing was started from the 3rd post-operative day depending on the pain tolerance level by the patient. Partial weight Bearing was started between 5- 6 weeks. Most of the patients started full weight bearing by 3- 4 months. Weight bearing was delayed in cases treated with DCS and full weight bearing was started only after complete radiological evidence of callus formation. In our study we observed that 76.6% of cases in PFN group had good to excellent Harris Hip Score, 71S.V. Yadikar et al in their study had 92% of cases with good to excellent results. In DCS group 70 % of cases had good to excellent Harris Hip Score ,study by[9] Vikram Patidar et al it was observed that 90% of cases had a good to excellent Harris Hip Score whereas in a study by [10] Mohammad Elzoiry et al a good to excellent Harris Hip Score was seen in 93.5% of patients. Among the cases treated with PFN all cases union was achieved except for 1 cases which showed nonunion at the end of 10 months. The cause for nonunion in this patient could be due to inability to achieve posteromedial cortical continuity, lack of an accurate reduction , excessive distraction at the fracture site and inherent nature of the fracture pattern to go for nonunion. Nonunion could be avoided in this patient if we had done a proper reduction of the fracture fragments. Another PFN case that had implant failure, had breakage of distal locking bolts, breakage of the nail distal to the lag screw. The nail broke at 6 months of folIow up but eventually the fracture united with varus collapse of the proximal fragment. Reason for breakage of the nail could be due to the failure to achieve posteromedial continuity and inadequate reduction. In a study by[11] B Kanthimathi et al,it was observed that the rate of implant breakage in PFN was 4%. [77]The inherent instability of the fracture pattern and the difficulty to achieve medial buttressing is considered as a cause of failure in PFN fixation. Studies on subtrochanteric fractures using PFN by Lei-Sheng Jiang et al showed one case of delayed union on their study.[78]Philip N.Streubel et al in their study had 5% non-union. [12] In a study by Gadegone and Salable 100 cases treated by PFN, complications like femoral head cut through was seen in 4.8% of patients, implant breakage in 0.8% and intra-operative femoral shaft fractures 0.8%. In one of our cases with PFN, cerclage wiring was done, this patient achieved union by 12 weeks. Tomas et al emphasized the importance of cerclage wiring, and all cases in his study showed complete union. Codesido et al in a study compared open reduction and cerclage wiring with closed reduction and found that patients treated with cerclage wiring had better results than open reduction. For better functional outcomes in PFN, an ideal entry point and reduction is crucial.[13]Paulo Roberto Barbosa and Streubel et al in their study after analyzing 50 x rays of normal hips demonstrated that the ideal entry point was medial to the tip of greater trochanter in 70% of patients and lateral in the remaining patients. In spite of evolution of different implants for subtrochanteric fractures, reduction is considered as isolated crucial factor in prognosis of subtrochanteric fractures. Miedel et al in their study analyzing the results of intramedullary fixation in the treatment of subtrochnateric fractures, observed that in those cases with acceptable reduction, the rate of reoperation was 23% whereas those with good reduction, no patients were reoperated. The aim should be to restore the cervico diaphseal angle in addition to the correction of rotation and flexion of the proximal fragment with methods that cause minimal biological damage. Among the patients operated with DCS, we had 1 case of implant failure. Revision surgery using PFLCP was done for one of the cases. Causes for implant failure in this patient was due to varus malreduction at the time of surgery, medial comminution and distraction at the fracture site which would have causes high stress at the plate screw interface, eventually leading to plate breakage. We could have avoided this complications by achieving a perfect reduction and earlier bone grafting. Another patient had implant failure at 8 weeks follow up. Patient was not compliant and started weight bearing early inspite of strict advise. In this case the cause of failure was collapse of the fracture due to early weight bearing of the patienteven before evidence of callus formation and lack of posteromedial continuity. We observed that the cause of failure in our study among DCS patients was due to mechanical stress at the plate screw interface caused due to early weight bearing on the affected leg, before bone healing has been completed. Factors important in plate fixation are: critical technique and good surgical experience, protected weight bearing until evidence of bony healing is important, good anatomical reduction of the fracture fragments and maintenance of posteromedial continuity. On weight bearing, mechanical stress acts on the femur and the highest compression stress is seen at an area 3cm distal to lesser trochanter, so the main focus is on medial cortical buttress, bending forces causes medial cortex to be loaded in compression and the lateral cortex in tension. As comminution increases the biomechanical stability decreases. In cases of inadequate medial cortical support the internal fixation device will act as a tension band in lateral femoral cortex, and loads are

concentrated in an area of the implant resulting in implant failure and loss of fixation. The concept of lateral trochanteric wall as a stabilizing factor in management of subtrochanteric fractures led to the development of concept of locking plates for subtrochanteric fracture management. In a study by [7]Jie Wang et al where biomechanical evaluation of different implants like PFN & DCS were compared it was observed that PFN was superior biomechanically than other implants in terms of its construct. We observed that PFN has more advantages as compare to DCS, PFN has shorter bending lever arm and it can bear more compressive stresses on medial cortex of proximal femur. PFN also prevents varus collapse of the medial cortex of subtrochanteric region thus reducing the incidence of failure rate. In our study we observed that even though there were no major differences in the functional outcomes and union, implant failure was more associated with PFN and there is significant decrease in the amount of blood loss and operating time in patients treated with PFN when compared to patients managed by DCS.

CONCLUSION:

All PFN and DCS are effective in the management of subtrochanteric fractures. Subtrochanteric fractures are fractures which take a longer time for union. No major differences were noted in the functional outcomes and complication between the PFN and DCS. Advantages of PFN over DCS are decreased blood loss, decreased duration of surgery and less devascularisation of the fracture fragments, with less disturbance of fracture hematoma, due to increased chances of closed reduction in PFN over DCS.

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