

Original Research Article

Evaluation of outcome following clamp assisted mini open reduction and internal fixation with intramedullary nailing of subtrochanteric femoral fractures

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ABSTRACT

Background: Subtrochanteric fractures of the proximal femur have been defined as the fractures extending from lesser trochanter distally for 5 cm. These fractures usually occur in two age distributions. In the elderly osteopenic population resulting from trivial trauma as fall from standing height or in the younger ones as a result of high energy trauma. Incidence has been on the rise and they comprise about 7 to 10% hip fractures and could lead quickly to large amount of blood loss and other complications.

Methods: This is a multicentric prospective prognostic study level 1 consisting of 25 patients admitted in government civil hospital, Ahmedabad during April 2013 to May 2015 having high subtrochanteric femur fractures treated by clamp assisted reduction and intramedullary nailing. Out of these, 20 patients (80%) came for final follow up with average follow up of 11.5 months and evaluated for union, complication and functional outcome.

Results: In our study final outcome is assessed based on hip outcome score (modified) based on which 85% had excellent outcome, 10% had good outcome and 5% had fair outcome with none of the patient having poor outcome.

Conclusions: We found that clamp-assisted reduction and intramedullary nail fixation provides excellent reduction quality, high rate of fracture union, with no apparent increase in complications in subtrochanteric fractures of the femur.

Keywords: Clamp assisted reduction, Minimally open procedure, Subtrochanteric femur fracture

INTRODUCTION

Civilization and modernization has brought certain problems along with its own benefits to the citizens of the world over. Fast life styles, rapid and high speed transportation, risky infrastructural projects and modern commando warfare activities have brought in with them morbidity and mortality due to trauma in general and fractures of femur in particular.

The treatment of subtrochanteric fractures has evolved over a period of time, from conservative to extra

medullary fixation to intramedullary fixation. The high incidence of delayed union, malunion and nonunion of fractures in this region has left conservative treatment; as advocated by De Lee et al abolished in modern trauma care.¹ This evolution in treatment modalities is due to unsatisfactory results achieved in these fractures due to medial comminution, high tensile forces active in this region and various muscular deforming forces acting on the fracture fragments thus leading to high incidence of malunion and nonunion in these fractures and mechanical failure of the implant.²⁻⁵ The appropriate implant for the internal fixation of subtrochanteric fractures remains debatable; and a multitude of different intra- and

extramedullary devices for their surgical fixation have been advocated.⁶⁻¹⁰

The advantage of closed reduction over open reduction cannot be over emphasized. Open reduction increases the risk of infection, soft-tissue devitalisation, and non-union and thus, poor functional results. Up to one half of the patients with subtrochanteric fractures may not regain their pre-fracture walking capacity, and independent living may no longer be possible.¹¹ The management of these fractures poses a significant challenge, the criteria for functional recovery becoming more and more exacting. Subtrochanteric fractures are predisposed to complications from loss of position including coxa vara, rotational deformity or shortening, non-union due to implant breakage or failure of bone substance and migration of fixation components.¹²

We did our study on 20 patients in whom clamp assisted minimally open reduction of the fracture preserving the biology and subsequent nailing procedure resulted in high union rates and excellent functional outcome.

METHODS

This is a multi-centric prospective prognostic study level 1 consisting of 25 patients admitted in government civil hospital, Ahmedabad during April 2013 to May 2015 having high subtrochanteric femur fractures treated by clamp assisted reduction and intramedullary nailing. Out of these, 20 patients (80%) came for final follow up with average follow up of 11.5 months and evaluated for union, complication and functional outcome.

Upon arrival the patients were assessed clinically and were stabilized haemo-dynamically. They were then subjected for radiographs of pelvis with both hips Antero posterior view and full length femur antero posterior and lateral views and fractures are classified according to Seinsheimer classification.¹³ Following radiographs patients were admitted to orthopaedic wards and were maintained on skeletal traction over a Bohler-Braun frame till surgery. Appropriate blood investigations were done and surgical fitness was obtained. All the patients were operated on a fracture table in supine position under image intensifier control using standard techniques.

Patients were assessed clinically and radiologically on the 2nd post-operative day, at 1 month, 3 months and then between 6 months to 1 year depending upon the fracture union. Average follow up of 11.5 months. These findings are documented according to a protocol that was developed. Healing was judged by both clinical (pain and motion at fracture site) and radiological (bridging callus filling the fracture site or trabeculations across the fracture site) criteria and functional outcome was reviewed according to the hip outcome score (modified).

The results of treatment of clamp assisted reduction of high subtrochanteric femur fractures were assessed as per

hip outcome score (HOS). Hip outcome score was modified according to our demands in which out of 28 points in questionnaire 3 were removed and hip outcome score brought down to 25 points.

We used Microsoft Office Excel 2007 and Epi Info software (version 7.1.5.0.) for chi-square test for data analysis and result comparison.

RESULTS

The following observations were made from the data collected during this study of outcome of clamp assisted reduction of high subtrochanteric fractures of femur.

In our series maximum aged patient was 78 years. Most of the patients were in the age group of 21 to 60 years, with mean average of 43.5 years. In this series 16 patients were male and 4 were female. This shows preponderance of males (80%) over females (20%).

Table 1: Age distribution.

Age groups (years)	Number of cases	%
0-20	02	10
21-40	09	45
41-60	04	20
61-80	05	25
Total	20	100

Sex distribution

In this series 16 patients were male and 4 were female. This shows preponderance of males (80%) over females (20%).

Table 2: Sex distribution.

Sex	Number of cases	%
Male	16	80
Female	04	20

Types of fracture

Subtrochanteric fractures were classified according to Seinsheimer's classification. In our study the majority of cases belonged to Seinsheimer type III B i.e., 25%.

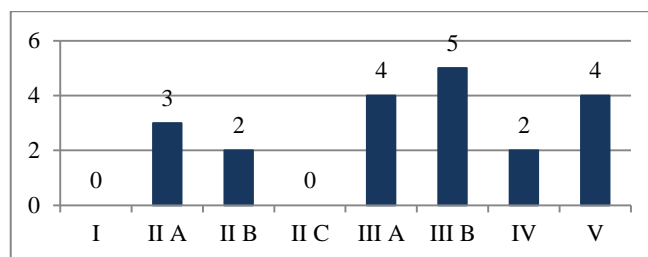


Figure 1: Types of subtrochanteric fracture (Seinsheimer classification).

Associated injuries

Out of 20 cases only 5 showed associated injuries i.e., 1 had fracture shaft right tibia, 2 had comminuted distal end radius fracture, 1 had subdural haemorrhage, 1 had bilateral foot crush.

Table 3: Associated injuries.

Associated injuries	Number of cases	%
Comminuted distal end radius fracture	2	10
Bilateral foot crush	1	5
Subdural haemorrhage	1	5
Fracture shaft tibia	1	5

Implant used

In our study, we used three types of intra medullary nailing system namely reconstruction femur nail, proximal femur nail and interlocking femur nail. Out of these three proximal femur nail was the commonest implant used in 60% of patients.

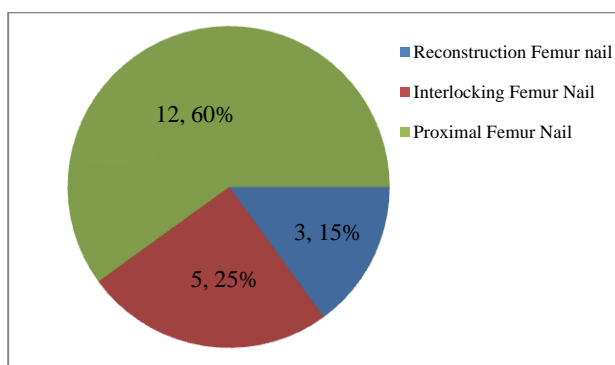


Figure 2: Type of implant used.

Weight bearing

Patients were allowed weight bearing depending upon the alignment of the fracture, comminution at the fracture site and on follow up studies depending upon the union status.

Table 4: Status of weight bearing.

Weight bearing	Duration
Non weight bearing	17.5 days
Partial weight bearing	41.3 days
Full weight bearing	14 weeks

Follow up

All the 20 patients had minimum follow up of 6 months with the average follow up of patients in the study being 11.5 months.

Complications

In this study one patient had deep infection, three were put in delayed union, and none of them had non-union, two patients in which interlocking nail were done broke out of which one required revision whereas the other patient had union in varus with shortening.

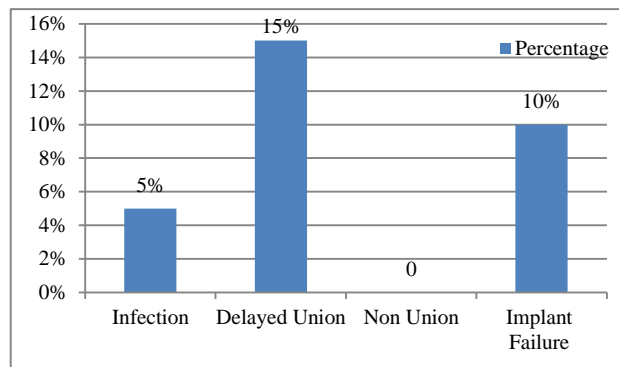


Figure 3: Rate of complications.

Union duration

The mean time to union among patients treated with clamp assisted open reduction and intramedullary nailing is 22 weeks.

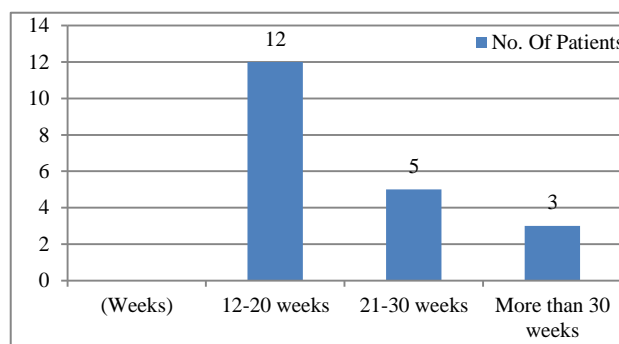


Figure 4: Union status.

Additional procedures

In two patients due to possibility of delayed union and gap at the fracture site dynamisation was done so as to fasten the union process. In one patient implant removal was done post union due to persistent sinus tract infection which eventually healed. In one patient intramedullary nail broke at distal part of proximal locks so implant removal and proximal femoral nail (PFN) was done.

Final outcome and result

In our study final outcome is assessed based on hip outcome score (modified) based on which 85% had excellent outcome, 10% had good outcome and 5% had fair outcome with none of the patient having poor outcome.

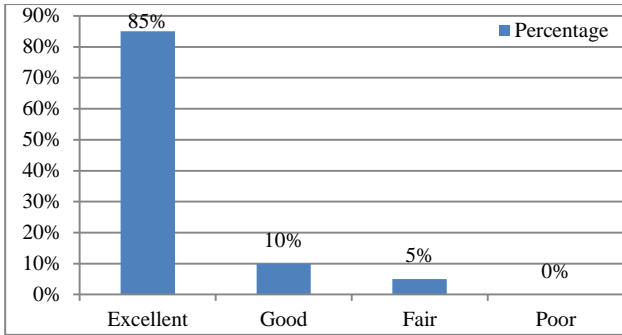


Figure 5: Results of study based on hip outcome score.

Case with excellent outcome

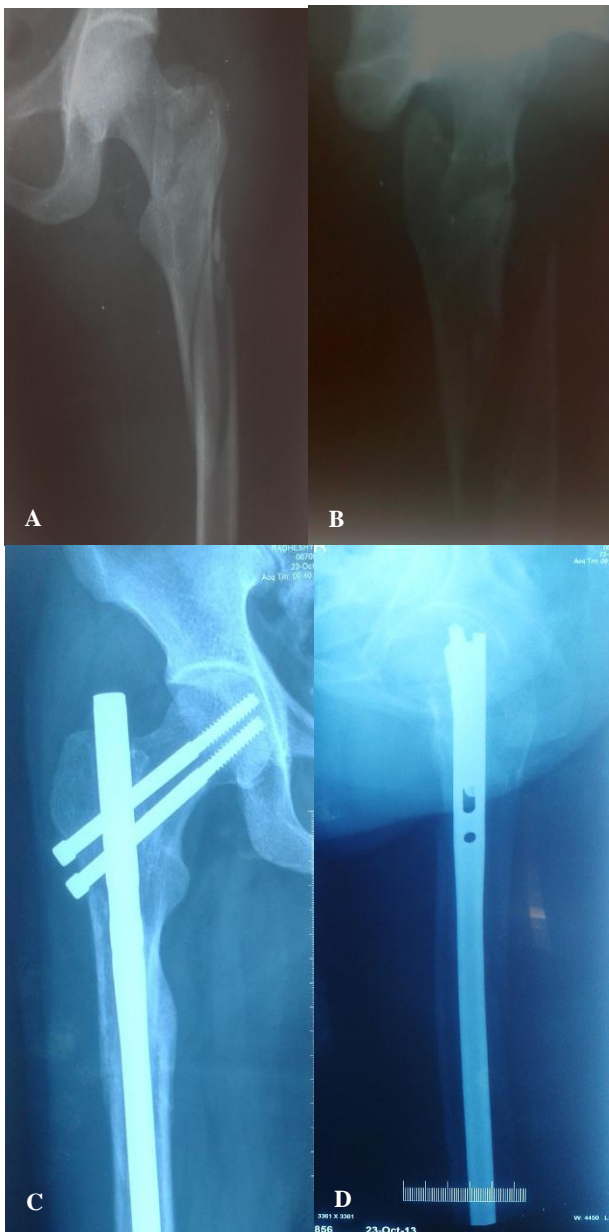


Figure 6: Pre-operative X-rays (A and B) and final follow up with union (C and D).

Case with excellent outcome-implant failure

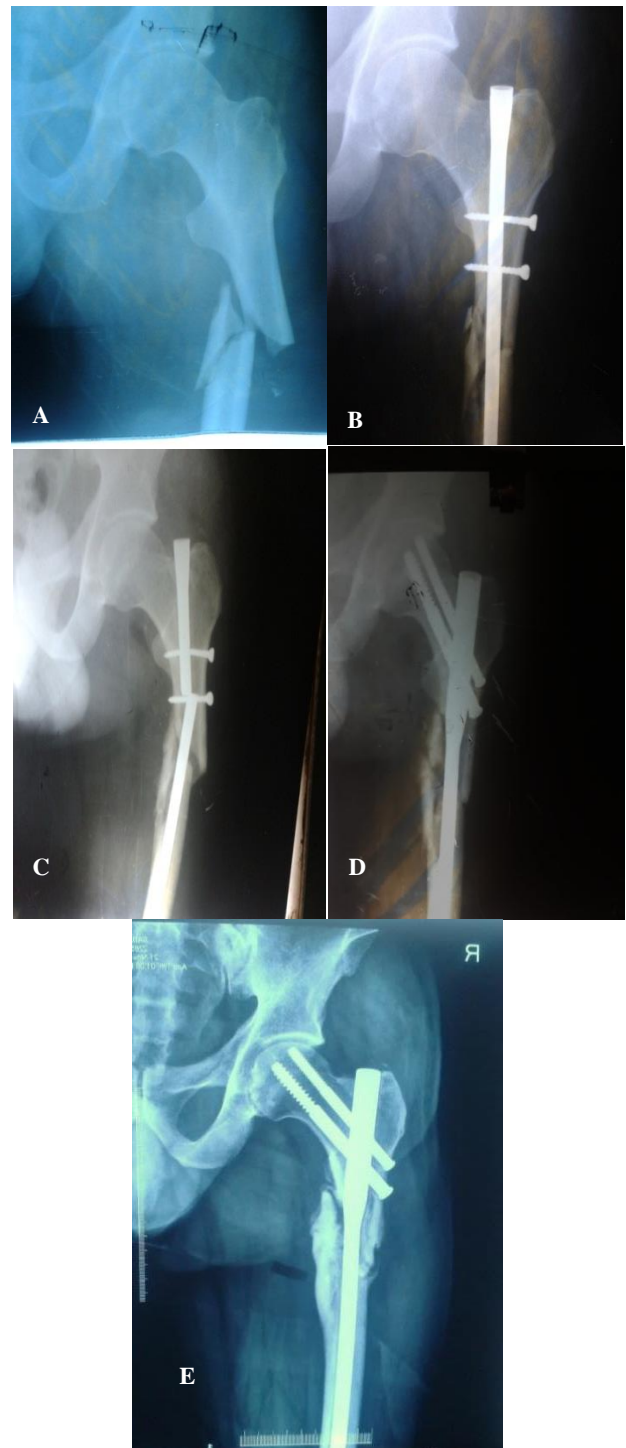


Figure 7: (A) Pre-operative X-ray, (B) post-operative X-ray, (C) X-ray with implant failure, (D) post-operative revision X-ray and (E) final follow-up with union.

DISCUSSION

Fractures of the long bones are major social and economic problem. Of the long bone fractures subtrochanteric fractures of the femur have peculiar

anatomic and mechanical characteristics which pose problems in their management.

Extramedullary fixation with plating has the potential disadvantages of extensive surgical exposure, severe soft tissue damage and blood loss, thus leading to problems of fracture union and implant failure. In addition, the eccentric plating is prone to fatigue breakage due to their mechanical load-sharing effect.¹⁴

More efficient load transfer through calcar femorale and decreased tensile strain on the implant because of its shorter lever arm, and its biologically friendly implantation techniques, intramedullary nail fixation of subtrochanteric fractures has resulted in high union rates makes proximal femoral nail a good choice of implant for subtrochanteric fractures of the femur. Allowing a minimally open approach, intramedullary nailing is closely linked to “biological internal fixation”, in addition to its mechanical benefits over plate fixation.¹⁵

Closed nailing techniques can be technically difficult as a result of the position of the proximal fragment. Starting points were often too lateral, resulting in varus alignment of the proximal fragment. We used a clamp, which we applied through a small lateral incision, to reduce these displaced fractures prior to nailing. This is comparable with the studies of Boldin et al and other studies done elsewhere.¹⁶

Patients were allowed weight bearing depending upon their general status, age, alignment of the fracture, and any associated trauma. The average duration when the patient began non weight bearing walking was 17.5 days, partial weight bearing is 41.3 days and full weight bearing walking since 14 weeks. Osteoporosis, medial buttress alignment plays an important role for early weight bearing.

All the patients in our study had fracture united at final follow up with average duration being 22 weeks. None of the patients had non-union (0%) nor did any one require any supplemental procedure like bone grafting as is commonly thought in cases of subtrochanteric femur fracture. In subtrochanteric fracture with small proximal fragment, due to muscle force anatomical closed reduction is not possible and it may lead to non-union or implant failure. So clamp assisted minimally open reduction help in good alignment as well as preservation of biology that lead to good union rate.

Out of 20 patients in our study commonest complication which we encountered was that of delayed union (15%). It occurred because there being gap at the fracture site and comminution at the fracture site with poor reduction. In such comminuted fracture fragments using an additional interfrag screw or an encirclage cable could have solved our purpose and resulted in early union. It proves that bone to bone contact at the level of subtrochanteric femur fractures is necessary for union. In

other series, the rate of fixation failure, femoral shaft fracture, and re-operation rate is high (12%).¹⁷

Depending upon the fracture pattern and alignment of the fracture we could go for dynamisation or we can augment the union process with autologous bone marrow injection in order to fasten the union process.

One of the patients in our study had superficial infection which was controlled with antibiotics and once the fracture united we did implant removal.

One case in our series developed deep infection which required debridement and implant removal to control the infection. In this case most probably long duration surgery in aged debilitated patient is responsible for deep infection, otherwise minimal open reduction with preserving the biology reduces infection rate. In the study conducted at AO infection rate was zero, in our study 1 case had deep infection, whereas study by Manzoor et al in which open reduction and fixation with DCS was done, infection rate was 7%.¹⁸ This shows that by preserving the biology minimally open technique is better than other open techniques.

Two patients in our study had implant failure because of comminution of medial buttress and thinner size nail in a narrow femur canal of young patient lead to longer union time & implant failure on loading. This proves that continuity of medial cortex in any subtrochanteric fracture is essential to improve the functional outcome and it may require additional procedure if medial buttress is not well aligned.

One of the patients (5%) had union in varus because of implant failure which as compared with Bashir et al (20%) is considerably less.¹⁹ This is because by minimal open reduction, we were able to restore the anatomy in all the cases.

In our study we found 85% patients had excellent outcome and 10 % had good, rest 5% had fair outcome as per Hip Outcome Score. Comparing this observation with Schipper et al found that 40 % had excellent outcome and 45% were good and 15% had fair.²⁰ This difference was stastically highly significant at 95% confidence limit ($\chi^2=43.20$, $p<0.05$) and on comparing with Subramanyam et al, the difference was also found to be significant at 95% confidence limit ($\chi^2=32.00$, $p<0.05$).¹² So our study result was significantly ($p<0.05$) better than other two study.

Limitation of the study is there was no randomization and smaller sample size.

CONCLUSION

In subtrochanteric fractures of femur, the deforming forces, high mechanical stresses and morbidity have

always challenged the ingenuity and skills of the orthopaedic surgeon.

The technical difficulties for reduction and associated poor functional outcome are often seen in closed nailing of subtrochanteric femur. So we went for minimal open clamp assisted reduction, preserving the biology and biomechanics and nailing procedure.

From above inference it is clear that clamp-assisted reduction and intramedullary nail fixation provides excellent reduction quality, high rate of fracture union, with no apparent increase in complications, in subtrochanteric fractures of the femur.

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Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

- De Lee JC, Clanton TO, Rockwood CA Jr. Closed treatment of subtrochanteric fractures of the femur in a modified cast-brace. J Bone Joint Surg Am. 1981;63:773-9.
- Koch JC. The laws of Bone architecture. Am J Anat. 1917;2:177.
- Canale ST, Beaty JH. Campbell's operative orthopaedics. 12th edition. Volume 3. Elsevier; 2013: 2751-2752.
- Haidukewych GJ, Berry DJ. Non-union of fractures of the subtrochanteric region of the femur. Clin Orthop Relat Res. 2004;419:185-8.
- Broos PL, Reynders P. The use of the unreamed AO femoral intramedullary nail with spiral blade in non-pathologic fractures of the femur- experiences with eighty consecutive cases. J Orthop Trauma. 2002;16:150-4.
- Blatter G, Janssen M. Treatment of subtrochanteric fractures of the femur- reduction on the traction table and fixation with dynamic condylar screw. Arch Orthop Trauma Surg. 1994;113:138- 41.
- Hotz TK, Zelweger R, Kach KP. Minimal invasive treatment of proximal femur fractures with the long gamma nail- indication, technique, results. J Trauma. 1999;47:942-5.
- Tornetta P. Subtrochanteric femur fracture. J Orthop Trauma. 2002;16:280-3.
- Siebenrock KA, Muller U, Ganz R. Indirect reduction with a condylar blade plate for osteosynthesis of subtrochanteric fractures. Injury. 1998;29(3):7-15.
- Ruff ME, Lubbers LM. Treatment of subtrochanteric fractures with a sliding screw-plate device. J Trauma. 1986;26:75-80.
- Koval KJ, Skovron ML, Aharonoff GB, Zuckerman JD. Ambulatory ability after hip fracture. A prospective study on geriatric patients. Clin Orthop Relat Res.1995;310:150-9.
- Roberto U, Velasco MD, Thomas HC. Analysis of treatment problems in sub-trochanteric fractures of the femur. J Trauma. 1978;18:513-23.
- Seinsheimer F. Subtrochanteric fractures of the femur. J Bone Jt Surg. 1978;60-A:300-6.
- Lunsjo K, Ceder L, Thorngren KG, Skytting B, Tidermark J, Burntson PO. Extramedullary fixation of 569 unstable intertrochanteric fractures. Acta Orthop Scand. 2001;72:133-40.
- Brien WW, Weiss DA, Becker V, Lehman T. Subtrochanteric femur fractures- a comparison of the Zickel nail, 95-degree blade plate and interlocking nail. J Orthop Trauma. 1991;5:458-64.
- Christian B, Franz JS, Florian F. The proximal femoral nail (PFN)-a minimal invasive treatment of unstable proximal femoral fractures. Acta Orthop Scand. 2003;74(1):53-8
- Menezes DF, Gamulin A, Noesberger B. Is the proximal femoral nail a suitable implant for treatment of all trochanteric fractures? Clin Orthop Relat Res. 2005;439:221-7.
- Manzoor AH, Shabir AD, Mohammed IW, Mohammed FB. The dynamic condylar screw in the management of subtrochanteric fractures: does judicious use of biological fixation enhance overall results? Strategies Trauma Limb Reconstr. 2007;2(2):77-81.
- Tahir D, Arshad B, Abdul RB, Muzaffar G. Complications of treatment of the subtrochanteric fractures of the femur by russell-taylor reconstruction nail. Internet J Orthop Surg. 2008;12(1):1-4.
- Schipper B. Treatment of Unstable trochanteric fractures. JBJS. 2004;86 B:86-94.
- Subramanyam Y. A study of management of subtrochanteric fracture femur by proximal femoral nailing. Dissertation. 2011:1-85.

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