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RESEARCH ARTICLE

# COMPARATIVE STUDY OF EXTRAMEDULLARY AND INTRAMEDULLARY DEVICES IN MANAGEMENT OF SUBTROCHANTERIC FEMORAL FRACTURES

Dr. Paresh Patil, *Dr. Gaurang Chanchpara, Dr. Kiran Gaonkar, Dr. Nishant Gaonkar, Dr. Jayesh Pawar, Dr. Mihir Solanki and Dr. Prashant Alwani

Krishna Institute of Medical Sciences, Karad

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**ABSTRACT**

**Introduction:** Subtrochanteric fractures result from high energy trauma in young patients and most cases are associated with multiple injuries. In elderly patients, this fracture is often caused by low energy trauma because of osteoporosis and Surgical treatment is the preferred method for subtrochanteric femoral fracture and two main categories of implants are used which are Extra medullary and Intramedullary.
**Aims and Objective:** To study the outcome of subtrochanteric hip fractures treated with extra medullary & intramedullary devices.
**Materials and Methods:** Sixty patients with subtrochanteric fractures were divided into two groups. Thirty patients in group A & thirty patients in group B. Group A was treated with intra medullary device (PFN) and group B was treated with extra medullary device (DCS). Follow-up was done at 6 weeks, 3 months, 6 months, 9 months and 12 months post operatively for clinico-radiological assessment.
**Results:** In Group A (PFN), Excellent results were seen in 47% of cases, good in 40% of cases and fair in 12% of cases with lesser duration of surgery and blood loss. In group B (DCS), excellent results were seen in 33% of cases, good in 27% of cases and fair in 40% of cases.
**Conclusion:** Intramedullary devices used in Subtrochanteric femur fractures has high rates of union, minimal soft-tissue damage, minimal blood loss, lesser hospital stay with biological and biomechanical advantage.



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## INTRODUCTION

The incidence of intertrochanteric femoral fracture has been estimated to be more than 250,000 patients each year in the United States, with the reported mortality ranging from 15 to 20%. (Cummings *et al*., 1990; Cummings *et al*., 1985). The reverse oblique trochanteric fracture of proximal part of femur is a distinct fracture pattern which is mechanically different and accounts for 2% of all the hip fractures and 5% of all the intertrochanteric and subtrochanteric fractures (Haidukewych, 2001). A sliding hip screw is not indicated for stabilization of these fractures because the large diameter lag screw does not cross the primary fracture line and telescoping of implant may promote fracture separation rather than its impaction (Koval, 2006).

***Corresponding author: Dr. Gaurang Chanchpara,***
*Krishna Institute of Medical Sciences, Karad*

This leads to an unacceptably high rate of failure when a conventional sliding hip screw is used to treat such fracture patterns. To overcome this problem, the 95° dynamic condylar screw (DCS) was introduced to stabilize this fracture pattern (Haidukewych, 2001; Baumgaertner *et al*., 1998 and Sanders, 1989). Though its use involves a relatively simple operative procedure, various modes of failure of DCS were observed in reverse oblique trochanteric fractures like cutting out of screw, breakage of the plate, and screw or plate pull off from the bone (Sanders, 1989 and Sadowski *et al*., 2002). In an attempt to overcome some of these limitations, intramedullary devices like proximal femoral nails (PFNs) were used for these fractures (Leung, 1992), with the use of intramedullary devices, the shaft fixation is nearer to the center of rotation of the hip, which gives a shorter lever arm and a lower sliding moment or tensile strain on the implant. The intramedullary location provides buttress against lateral displacement and reduces bending strain on the implant.

## MATERIALS AND METHODS

In this study, 60 patients aged 20-50 years with subtrochanteric fractures were included. They were divided into two groups, Group A was treated with intramedullary devices and Group B was treated with extra medullary devices, 30 each. Patients with subtrochanteric femur fracture were admitted and traction was applied. They were classified according to Russell-Taylor Classification (Fig. 1), (Russell-Taylor, 1998). All routine blood investigations were done with Pre-Anaesthetic Check-Up. Group A was operated with Intra Medullary Device (PFN) and group B was operated with Extra Medullary Devices (DCS). All subtrochanteric fractures either alone or with intertrochanteric extension were included in the study. We excluded pathological fractures, fracture with concurrent ipsilateral lower limb injuries and fractures older than 3 weeks. Comparison was done in between two groups in view of Intra Operative & Post-Operative outcomes on the basis of rate of union, soft tissue damage, blood loss, hospital stay, range of movements and complications related to surgical procedure. Regular follow up was done at 6 weeks interval till union and then at 6, 9 and 12 months for clinical and radiological assessment.

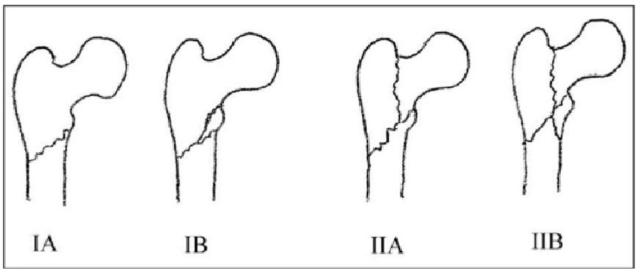


**Fig. 1. Russell-Taylor classification**

Type I: Fractures do not extend into piriformis fossa:
A: Lesser trochanter is attached to the proximal fragment
B: Lesser trochanter is detached from the proximal fragment
Type II: Fractures that extend into the piriformis fossa:
A: No significant comminution or fracture of lesser trochanter
B: Significant comminution of the medial femoral cortex and loss of continuity of lesser trochanter

### Surgical Technique

**Proximal Femoral nail (PFN):** Patient was positioned supine on fracture table with adduction of the injured limb by 15 degrees and reduction done under an image intensifier. Using standard lateral approach, entry point was determined, and then guide wire was put in, followed by proximal reaming and PFN insertion. Neck screw and hip pin were inserted and distal locking was done.

**Dynamic Condylar Screw (DCS):** Patient positioning, fracture reduction and surgical approach were the same as for PFN. Lateral incision was used with plane developed between vastuslateralis and inter muscular septum. Lateral cortex was predrilled with 2 mm drill bit. Guide wire was placed in the femur to enter slightly anterior to the midpoint of the greater trochanter, near the vastus ridge using DCS drill guide. The precise level at which the guide wire enters the femur was determined preoperatively. In the AP view, the wire should lie in the centre of the neck and in the inferior half of the femoral head. Triple reaming was done with DCS triple reamer and DCS plate was seated with an impactor. Two 6.5 mm cancellous bone screws were inserted through the proximal round holes of the DCS plate, using lag screw technique. DCS plate was fixed to the femur with 4.5 mm cortical screws.[10] Closure of the wound was done in layers and compression bandage was applied. Postoperatively, active toe movements were encouraged. Antibiotics were continued for 5 days. Patients were encouraged to sit in bed the next day. They were taught static quadriceps-hamstring exercises and knee mobilization. Gait training was imparted before discharge. Suture removal was done on the 11$^{th}$postoperative day.

## RESULTS

78% of patients were male and 22% were female with the mean age of 37.53 years. The right femur was affected in 73% of cases and left femur in 27% of cases. The most common mode of injury was motor vehicle accidents in 67% of cases and rest was fall from heights. The detailed parameters for intra-operative and post-operative outcomes are Duration of surgery, Blood Loss, Hospital Stay, complications with surgical procedure and Functional outcomes in between two groups are shown in figures as follows:

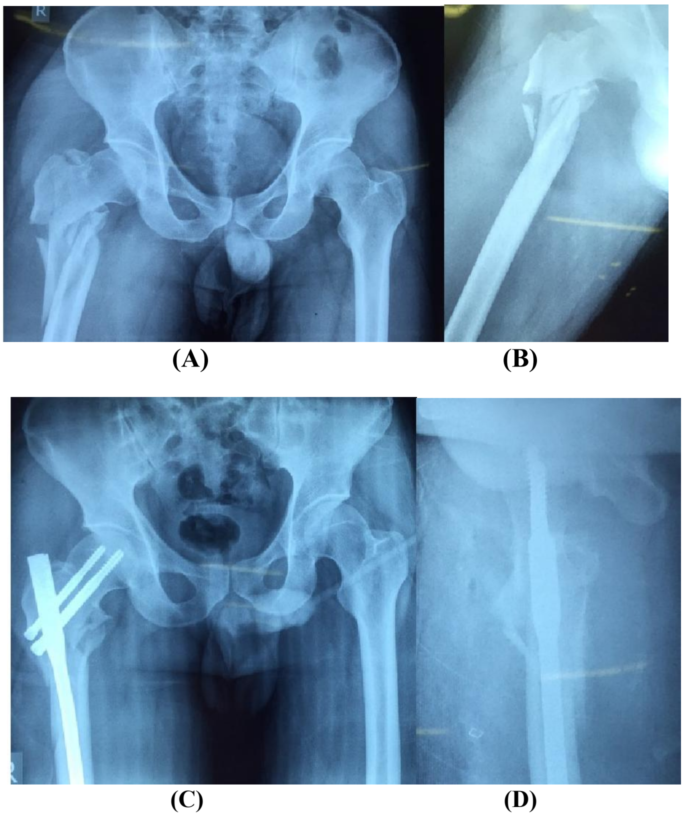


**Fig. 2. Intra medullary device (PFN) Fixation**
**(A) Pre-operative AP, (B) Pre-operative Lateral**
**(C) Post-Operative AP(D) Post-Operative Lateral**

At discharge, 4 patients in group A and 12 patients in group B had non-weight bearing walk and others had toe touch partial weight bearing walk with walker support. All the patients were followed up at 6 week intervals till union, and then at 6, 9 and 12 months. Results for group A (PFN) were Excellent in 47% of cases, good in 40% of cases and Fair in 12% of cases.

(A) (B)

**Fig. 3. Extra medullary device (DCS) Fixation (A) Pre-operative AP (B) Post-Operative AP**

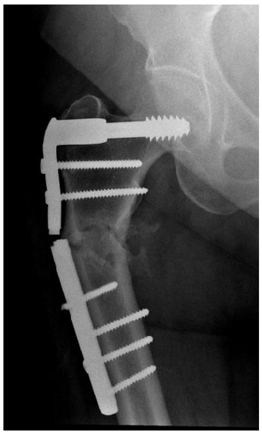

**Fig.4. Extra Medullary Implant Failure**

In group B (DCS), excellent results were 33%, Good 27% and Fair 40%. None of the cases showed poor results. One case of extra medullary device (DCS) implant failure is shown in Figure 3. Intra-operative and post-operative complications are shown in Figure8&9. Fracture union was confirmed with radiographs taken in AP & LATERAL view on each follow up.

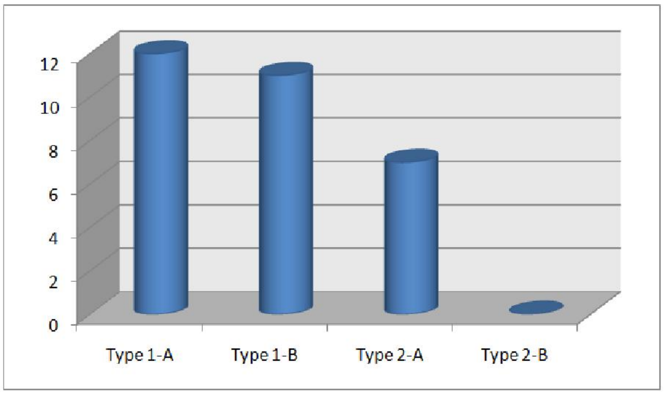


**Fig. 5. Cases Classified According to Russell-Taylor Classification**

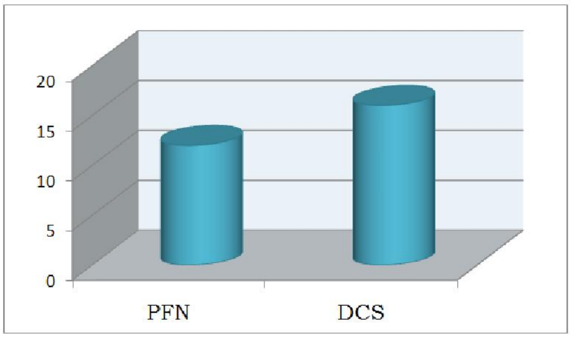


**Fig. 7. Comparison of Hospital Stay in Days in between two groups**

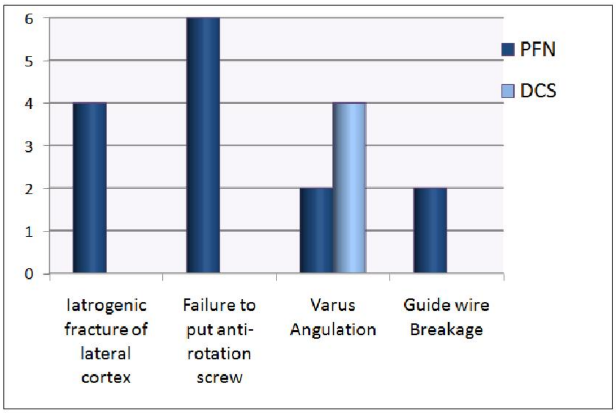


**Fig. 8. Intraoperative complications between groups**

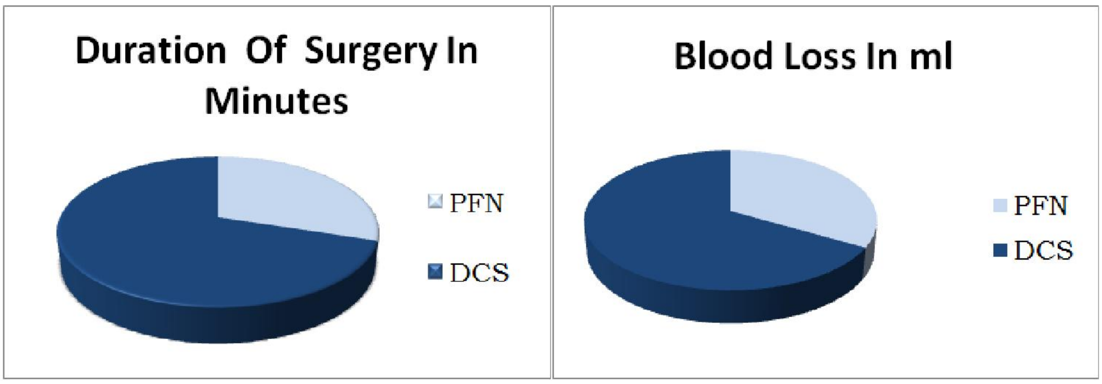


**Fig. 6. Comparison of intra-operative outcomes between two group**

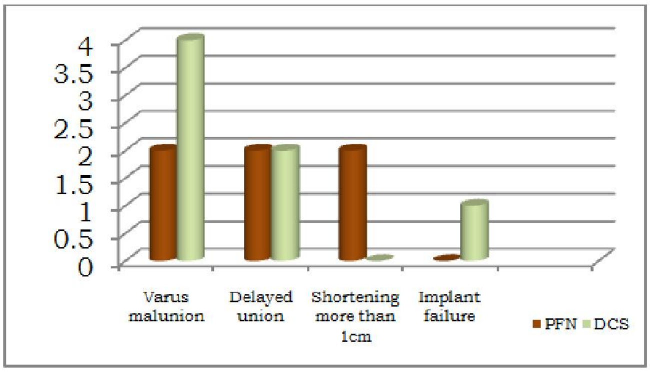


**Fig. 9. Delayed complications between two groups**

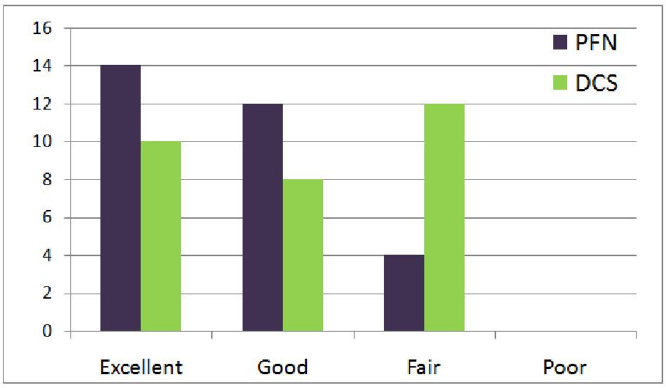


**Fig. 10. Comparison of Functional Outcomes between two groups**

## DISCUSSION

Subtrochanteric fractures are usually the result of high-energy trauma. Its significant displacement and great difficulty in closed reduction with traction causes delayed union, malunion and non-union of such fractures which favour operative management. Healing in the cortical bone of the subtrochanteric region is slower than in the cancellous intertrochanteric region (Schipper, 2002 and Saarenpää, 2007). The dynamic condylar screw and plate provides strong fixation in the cancellous bone of the neck and the head with considerable rotational stability. Additional screw fixation of the proximal fragments in the head and the calcar enhances the stability of the construct. After indirect reconstruction of the medial cortex the dynamic condylar screw and plate acts as a tension band device on the lateral side (Rybicki, 1972). With insufficient reconstruction of the medial cortex the implant is loaded with substantial bending forces and strict partial weight bearing has to be observed Siebenrock *et al*. (1998) found that when a conventional technique was used for subtrochanteric fracture fixation with a condylar scew plate there was a greater incidence of delayed union or non-union (16.6%) (Vanderschot, 1995) and a higher infection rate as compared to fixation done by a biological method.

Using the DCS in the conventional technique fixation failures have been equally high (20%) (Nungu *et al*., 1993). Extramedullary fixation with plating has the potential disadvantages of extensive surgical dissection, significant soft tissue damage and blood loss. This leads to problems of fracture non-union and implant failure. Nungu *et al*. (1993), Warwick *et al*. (1995) and Wile *et al*. (1983), reported delayed union or non-union and implant failure in the range of 15–17% using compression hip screw devices to treat such fractures. Intramedullary fixation allows a minimally invasive approach. It is closely related to biological internal fixation and has mechanical benefits over plate fixation. It also allows minimal soft tissue dissection which reduces surgical trauma, blood loss, incidence of infection and wound complications (Boldin, 2003). The AO-ASIF in 1996 developed PFN to reduce the risk of implant-related complications. In addition to the 8 mm load bearing femoral neck screw, the PFN has a 6.5 mm anti rotation screw to increase the rotational stability of the neck fragment.

An anatomic 6° neck valgus bend in the coronal plane, a narrower distal diameter and distal flexibility of the nail eliminates the need for routine reaming of the femoral shaft and also minimizes stress concentration and tension in the femoral shaft (Rüedi *et al*., 2000 and Simmermacher *et al*., 1999). This should reduce the risk of intraoperative andpostoperative femoral shaft fracture. PFN reduces the risk of implant-related complications. In addition to the 8 mm load bearing femoral neck screw, the PFN has a 6.5 mm anti rotation screw to increase the rotational stability of the neck fragment. PFN also has all the advantages of intramedullary devices such as decrease of the moment arm and can be inserted by closed technique which retains the fracture hematoma and decreases blood loss. In an experimental study, Gotze *et al*. (1998) compared the load bearing ability of osteosynthesis of unstable and subtrochanteric fractures and found that the PFN could bear the highest loads of all devices. In the current study, results for group A (PFN) were excellent in 47% of cases, good in 40% of cases and fair in 12% of cases. Corresponding data in group B (DCS) is 33%, 27% and 40%. None of the cases showed poor results.

### Conclusion

In the treatment of Subtrochanteric fractures, extra medullary methods of fixation are being replaced more and more by the newer intramedullary techniques as it has high rates of union, minimal soft-tissue damage, minimal blood loss and lesser hospital stay. In addition, use of intramedullary PFN in the treatment of subtrochanteric fractures may have a positive effect on the speed of rehabilitation.

## REFERENCES

Baumgaertner, M.R., Chrostowski, J.H., Levy, R.N. 1998. Intertrochanteric hip fracture. In: Brown BD, Jupiter JB, Levine AM, Trafton PG, editors. Skeletal trauma: Fractures, dislocations, ligamentous injuries. Philadelphia: WB Saunders; p.1833-81. Back to cited text no. 5

Boldin, C., Seibert, F.J., Fankhauser, F., *et al*. 2003. The proximal femoral nail (PFN)-a minimal invasive treatment of unstable proximal femoral fractures: a prospective study of 55 patients with a follow-up of 15 months [J]. *Acta Orthop Scand;* 74(1):53-8.

Cummings, S.R., Kelsey, J.L., Nevitt, M.C., O'Dowd, K.J. 1985. Epidemiology of osteoporosis and osteoporotic fractures. *Epidemiol Rev* ;7:178-208. Back to cited text no. 2

Cummings, S.R., Rubin, S.M., Black, D. 1990. The future of hip fractures in the United States. Numbers, costs, and potential effects of postmenopausal estrogen. *ClinOrthop* 1990; 252:163-6. Back to cited text no. 1

Götze, B., Bonnaire, F., Weise, K., *et al*. Belastbahrkeit von osteosynthesenbeiinstabilen per- und subtrochanterenfemurfracturen [J]. Akt Traumatol 1998 ; 28:197-204.

Haidukewych, G.J., Israel, T.A., Berry, D.J. 2001. Reverse obliquity fractures of the intertrochanteric region of the femur. *J Bone Joint Surg Am*; 83:643-50. Back to cited text no. 3

Koval, K.J., Cantu, R.V. 2006. Intertrochanteric fractures. In: Bucholz RW, Heckman JD, Court-Brown CM, eds. Rockwood and Green's fractures in adults. 6 th Ed, vol. 2. Philadelphia: Lippincott Williams and Wilkins; p. 1793-825. Back to cited text no. 4

Leung, K.S., So, W.S., Shen, W.Y., Hui, P.W. 1992. Gamma nails and dynamic hip screws for peritrochanteric fractures. A randomised prospective study in elderly patients. *J Bone Joint Surg Br*; 74:345-51. Back to cited text no. 8

Muller, M.E., Allgower, M., Schneider, R., *et al*. 1990. Manual of internal fixation: techniques recommended by the AO group [M]. 3rd ed. Berlin: Springer-Verlag, 5-9.

Nungu, K.S., Olerud, C., Rehnberg. L. 1993. Treatment of subtrochanteric fractures with the AO dynamic condylar screw Injury, 24 (2) , pp. 90–92

Rüedi, T.P., Murphy, W.M. 2000. AO Principles of Fracture Management [M]. 2nd ed. Stuttgart, New York: Thieme Publishers; 751-5.

Russell-Taylor, 1998. Classification of subtrochanteric fractures. Skeletal Trauma ;2:1891-7.

Rybicki, E.F., Simonen, F.A., Weis E.B Jr. On the mathematical analysis of stress in the human femur *J. Biomech.,* 5 (1972), p. 203

Saarenpää, I., Heikkinen, T., Jalovaara, P. 2007. Treatment of subtrochanteric fractures. A comparison of the Gamma nail and the dynamic hip screw: short-term outcome in 58 patients [J]. *Int Orthop*;31(1):65-70.

Sadowski, C., Lübbeke, A., Saudan, M., Riand, N., Stern, R., Hoffmeyer, P. 2002. Treatment of reverse oblique and transverse intratrochanteric fractures with use of an intramedullary nail or a 95° screw-plate. *J Bone Joint Surg Am*; 84:372-81. Back to cited text no. 7

Sanders, R., Regazzoni, P. 1989. Treatment of subtrochanteric femur fractures using the dynamic condylar screw. *J Orthop Trauma* ;3:206-13. Back to cited text no. 6

Schipper, I.B., Bresina, S., Wahl, D., *et al*. 2002. Biomechanical evaluation of the proximal femoral nail [J]. *Clin Orthop Relat Res*; (405):277-86.

Siebenrock, K.A., Muller, U., Ganz, R. 1998. Indirect reduction with a condylar blade plate for osteosynthesis of subtrochanteric femoral fractures. *Injury*; 29(Suppl 3):C7–15.

Simmermacher, R.K., Bosch, A.M., Werken, C. 1999. The AO/ ASIF-proximal femoral nail (PFN): a new device for the treatment of unstable proximal femoral fractures [J]. Injury ;30(5):327-32.

Vanderschot, P., Verheyen, L., Broos, P. 1995. A review on 161 subtrochanteric fractures—risk factors influencing outcome: age, fracture pattern and fracture level Unfallchirurg, 98 (5), pp. 265–271

Warwick, D.J., Crichlow, T.P.K.R., Langkamer, V.G. and M Jackson. 1995. The dynamic condylar screw in the management of subtrochanteric fractures of the femur Injury, 26 (1995), p. 241

Wile, P.B., Panjabi, M.M. and Southwick W.O. 1983. Treatment of subtrochanteric fractures with a high-angle compression hip screw. *Clin. Orthop*., 175 (1983), p. 72

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