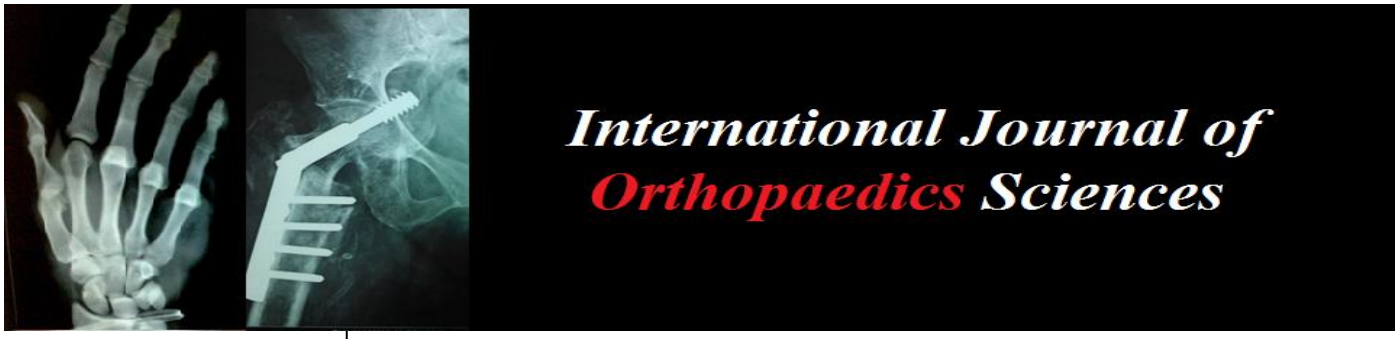

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Is trochanteric fixation nail a better implant in the management of intertrochanteric fracture in elderly compared to dynamic hip screw

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Abstract
Background: Intertrochanteric fractures are the most common fractures in elderly and have devastating sequence if not managed properly. The ultimate goal in the management of Intertrochanteric fracture is early mobilization of patients to prevent morbidity and mortality. Early mobilization primarily depends on the implant used & stability of the surgical construct. The purpose of this study is to compare the functional and radiological outcome of intertrochanteric fractures in elderly & osteoporotic patients managed with Dynamic Hip Screw (DHS) & Trochanteric Fixation Nail (TFN).
Materials and Methods: The present study was carried out at Rajah Muthiah Medical College & Hospital from June 2016 to May 2017. 20 patients of age more than 60 years with intertrochanteric factures of femur were treated with Trochanteric Fixation nail (10 cases) and Dynamic Hip Screw (10 cases).
Discussion: Individual cases were followed up for at least 24 weeks to one year and during each & every follow up visit clinical, radiological, functional outcomes were documented, analyzed, evaluated and compared. In our study of 10 patients, we had 8 patients (40%) with stable type of fracture pattern and 12 patients (60%) cases were of unstable fracture pattern. 5 patients underwent DHS and 3 patients underwent TFN in the stable category of 8.Whereas 5 patients underwent DHS and 7 patients underwent TFN in unstable Intertrochanteric fracture group of 12 patients.
Results: The Average time taken for union was about 16 weeks (Range: 12 to 20 weeks) and full weight bearing correlated well with the time of fracture union.
Conclusion: We conclude that the fracture pattern& experience of the surgeon are the primary determinants of implants choice & primary fixation of intertrochanteric fractures aid early rehabilitation and return back to activities of daily living.

Keywords: intertrochanteric fracture, trochanteric fixation nail, dynamic hip screw

Introduction
Proximal femur fractures are relatively common in elderly individuals, constituting about 11.6% of total fractures. Among these intertrochanteric fractures constitute 53.4% with a female predominance in the ratio of 3:1 [1]. Intertrochanteric fractures are commonly seen in elderly over 60 years of age, due to trivial trauma. Incidence of theses fractures has increased primarily due to increasing life span with increased incidence of osteoporosis and more sedentary lifestyle brought by urbanization.
Majority of the intertrochanteric fractures (90%) result from simple slip & fall and pathological fractures constitute 1.3% of total fractures [2]. These fractures form sizeable portion of admissions to trauma ward and their management has created considerable interest in this modern era. Fractures union is not a major problem due to abundant blood supply, cancellous nature of bone and a wide cross sectional area at fracture site [3]. Majority of the treatment modalities are aimed at preventing malunion and deformity. The standard treatment for intertrochanteric fracture is stable internal fixation with early mobilization.
Even though conservative treatment yields good results it necessitates prolonged immobilization of not less than two months duration with obvious economic implications, complications including pin tract infections and effects of prolonged bed rest like bed sores, deep vein thrombosis, fracture disease, pulmonary thromboembolism, varus drift and shortening.

Hence surgery is the mainstay of treatment.

The goal of surgical management is fracture reduction to near anatomic alignment & obtaining normal femoral anteversion [4].Various implants are available in this modern era which can be broadly classified into intramedullary devices and extramedullary devices. Extramedullary device primarily include the Dynamic Hip Screw which include the Richard screw in fixed angle and side plate, which is considered gold standard in the management of intertrochanteric fractures. Intra medullary fixation include devices like Gamma nail, Russell - Taylor reconstruction nail, TFN (Trochanter fixation nail) and the PFN (Proximal femoral nail).

DHS has biomechanical disadvantage compared with the intramedullary implants because of a wider distance between the weight bearing axis and the implant [5]. It hasn't performed very well in unstable intertrochanteric fractures, with high rates of failure [6]. The Trochanteric nail (TFN) has been in use in treating trochanteric fractures in very recent years [7].TFN being an intramedullary implant enjoys the theoretical advantage of being a biomechanically stable construct. Several reports show benefits of proximal femoral nails [8], but it is still associated with technical failures.

This study consists of 20 cases of intertrochanteric fractures in gediatric patients selected randomly and treated by TFN (intramedullary device) or DHS (extramedullary device) and comparison of their clinical outcome.

Materials and Methods

Ethical Committee of Rajah Muthiah Medical College & Hospital, Annamalai University had granted Ethical approval for this study and it has been performed in accordance with the Ethical standards of the 1964 Declaration of Helsinki as revised in 2000.

In this prospective study, all consecutive patients (T=20) with intertrochanteric femoral fractures were randomized to undergo fixation with the DHS or the TFN device between June 2016 and May 2017.

Inclusion Criteria

AO types (AO 31A1 to A3),
61 to 90 years of age.

Exclusion Criteria

Pathological fracture
Inability to walk before the fracture
Associated neurological disorders
Poly trauma patients

Course in Hospital

When the patient comes to the Emergency/OPD with suspected Intertrochanteric fracture, necessary clinical and radiological evaluation was done and admitted to ward after necessary resuscitation and splintage with either skin or skeletal traction. All the routine investigations were done as follows: haemogram, blood urea, serum creatinine, blood sugar level, serum electrolytes, blood grouping & typing, HIV, HBsAg, HCV, Chest X-ray and ECG. All the patients were evaluated for associated medical problems and opinion was obtained from respective department and treated accordingly. The patients were operated on after anaesthetic assessment

Written & Informed Consent

Written informed consent in regional language were obtained from every patient, prior to including them in the study.

The hypothesis was that the TFN would have better functional outcome and fewer complication rates than the DHS. The primary comparative parameters were clinical and radiological union of the fracture. Secondary comparative parameters were intra-operative complications, revision surgery (related to the failure of primary treatment) morbidity & mortality. Baseline characteristics were documented pre-operatively; outcome measures were subdivided into intra-operative, post-operative and follow-up data at six weeks, three months and six months. Functional assessment of patients were done using Modified Harris Hip Scoring system.

Pre-operative planning

1. Determination of Nail Diameter: It was measured at the level of Isthmus of femur in lateral X-ray.
2. Determination of Neck Shaft Angle: It was measured using goniometer on the normal side.
3. Length of Trochanteric Femoral Nail: A standard TFN - 18 cm in length was used in our study.

Surgical procedure for TFN

The TFN used in the study was a Stainless Steel (316 LVM) nail of 180 mm in length and 9,10, 11, and 12 mm in diameter, which was inserted into the medullary canal. Two screws (one cervical screw & other de rotation screw) were inserted in the femoral head-neck fragment. These screws provide rotational stability. The TFN can be distally locked either dynamically or statically. Surgery was performed with the patient in the supine position on a fracture table, with the injured extremity slightly adducted to facilitate insertion of the implant. After surgery, the patients were mobilized and given standard rehabilitation instructions by a physiotherapist.

Surgical procedure for DHS

The DHS used in the study was Indian make stainless steel one. Richard screw of varying length & other de rotation screw (4mm cc) with washer were used when required with a fixed 135 degree angle plate. Side plate with minimum of three holes fixed with 4.5 mm cortical screws were used. Surgery was performed with the patient in the supine position on a fracture table, with the unaffected hip being placed in abduction and flexed position. Fracture reduction was done by applying longitudinal traction followed by abduction to correct varus and external rotation and then internal rotation of distal segment [10]. Fracture fixation with the DHS was performed according to the surgical technique described by Campbell's Operative Orthopaedics 12th edition [9]. After surgery, patients were mobilized and given standard rehabilitation instructions by a physiotherapist.

Post-operative care

1. Elevation of Operated limb for a day.
2. Broad spectrum antibiotics(Intravenous) for 5 days
3. On 2nd post-operative day- Static quadriceps exercises were begun
4. On 5th post-operative day -Active quadriceps exercises and hip flexion exercises were started.
5. Patient was encouraged non-weight bearing ambulation withwalker.
6. On 12th post-operative day -Alternate sutures were removed
7. On 13th post-operative day - complete suture removal was done.
8. Partial weight bearing was started at about 6 weeks post-

operatively after noticing clinical and radiological union progressing at satisfactory levels.

9. Full weight-bearing was allowed only after the confirmation of radiological union and confirmation of clinical union by assessing pain, fracture gap and other parameters clinically.

Patient assessment and follow UP

Intra-operatively, blood loss was measured from the number of mopping pads and quantum of blood in suction unit. The time required for closed reduction of the fracture, the operating time and the fluoroscopy time were recorded. The demographic data (age and sex), perioperative information and length of hospital stay were recorded for each patient.

Follow-up evaluations consisting of clinical examination, assessment of functional outcome and radiographs, were performed at 6 weeks, 3 months, 6 months and then annually. Patients were followed up for a minimum of 1 year. Functional outcomes were assessed using the Harris Hip scoring system. Patient outcome scores were categorized as excellent (≥ 90), good (89 – 80), fair (79 – 70) or poor (≤ 70). Radiographic evaluation was done for fracture union, extent of fracture collapse, medial displacement, neck-shaft angle alteration, implant failure and change in implant position. Radiographic fracture union was defined as the presence of bridging callus on antero-posterior and lateral radiographs.

Results

Table 1: Age wise distribution of patients

Age Group	No. of Patients in DHS Group	No. of Patients in TFN Group	Total	%
61 to 65	3	2	5	25
66 to 70	2	2	4	20
71 to 75	2	3	5	25
76 to 80	2	1	3	15
81 to 85	1	2	3	15
86 to 90	0	0	0	0
Total	10	10	20	100

1. In our study, majority of cases were in the age group of 61 to 75 years- 14 cases [70%].
2. Mean age of patient in DHS group = 62.3 years.
3. Mean age of patient in TFN group = 73.9 years.

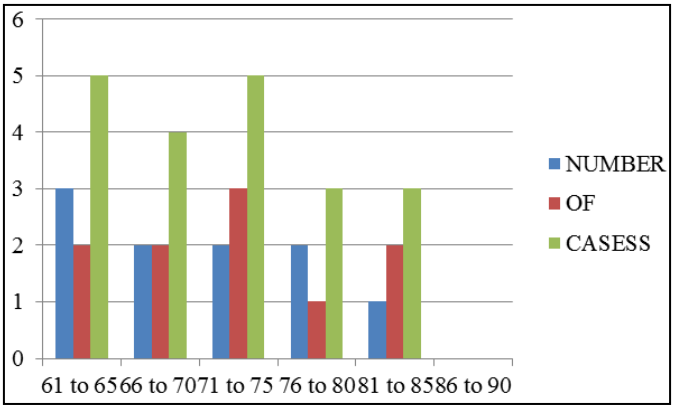
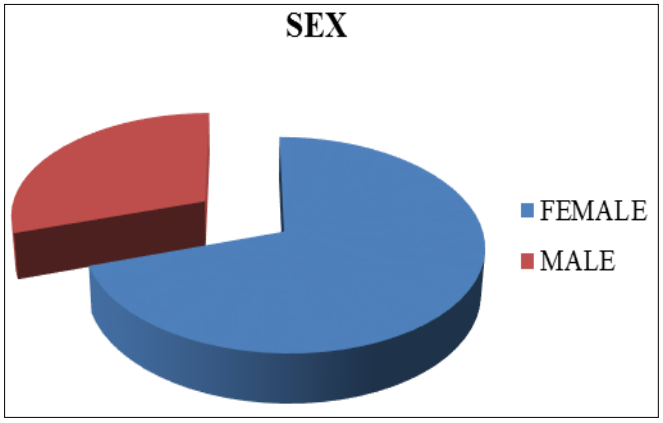


Table 2: Sex wise Distribution of Cases

Sex	DHS	PFN	%
Female	6	8	70
Male	4	2	30
Total	10	10	100



1. Most of the cases (70%) in our study were females.

Table 3: Side Distribution

Side	DHS	PFN	Total	%
Right	3	4	7	35
Left	7	6	13	65
Total	10	10	20	100

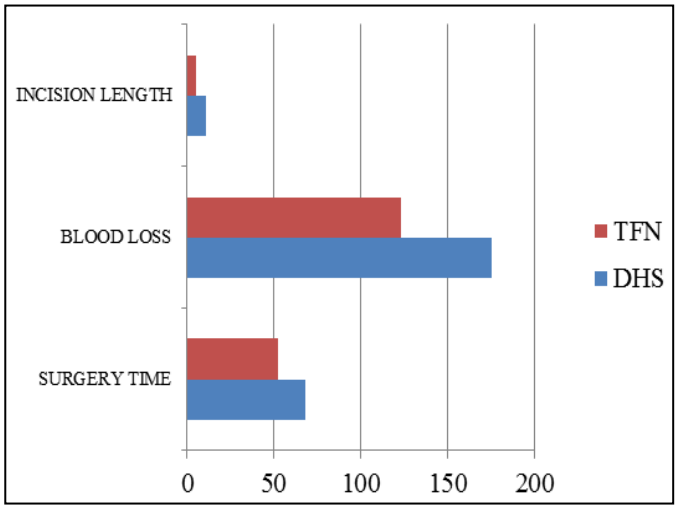
1. Majority of cases were left sided injuries

Table 4: AO classification for Intertrochanteric Fracture

Type of fracture	No. of patients (TFN)	No. of Patients (DHS)
31-A1	5	3
31-A2	3	4
31-A3	2	3

Table 5: Comparison in Intra Operative factors of Patients treated for Intertrochanteric Fracture of Femur

Factors	DHS	Trochanteric Fixation Nail
Average time taken for surgery from admission in Days	6.2	5.6
Mean Duration of Operation in Minutes	68.15	52.25
Mean Blood Loss in ml	175.85	123.4
Mean Length of Incision in cm	11.25	5.8



1. The average surgical time was more in DHS group than the patients in TFN group
2. The mean blood loss was more in patients with DHS compared to the TFN group.
3. The average length of incision was more in DHS group when compared to the TFN group.

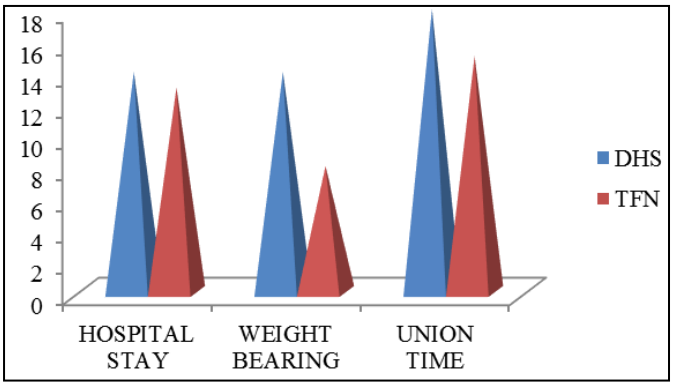
Table 6: Intra-operative Complications of Patients treated for Inter trochanteric Fracture with TFN & DHS

Complications	DHS	TFN
Failure of Closed Reduction	2	1
Fracture of Lateral Cortex	0	0
Difficulty in Introducing Two Screws in Neck	0	1
Failure of Distal Locking	0	1

1. Intraoperative complications were relatively more in the TFN group as the procedure was a relatively new technique and required experience but can be simplified to perfection with practice

Table 7: Radiological & functional -Outcome of Patients treated for Inter trochanteric Fracture of Femur in TFN & DHS

Factors	DHS	TFN
Mean Duration of Hospital Stay in Days	14.8	13.6
Mean Time of full Weight Bearing in Weeks	14.5	8.7
Mean Duration of Fracture Union in weeks.	18.7	15.4
Mean Harris Hip	68.26	84.34
Score in 6 Weeks		
Mean Harris Hip		
Score in 20 Weeks	82.45	91.83



1. Mean duration of hospital stay was slightly more in DHS group than TFN
2. Time of initiating on full weight bearing was relatively late in DHS group compared to TFN group.
3. Time of radiological union was earlier in TFN group than DHS
4. Fracture union was faster in TFN group [15.4 weeks] when compared to DHS group [18.7 weeks].
5. Harris hip score (Mean) was more in TFN group at 6 weeks after surgery and at 20 weeks period.
6. TFN group had early rehabilitation and early weight-bearing when compared to DHS group due to minimal invasive nature of surgery.

Table 8: Post-operative Complications

Complications	DHS	TFN
Infection	1	0
Lag Screw Cutting Out	1	0
Z effect	0	1
Shortening > 2 cm	2	0
Persistent Hip Pain	2	0
Varus Displacement > 10 *	1	0
Persistent thigh pain	1	1

1. In DHS group- One case of infection was noted
2. One case of lag screw cut-out in DHS group and one case of 'Z' effect in TFN group was observed.
3. In DHS group shortening of more than 2 cm was noticed in two case and varus displacement >10 degree in one case was observed.
4. There was no infection, no distal femoral shaft fracture, nor any shortening and varus displacement in TFN Group.
5. Persistent hip occurred in 2 cases in DHS group.
6. Persistent thigh pain occurred in one cases in each TFN & DHS group.
7. Post-operative complications were less in TFN group compared to DHS group.

Implant Related Intra-operative Complications

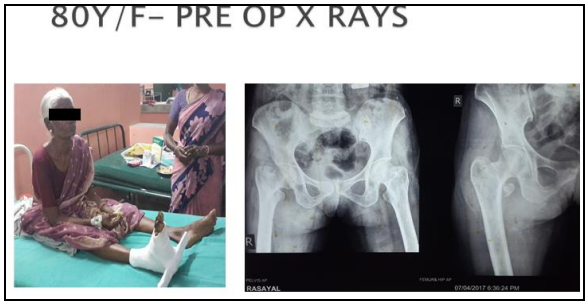
In one cases of TFN, during surgery we were unable to put the second screw (derotation screw) which was encountered due ill-fitting jig. Besides this we had one case in which there was difficulty in fracture reduction and in one case there was a failure in distal locking.

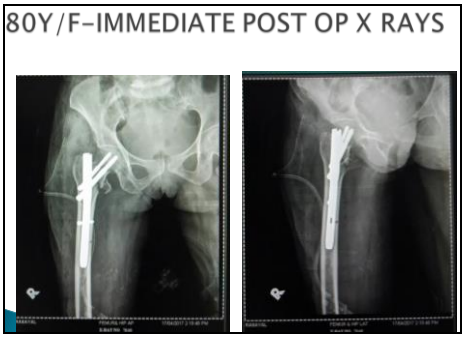
In the DHS group, we had difficulty in reduction in one case which was due to delay in surgery for about 2 weeks as it was a known case of uncontrolled diabetes & hypertension and hence was operated late.

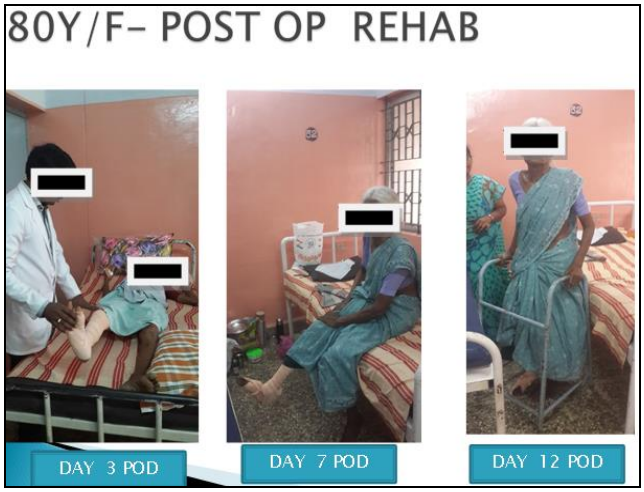
Radiation Exposure

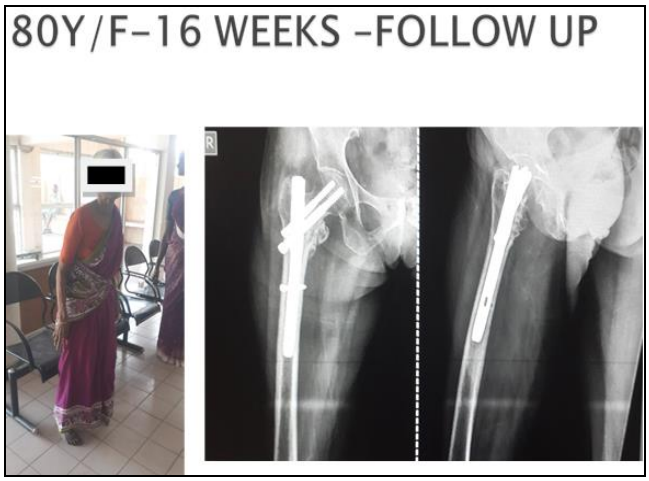
Radiation exposure was more in TFN group than in DHS group as more views were required to confirm the position of screws in the head

Case Reports









Discussion

While a wide range of intertrochanteric fracture fixation devices have been employed over the years, the choice for optimal fixation device is still controversial at present[11]. Intertrochanteric fractures in the elderly pose certain special problems. In this age group the fracture configuration is generally comminuted with presence of extensive osteoporosis. There is problem with correct and accurate placement of the implant and hold of the implant[12]. So if the fixation is not stable, prolonged immobilization may be required to achieve complete union.

Anthropometric measurements of proximal femur in Indian population is smaller than western population. So there appeared a need of design suitable for Indian Population. Egol KA, Chang EY, Cvitkovic J, Kummer FJ, Koval KJ [13] (2004) did a study on the mismatch of current intramedullary nails with the anterior bow of the femur. They inferred that Intra-operative complications such as splintering and fractures are due to oversized implants that are manufactured according to western population parameters. In India, the proximal femoral nail is available with a length of 200-240 mm. It crosses the middiaphysis of the femur. This may give rise to intra-operative femoral shaft fractures and thigh pain, because the implant touches the anterior cortex of the femur.

Trochanteric Femoral Nail (TFN) is relatively new member in the intramedullary group. Very few biomechanical and clinical studies have been published over its efficacy [14]. No vast published data regarding the comparative study about the efficacy and functional outcome with the use of TFN and DHS in comminuted unstable trochanteric fractures is available. Hence this study was undertaken at the Rajah Muthiah Medical College & Hospital, Annamalai University, Chidambaram from June 2016 to May 2017.

In our study the primary advantages of TFN were - smaller incision, less blood loss & less morbidity. The mechanical advantage Trochanteric Fixation Nail were that it possesed shorter lever arm and lower bending movement. TFN was found to be the implant of choice in osteoporotic bones. Its blunt end and length (180mm) ensured that it was well above anterior bow of femur and avoided anterior cortical penetration which was common in osteoporotic individuals. Complications like malrotation and other deformities in treating intertrochanteric fracture were less in our study. The mean blood loss was very much less in TFN group. Varus collapse and shortening were more in DHS group than TFN group. There were no femoral shaft fracture in our study though it was reported as a complications in various literatures. Radiation exposure was less in DHS than in TFN. Intra operative complications were less in DHS than in TFN because of familiarity of the standard procedure. Rate of fracture union & mobilisation were early in TFN group. DHS was found to be the implant of choice as far as stable fracture is concerned. But for unstable fracture the pendulum swings in favour of TFN.

Conclusion

Thus, we can safely conclude that choice of implants depend on the experience of the surgeon and the type of fracture pattern. In our study, we also conclude that fixation of intertrochanteric fractures aid in early rehabilitation and early weight bearing and TFN definitely had an edge over DHS both in terms of better functional outcome, radiological union & less post operative complications.

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