

Different Methods of Treatment of Trochanteric Fractures in Elderly

Ayman M. Abbas, Galal El Din H. Kazem, Abd El Salam Abd El Alem, Saad A. Shoulah

Department of Orthopaedics,
Benha faculty of medicine,
Banha University, Egypt.

Correspondence to: Ayman
M. Abbas, Department of
Orthopaedics , Benha faculty of
medicine, Banha University,
Egypt.

Email:

ayman.yougi@gmail.com

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Abstract:

Background: Trochanteric femoral fractures constitute 3% of all fractures and a large portion of fractures after the age of 60. Trochanteric femoral fractures in elderly usually occur due to a low-energy trauma and can be treated successfully with internal fixation or prosthesis depending on the patient's age and general condition and also the quality of the bone. **Aim and Objective:** This is a systematic review to evaluate different techniques of fixation used in management of intertrochanteric fracture, regarding the efficacy results and complication of each technique in the literature. **Methods:** A review was performed using the Cochrane Central Register of Controlled Trials, PubMed, and MEDLINE as database for search. **Results:** the results of the study revealed that the percent of changes were 44.69% of RT side group A, 45.26% of RT side group B, 40.86% of LT side group A, and 45.90% of LT side group B with no significant difference between the studied groups. included studies focusing on intertrochanteric fracture fixation in elderly patients as the main

research point, if it was not the main point, paper was excluded. **Conclusion:** Prosthetic replacements can treat unstable intertrochanteric fracture well, if operative indication is correctly selected. It is suitable for elderly patients and the operation should be performed by experienced surgeons.

Keywords: Trochanteric, Femoral, Fractures, MEDLINE.

Introduction

Trochanteric femoral fractures constitute 3% of all fractures and a large portion of fractures after the age of 60. Trochanteric femoral fractures in elderly usually occur due to a low-energy trauma and can be treated successfully with internal fixation or prosthesis depending on the patient's age, general condition and also the quality of the bone. ⁽¹⁾

If they are not adequately treated, they may cause a considerable change in the quality of life. The trauma becomes more severe leading to prolonged bed ridden, and leads to worsening of existing disease, which is the major cause of mortality from this fracture especially in elderly⁽¹⁾.

Trochanteric fracture femur occurs in the area between the greater and lesser trochanter and may involve these two structures. Trochanteric fractures make up to 45% of all hip fractures. This region consists of weight bearing trabeculae and has a good amount of cancellous bone and vascularity thus minimizing the risk of avascular necrosis and non-union. Biomechanically, the structural composition of the femur (thigh bone), is adapted in response to the mechanical environment that it is subjected to. Trochanteric fractures can be classified in many ways viz, Evan's classification,

Kyle's Classification, Jenson's classification. All of them divided this fracture into stable fractures and unstable fractures (reverse oblique and coronal split fractures).

Evans Classification⁽³⁾:

In 1949, Evans published his classification on intertrochanteric (IT) fractures

Jensen's Modification of the Evans Classification⁽⁴⁾:

Jensen (1975) later modified Evans classification into three groups displaced or undisplaced stable 2-fragment fractures, unstable 3-fragment fractures with greater or lesser trochanter fracture and 4-fragment fractures

Kyle's Classification⁽⁶⁾:

Kyle has classified trochanteric fractures into four types.

Various treatment modalities⁽⁶⁾ have been introduced for the reduction and fixation of trochanteric fractures, ranging from conservative treatment to operative intervention in form of different techniques of internal and external fixation including dynamic hip screw (DHS), proximal femoral nail, trochanteric fixation nail (TFN), gamma nail, dynamic compression screw, proximal femoral plate, external fixator, bipolar hemi-arthroplasty. All of which have their specific advantages and disadvantages

The application of the contemporary operational methods substantially reduces the mortality risks, in comparison to the conservative methods of treatment, furthermore, the contemporary methods can result in fewer percentages of complications, and valid functional results⁽⁶⁾.

The goal of operative treatment is strong and stable fixation of the fracture fragment.

Dynamic hip screw (DHS) or Sliding Screw Fixation⁽⁷⁾ is a type of orthopedic implant designed for fixation of certain types of hip fractures. **The Gamma Nail⁽⁸⁾** is the latest advance in the treatment of trochanteric fractures based on intramedullary nailing principles during closed procedures. Its design is based on Küntscher's Y-nail and locking intramedullary (IM) nails.

Proximal femoral nail⁽⁹⁾ Helical blade PFN has been introduced as an intramedullary option in recent years. Helical PFN is more suitable implant for unstable trochanteric fractures in elderly, osteoporotic patients' population.

Conservative treatment⁽¹⁰⁾ in which, applying traction to the injured limb either via a pin inserted into the tibia (skeletal traction), or using adhesive tape or bandages applied to the injured leg (skin traction). Between four to nine kilo-grams of weight is

then applied to reduce the fracture. Traction is then maintained whilst the fracture heals, a period of two to four months.

Materials and Methods

A systematic review study was performed using the Cochrane Central Register of Controlled Trials, PubMed, and MEDLINE as database for search till the year of 2018 .

Search keywords were isolated or combined and included: intertrochanteric fracture, fixation and surgical management combined with elderly, elder or old age patients. We only included studies focusing on intertrochanteric fracture fixation in elderly patients as the main research point, if it was not the main point, paper was excluded.

This study was conducted according to the following eligibility criteria:

Inclusion criteria:

- Clinical studies with at least 2 years of follow up.
- English literatures only.

Exclusion criteria:

- Non-human studies.
- Reviews, commentaries, and general discussion papers not presenting data on impacts.
- Clinical studies with < 2 years of follow up.
- Case report

All abstracts were screened in duplicate. Abstracts proceeded to full-text review if they reported original data; assessed the fixation methods; included elderly participants with intertrochanteric fractures. Abstracts were excluded if they failed to meet the criteria above or if they included animals, reported nonoriginal data or included pediatric or young populations.

Abstracts selected for inclusion by either reviewer proceeded to full-text review.

For all studies, patient selection, study inclusion and exclusion criteria, patient characteristics, procedure protocol and outcomes measured were extracted using standardized data extraction forms. Outcomes for intervention, were extracted from each study.

Results:

Table 1: Studies used DHS for treatment of intertrochanteric fractures in elderly

Study (Author, date)	Aim	Type	Number of participants	Age Mean (range)	Follow up period
(Li et al. 2011)[104]	The therapeutic effect and characteristic of dynamic hip screw with modified reamer compared with DHS	Retrospective	54 patients Dynamic Hip Screw With Modified Reamer (MDHS) : 27 DHS: 27	79.4 (69 to 93) 77.2 (66 to 88)	27.6 (21-36 months)
(Wu et al. 2013)[105]	effectiveness of anterolateral C-shaped approach by comparing with traditional anterolateral approach	Retrospective	66 patients anterolateral C-shaped approach: 37 traditional anterolateral approach: 29		17.8 (12-24 months)

Table 2: Results of DHS for treatment of intertrochanteric fractures in elderly

Study (Author, date)	The time of fracture healing	The forepart movement time	The loosening screw	The Harris score of hip joint function
(Li et al. 2011)[104]	No significant difference ($P > 0.05$). was higher than that of MDHS	MDHS (14.2 ± 2.1) DHS (18.9 ± 3.1) ($P < 0.05$).	MDHS group (1 case) DHS group (8 cases) ($P < 0.05$).	MDHS (87.8 ± 4.7) DHS (83.3 ± 7.5) ($P < 0.05$).
(Wu et al. 2013)[105]	3-6 months (mean, 4.8 months)		No loosening or breaking of internal fixation was observed during follow-up period.	According to self-established criterion, improved group was significantly better than conventional group in recovery of hip joint motion and function at 6 and 12 months after operation ($P < 0.05$).

Table 3: Studies on proximal femoral nail for treatment of intertrochanteric fractures in elderly

Study (Author, date)	Aim	Type	Number of participants	of Age Mean (range)	Follow up period
(Wan et al. 2018)[106]	To investigate the difference in the effectiveness between proximal femoral nail anti-rotation (PFNA) and proximal femoral locking compression plate (PFLCP)	Retro	67 cases PFNA: 32 PFLCP: 35 cases		14 (12-24 months)
(Zhu et al. 2016)[107]	To compare clinical effect of closed reduction and limited open reduction and internal fixation with InterTan intramedullary nail	Retro	23 elderly -(closed reduction group): 12 cases -(limited reduction group): 11 cases	(63.6±12.1) years 60.8±12.5) years.	13.6 (12 to 23 months)

Table 4: Studies on arthroplasty for treatment of intertrochanteric fractures in elderly

Study	Aim	Type	Number of participant	Age Mean (range)	Follow up period
(Liu et al. 2008)[109]	To assess the curative effect and investigate the indications of total hip arthroplasty for comminuted intertrochanteric fracture	Interventional prospective	9 cases	68(48-75 years).	11 months (3 months-2 years)
(Zhang et al. 2013)[110]	Clinical efficacy of renovation stem revision femoral head arthroplasty for the treatment of unstable intertrochanteric fracture in the elderly.	Prospective study	32 patients	83.8 (80 to 98) years old	
(Zhang et al. 2005)[111]	To evaluate the clinical effect of bipolar long-stem prosthetic replacement on the treatment of comminuted intertrochanteric fracture of hip in the elderly osteoporotic patients.	prospective	18 patients Treated with bipolar long-stem prosthetic replacement.	Range from 72 to 91).	16.2 (6 to 28 months)
(Cui et al. 2016)[112]	To observe the clinical effect of steel cable or greater trochanter reattachment (GTR) device combined with cemented hip hemiarthroplasty for unstable intertrochanteric fracture in elderlies	Retrospective	57 patients received cemented bipolar femoral head replacement, using steel cable or GTR device	83 (80 to 95 years)	36 months

(Dong and Liao 2009)[113]	To investigate the operative procedure and the therapeutic effects of unstable femoral intertrochanteric fracture in elderly patients with rebuild septum bronchiale in artificial femoral head replacement.	Retrospective	113 elderly patients (test group):Treated with artificial femoral head replacement with fixation of femoral greater trochanter and smaller trochanter in the help of bone cement in 58 cases (control group): with gamma-type bone nail in 55 cases	Test group: 12-36 years months. Control group: 72.5 years
(Wang et al. 2018)[114]	To discuss the hemiarthroplasty	Retrospective	66 elderly patients Hip hemiarthroplasty: 34 cases Internal fixation: 32 cases.	85 (80 to 95) years old 2 years average
(Wada et al, 2017) [115]	To evaluate the clinical results of rigid fixation of the greater trochanter fragment through a consecutive hemiarthroplasty series using a cementless and modular calcar-replacement prosthesis with an integrated plate (MOD-Centaur stem)	Prospective interventional	44 very elderly patients	89.6 years average 1-year follow-up

Table 5: Results of comparative studies

	Healing time	joint activity	Complications	The Harris score of hip joint function
(Gashi et al. 2018) [119]		Early mobilization was significantly better in hemiarthroplasty (p<0.001) where 93.3% of patients started partial weight bearing on postoperative Day 1, while in the DHS group, 73.7% of patients started partial weight bearing after two weeks postoperatively.	Mortality rate did not differ between the two groups, but general and mechanical complications were more common in the DHS group.	The mean Harris Hip score was better in the hemiarthroplasty group (91.14 vs 74.11).
(Sun et al. 2016) [120]	In the clinical healing time of fracture, the PFNA group was significantly differently less than that of the reconstructing calcar group (P<0.05).	There were significant in the incision length, operation time, blood loss volume, clinical healing time of fracture.	1 case of screw blade cutting and 1 case of deep venous thrombosis in PFNA group; there was 1 case of deep venous thrombosis in the reconstructing calcar group (X ² =0.000, P=1.000).	There were no significant in postoperative partial weight bearing standing time, postoperative complications, hip functional score of Harris between two group.

Discussion

Open reduction and internal fixation (ORIF) are indicated for all intertrochanteric fractures, unless the patient's medical condition unsuitable for any anesthesia, whether general or spinal.

Total hip arthroplasty has a limited role in treatment and is usually reserved for patients with coexisting severe symptomatic arthritis of the hip. External fixation is also rarely indicated but is useful as a quick procedure in patients who may not tolerate general or spinal anesthesia and can only tolerate local techniques. Medial displacement osteotomy and valgus reduction are no longer practiced, because of the severe deformities they produced and because of substantial advances in the understanding of fracture fixation.

Surgery is contraindicated if the patient has an uncontrollable or uncorrectable bleeding disorder or another non-correctable metabolic disorder with an unacceptable mortality. It is also contraindicated if the patient has a stable, non-displaced intertrochanteric fracture, can physically and mentally tolerate nonsurgical care, and declines surgery for personal reasons.

The future of intertrochanteric fracture repair focuses, in part, on preventing such

fractures by means of antiosteoporosis treatments, including medications and health programs. Another focus includes fixation devices that require smaller incisions and are more forgiving, with retention of the fixation, regardless of whether the fracture is ideally reduced or has an element of instability.

A final goal is to eliminate or substantially decrease the mortality and morbidity of postoperative deep vein thrombosis (DVT) and pulmonary embolism (PE) by developing a better understanding of the clotting mechanism and the genetic, metabolic, serologic, and hormonal factors that affect the likelihood of developing PE.

Open reduction and internal fixation and Arthroplasty confined themselves to the management of unstable trochanteric fractures in people older than 70 years. Indeed, it is likely that stable fractures can be treated by internal fixation with a lower incidence of fixation complications than for unstable fractures. In parallel with treatment of people with intra-capsular fracture, arthroplasty is less likely to be considered for younger patients. Though ORIF and ARTHROPLASTY made the same basic comparison, there were important

differences in the interventions (cemented versus cementless arthroplasty; extra medullary versus intramedullary fixation) under comparison. Individually and overall the numbers of participants of the studies were too small to be able to detect any clear differences in mortality, morbidity or function. The statistically significant difference in mortality at “three years” has to be viewed with caution for several reasons: because of (a) the underlying variable follow up ranging from 24 months to 58 months, (b) the lack of a clear difference in mortality at one year, and (c) that the causes of death between one and three years were not known. There were inadequate results for longer-term outcome including a lack of information on longer-term complications in both trials.

In summary, the evidence from these trials was insufficient to be able to draw any definite conclusions about the relative merits of each type of operation. Furthermore, ORIF and ARTHROPLASTY, in particular, had methodological flaws that could have affected their findings and gave an adequate account of long-term outcome [11, 12].

This review was performed in an attempt to find evidence-based support for consensus of best treatment of unstable trochanteric femoral fractures and to discuss the current state of the art of treatment. There are some

limitations to this review literature since 1990 revealed a limited number of publications assessing too many different treatment methods to perform a systematic review. Moreover, methodology was found to be too defective for analysis, as for instance, method of randomization was not known in nearly half of the studies, and most did not include enough patients (power analysis was rarely presented). Many trials included both stable and unstable fractures; published studies could be used for specific analysis of results in unstable fractures. Randomized trials were selected starting from publication year 1990, as earlier study results may have been biased in favors of the sliding hip screw, because of limited experience with intramedullary devices. When we considered the results of the ORIF trials in general, treatment of unstable trochanteric fractures with extra-medullary devices showed high cut out and varus displacement rates, and a very high incidence of wound problems and infections. Treatment of unstable trochanteric fractures with intramedullary devices showed less complications and re-operations. The intramedullary fixation showed a lower risk of implant related complications, earlier and better mobilization capacity, less impaction of the fracture area and less limb shortening. Finally, other studies focused on patients

with unstable fractures only, and found significant fracture related complications and implant failures after extra medullary treatment, whereas hardly any of these problems were seen after intramedullary stabilization. Unfortunately, none of the reviewed trials comparing intramedullary and extra medullary treatment, analyzed groups with high numbers of unstable trochanteric fractures. Based on the above-mentioned limitations, attempts to find an evidence-based clinical consensus for the treatment of unstable trochanteric fractures remain unsuccessful.

As the experience of surgeons with the various intramedullary fixation systems increases, treatment results tend to improve, with less intraoperative and postoperative complications.

Modifications like adapted distal interlocking options have reduced the risk of postoperative adverse events, and emphasis on the correct positioning of the fixation device in the femoral head after optimal reduction of the fracture will help further decrease the risk of cut-out [13].

External fixation was introduced for the management of trochanteric fractures at about the same time as the first sliding internal fixation devices but its use has decreased considerably in recent years.

Studies comparing external fixation to sliding hip screws have reported superior outcomes in favor of external fixation. Collapse of the fracture into varus commonly found in unstable fractures but this seems to be well tolerated by elderly, possibly because of their low demands in activities of daily living [14-15].

Conclusion

Prosthetic replacements can well treat unstable intertrochanteric fracture if operative indication is correctly selected. It is suitable for elderly patients and the operation should be performed by experienced surgeons

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