Evaluation of proximal femoral plate in peritrochanteric fractures

Mohamed Y. Ali

Department of Orthopedic Surgery, Cairo University, Cairo, Egypt

Correspondence to Mohamed Y. Ali, MD, MRCS, MD, MRCS, Department of Orthopedics, Cairo University Hospital, Cairo, Egypt. fax: +20 225 170 541; e-mail: myouness@kasralainy.edu.eg

Received: 11 September 2017
Revised: 8 October 2017
Accepted: 1 November 2017
Published: 12 August 2021

The Egyptian Orthopaedic Journal 2020, 55:253–257

Background
Peritrochanteric fracture is one of the leading causes of mortality and morbidity of the elderly, in whom the fracture can occur from just a simple fall. In younger individuals, it occurs owing to severe trauma such as motor car accident or fall from a height. These type can occur in any age but got a higher incidence in the fifth and seventh decade of life. Multiple intramedullary and surface fixation implants have been designed to fix such a fracture, such as the dynamic hip screw, the anatomic proximal femoral plate, and the proximal femoral nail, but there is no single design that got the best results in all types of proximal femoral fracture.
Aim
To evaluate the outcomes of using proximal femoral plate in peritrochanteric fractures.
Patients and methods
A prospective study was conducted on 20 patients with proximal femoral fracture fixed by proximal femoral plate presented to the Cairo University Hospital from August 2014 to June 2016. The study included 14 male and six females. Their age ranged from 29 to 71 years old (mean 57 years old). The mode of trauma was three patients (15%) with motor car accident, three patients (15%) with motor bike accidents, 12 patients (60%) with fall on the ground, and two patients (10%) with fall from height. According to orthopeadic trauma association (OTA) classification, eight patients (40%) had 31-A2.1 pattern, six patients (30%) had 31-A2.2 pattern, and 2 patients (10%) had 31-A2 pattern.
Results
Radiological outcome was anatomical in eight patients (40%), satisfactory in nine patients (45%), and poor in three patients (15%). The follow-up was from 7 to 20 months (average 11 months). Fracture healing time ranged from 7 to 29 week (average 14 weeks). The modified Harris hip score was used to evaluate patients at 3 and 6 months postoperatively, which ranged from 60 to 74 (mean was 66.5±3.5) at 3 months and 68 to 93 (84.4±9.5) at 6 months.
Conclusion
Proximal femoral plate is an easy, safe, and dependable alternative for fixation proximal femoral fracture, giving satisfactory results comparable to other surface and intramedullary fixation devices, when applied in the accurate recommended position.

Keywords:
peritrochanteric fracture, proximal femoral plate, proximal femur

Egypt Orthop J 55:253–257

1110-1148

Introduction

Fractures of the proximal femur are a big challenge in traumatology. Patients of all age groups are affected, but the group in the fifth–seventh decades of life has been involved the most. Intertrochanteric fractures make up to 45% of all hip fractures [1]. Early surgical intervention is advocated in most patients to reduce the complications associated with long-term immobilization [2]. The aim of the surgery is to achieve initial stability and early mobilization of the patients to avoid complications, such as deep vein thrombosis, thrombophlebitis, pulmonary embolism, urinary, and lung infection and ulcers [3].

The peritrochanteric fracture is one of the most serious causes of mortality and morbidity in the elderly. Intertrochanteric fractures in younger individuals are usually the result of a high-energy injury, such as a motor car accident or fall from a height. Overall, 90% of intertrochanteric fractures in the elderly result from a simple fall. The tendency to fall increases with patient age and is exacerbated by several factors, including poor vision, decreased muscle power, labile blood pressure, decreased reflexes, vascular disease, and coexisting musculoskeletal pathology [4].

Trochanteric fracture is a serious injury that can lead to permanent disability, pneumonia, pulmonary embolism, and death [5]. Ambulation after a hip fracture is almost impossible until the fracture has been treated surgically [6]. Various intramedullary and extramedullary fixation methods are available for the surgical treatment of these fractures [7], such as the dynamic hip screw, the anatomic proximal femoral plate, and the proximal femoral nail; however, the ideal device for optimal fixation and optimal load transfer at the proximal femur and fracture line that fits all types of fractures has not been identified [8]. The dynamic hip screw (DHS) is extensively used to fix trochanteric fractures but has the following disadvantages: (a) lateralization of the greater trochanter, (b) excessive shortening of the femur, and (c) medialization of the femoral shaft [9]. The proximal femoral plate was designed to overcome the limitations of the DHS and to distribute proximal femoral loads and loads at the fracture line more evenly [10].

Patients and methods

A prospective study was done in Cairo University Hospital on 20 patients with peritrochanteric femoral fractures from August 2014 to June 2016, using anatomical proximal femoral pates for fixation. The study was approved by the institutional ethics committee in the Orthopedic Department of Orthopaedic Surgery, Ain Shams University, Cairo, Egypt. The study included traumatic and osteoporotic proximal femoral fracture in skeletally mature patients and excluded fractures for any other pathological case, and open fractures.

A detailed clinical history was taken in all patients, particularly regarding the history of the trauma: (mechanism of trauma, time of injury, side affected, and time elapsed till operation) as well as personal history, including name, sex, address, age, occupation, medical history, and previous surgeries. Clinical examination was done, including general examination and local examination: inspection of skin for its condition, edema and deformity, palpation for tenderness and functional disability, and neurological and vascular assessment of the affected limb.

Management

Frist aid

In polytrauma patients, resuscitation is done according to assisted trauma life support guide lines. Secondary to the previous survey, the traumatized leg is splinted. Frist aid measures for any other orthopedic insult are fulfilled. The patients should take analgesia and antiedematous unless there is a contraindication. Preoperative measures are done, including taking consent for operation.

The study included 14 male and six females. Their age ranged from 29 to 71 years (mean 57 years old). The mode of trauma was as follows: three patients (15%) with motor car accident, three patients (15%) with motor bike accidents, 12 patients (60%) with fall on the ground, and two patients (10%) with fall from height. According to orthopeadic trauma association (OTA) classification, eight patients (40%) had 31-A2.1 pattern, six patients (30%) had 31-A2.2, two patients (10%) had 31-A2.3, and four patients had 31-A3.3. A total of eight patients had associated injuries (four patients had distal radial fracture, two patients with fracture ribs, one patient with fracture humerus, and one patient with rupture spleen), and associated comorbidities were seen in six patients (four with hypertension and two with diabetes mellitus).

Operative technique

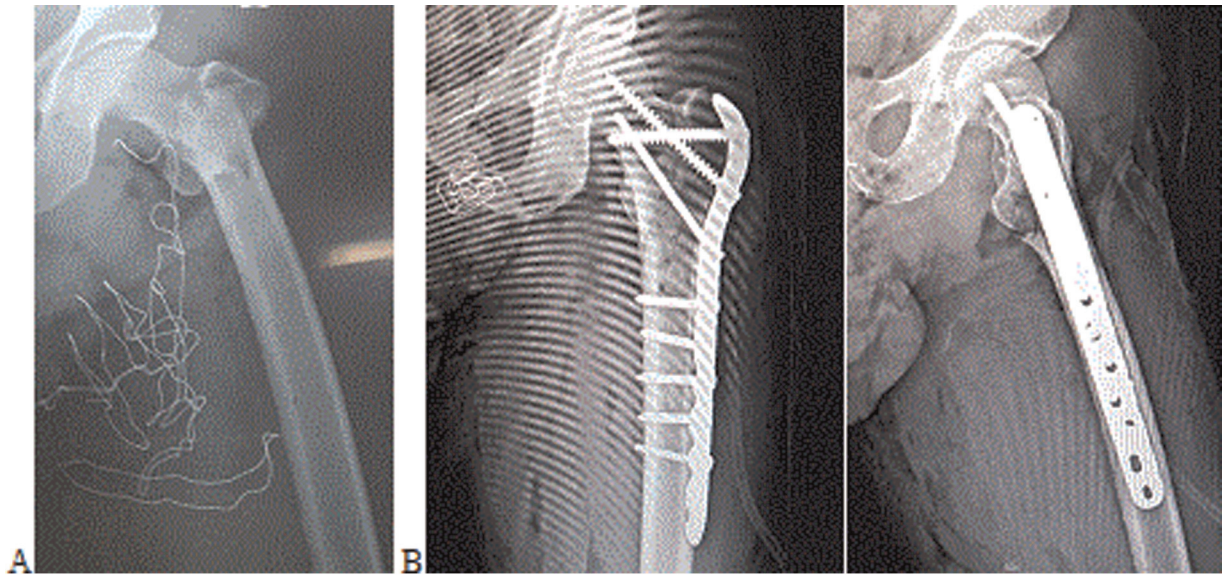
The patient was in supine position and under general or spinal anesthesia, with elevation of the ipsilateral side. A lateral approach of the proximal femur was used after preoperative planning and imaging of the contralateral side. Using an image intensifier, reduction of the fracture was done using either direct or indirect methods. Traction should be obtained first, and then insertion of a plate. The plate should be positioned on the proximal part so as the first screw is 95° with shaft, and the second and third ones should be 120° and 135°, respectively, holding the subchondral bone in the anteroposterior view, and should be slightly posterior to the center of the head in the lateral view. Afterward, the plate should be reduced to the shaft femur reducing the proximal part of the fracture to the diaphysis and then secured by screw insertion (Fig. 1).

Results

During the period from August 2014 to June 2016, this study included 20 patients, who were prospectively managed using proximal femoral plate in proximal fracture femur management. This study was done in Cairo University Hospital.

Operative time needed ranged from 90 to 130 min (mean was 113.1). A total of 16 patients needed blood transfusion (mean blood loss was 746.1±102 ml). Radiological outcome was anatomical in eight patients (40%), satisfactory in nine patients (45%), and poor in three patients(15%). Follow-up was from 7 to 20 months

Figure 1



A 57-year-old male patient with proximal femoral fracture (31-A3.3). (a) Preoperative and (b) postoperative radiographies after using proximal femoral plate.

(average 11 months). Fracture healing time ranged from 7 to 29 weeks (average 14 weeks). The modified Harris Hip score was used to evaluate patients at 3 and 6 months postoperatively, which ranged from 60 to 74 (mean was 66.5±3.5) at 3 months and 68 to 93 (84.4±9.5) at 6 months.

Complications

Infections occurred in three patients: two of them had superficial infection on tenth and sixteenth day postoperatively and were treated by debridement, repeated dressing, and antibiotic administration according to the culture and sensitivity done. The third case was a 57-year-old man with motor car accident and 31-A3.3 proximal femoral fracture, and he also had a splenic tear and underwent splenectomy. He developed deep infection on the seventh week postoperatively. Pus collection and infection were debrided on serial sessions, with antibiotic administration according to culture and sensitivity, but the patient developed osteomyelitis, which does not resolve until the plate removal was done on the 19th week postoperative (Fig. 2).

Figure 2

Infection developed postoperatively.

Deformity

Varus deformity occurred in three patients, who were 63, 65, and 77 years old with fracture types 31-A2.3, 31-A2.1, and 31-A3.3, respectively, with an average angle of 15°, but no revision was done, and their functional score at 6 months were good, good, and poor, respectively (Fig. 3).

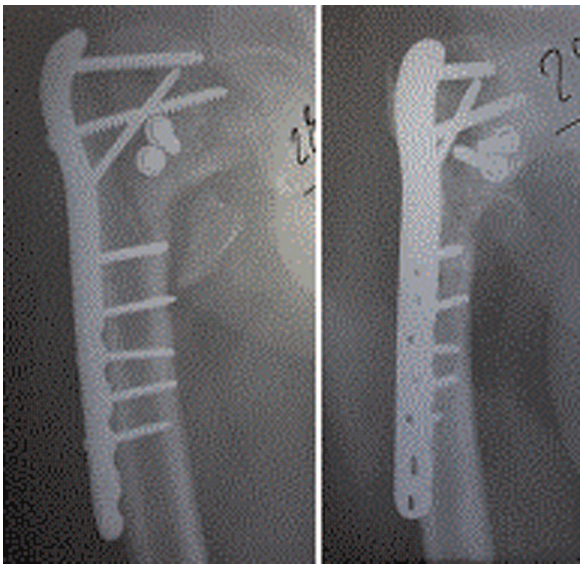
Screw cutout

A 63-year-old male patient fell on the ground and got 31-A2.1 proximal femoral fracture. He had no associated comorbidities with poor radiological outcome. Revision was done by total hip replacement on 12th week postoperatively (Fig. 4).

Figure 3

Varus deformity after fixation of proximal femoral plate.

Figure 4



Screw cut-out.

Delayed union

Two patients had delayed union, a male and a female patient, 60 and 63 years old, with 31-A3.3 and 31-A2.1 proximal femoral fracture, who eventually had union at 29 and 25 weeks postoperatively, respectively.

Discussion

Peritrochanteric fracture is one of the leading causes of mortality and morbidity of the elderly, in whom the fracture can occur from just a simple fall. In younger individuals, it occurs owing to severe trauma as motor car accident or fall from a height. These type can occur in any age but got a higher incidence in the fifth and seventh decades of life [4].

Multiple intramedullary and surface fixation implants have been designed to fix such a fracture, such as the dynamic hip screw, the anatomic proximal femoral plate, and the proximal femoral nail, but there is no single design that got the best results in all types of proximal femoral fracture [8]. However, management of unstable fracture remains a challenge for surgeons. Although the dynamic hip screw is widely used, it may cause medialization of femoral shaft, or lateralization of the greater trochanter, or even shortening of the femur [9].

This study was done on 20 patients with peritrochanteric femoral fractures from August 2014 to June 2016, using anatomical proximal femoral pates for fixation. The study included traumatic and osteoporotic proximal femoral fracture in skeletally mature patients and excluded fractures for any other pathological case, and open fractures.

The mean duration of follow-up was 39.70 weeks (24–58 weeks). Average time to union was 17.35 weeks (14–28 weeks). In a study conducted at the Department of Orthopaedics, Swami Man Singh Medical College and Hospital, India, by Saini *et al.* [11], the mean duration of follow up was 40.25 weeks, and time to union was 16.2 weeks. Partial weight bearing (15–20 kg) was allowed as soon as the patient could tolerate it, and full weight bearing was started when the fracture showed complete union. A total of 16 patients had union within 18 weeks, two patients had union within 24 weeks, and two patients had delayed union (28 weeks). One-centimeter shortening was seen in two patients. No patient had significant rotational malalignment as determine by clinical examination. There were no cut-outs, breakage, or pull-out of screws. When compared with this study, the rate of union was 17.35 weeks, and there was one case with screw cut-out and two cases with delayed union. A similar study of fixation of comminuted proximal femoral fracture in Orthopaedic Department CMH, Lahore, was conducted from October 2009 to September 2010, with 29 patients by Bukhari and Ashgar [12], in which one patient developed nonunion. Shaft-neck angle and range of motion of hip joint of the injured and healthy sides were measured at the last follow-up, and there was no significant difference between them ($P>0.05$). In this study, the modified Harris hip score was used to evaluate

patients at 3 and 6 months postoperatively, which ranged from 60 to 74 (mean was 66.5±3.5) at 3 months and 68 to 93 (84.4±9.5) at 6 months. Another study was done by Kayali *et al.* [13] in the Department of Orthopedics and Traumatology, the state Hospital Izmir, Turkey, and also reported no significant differences between injured and healthy hip movements and Shaft Neck Angle (SNA). In the study by Hossain *et al.* [14], Harris hip score was used for clinical assessment: 18 patients (90%) had good or excellent outcome and 2 had fair results (10%).In a biomechanical test setup done by Schneider *et al.* [15], the clinical failure modes observed with the proximal femur locking compresion plate (PF-LCP) were reproducible. A screw deviation of 28° from the normal axis consistently led to the failure. This highlights how crucial is the accurate placement of locking screws in the proximal femur. In this study, the failure occurred in one patient with screw backed out, and failure of fixation was owing to malposition of the screw, which is a crucial point to obtain good results.

Conclusion

Proximal femoral plate is an easy, safe, and dependable alternative for fixation of proximal femoral fracture, especially in unstable fractures (±osteoporosis), giving satisfactory results comparable to other surface and intramedullary fixation devices, provided that the plate and proximal screws are applied in the accurate recommended position.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Reška M, Veverková L, Diviš P, Konečný J. Proximal femoral nail (pfn) – anew stage in the therapy of extracapsular femoral fractures. Scr MEDICA 2006; 79:115–122.

2 Stern R. Are there advances in the treatment of extracapsular hip fractures in the elderly? Injury 2007; 38:77–87.

3 Dobbs RE, Parvizi J, Lewallen DG. Perioperative morbidity and 30-day mortality after intertrochanteric hip fractures treated by internal fixation or arthroplasty. J Arthroplasty 2005; 20:963–966.

4 Weil YA, Safran O, Greenberg A. Outcome of proximal femoral fractures caused by cycling in the young and mid-aged. Injury 2014; 45:1251–1255.

5 Keyak JH, Falkinstein Y. Comparison of in situ and in vitro CT scan-based finite element model predictions of proximal femoral fracture load. Med Eng Phys 2003; 25:781–787.

6 Keyak JH. Improved prediction of proximal femoral fracture load using nonlinear finite element models. Med Eng Phys 2001; 23:165–173.

7 Kaufer H. Mechanics of the treatment of hip injuries. Clin Orthop Relat Res 1980; 146:53–61.

8 Oken OF, Gulcek M, Yıldırım AO. The usage of femur proximal anatomic plate in the treatment of subtrochanteric femur fractures. Acta Orthop Traumatol Turc 2007; 41:36.

9 Palm H, Jacobsen S, Sonne-Holm S. integrity of the lateral femoral wall in intertrochanteric hip fractures: an important predictor of a reoperation. J Bone Joint Surg Am 2007; 89:470–475.

10 Fuad Oken O, Soydan Z, Ozgur Yildirim A, Gulcek M, Ozlu K, Ucaner A. Performance of modified anatomic plates is comparable to proximal femoral nail, dynamic hip screw and anatomic plates: Finite element and biomechanical testing. Injury 2011; 42:1077–1083.

11 Saini P, Kumar R, Shekhawat V, Joshi N, Bansal M, Kumar S. Biological fixation of comminuted subtrochanteric fractures with proximal femur locking compression plate. Injury 2013; 44:226–231.

12 Bukhari SAH, Asghar A. Dynamic condylar screw fixation for comminuted proximal femur fractures. J Surg Pak (Int) 2011; 16:149–152.

13 Kayali C, Agus H, Zincircioglu G. The role of biological fixation with bridge plating for comminuted subtrochanteric fractures of the femur. Turk J Trauma Emerg Surg 2008; 14:53–58.

14 Hossain MM, Alam QS, Quashem FH, Noman MTI. Evaluation of the outcome of proximal femoral locking compression plate for the treatment of comminuted trochanteric and subtrochanteric femoral fractures in lateral decubitus approach without peroperative image. Intensifier J Dhaka Med Coll 2014; 23:179–185.

15 Schneider K, Oh J-K, Zderic I, Stoffel K, Richards RG, Wolf S, *et al.* What is the underlying mechanism for the failure mode observed in the proximal femoral locking compression plate? A biomechanical study. Injury 2015; 46:1483–1490.