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Original Research Article

Functional and radiological outcome of valgus osteotomy (abduction osteotomy of Pauwel) and fixation with dynamic hip screw in neglected fracture neck of femur

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ABSTRACT

Background: Despite improvements in the techniques of surgery and internal fixation devices, non-union is still reported in one-third of cases of femoral neck fracture with displacement. Valgus intertrochanteric osteotomy alters the biomechanical environment of the fracture site and restores limb length.
Methods: This was a prospective study on functional outcome of valgus osteotomy and fixation with dynamic hip screw (DHS) in neglected fracture neck of femur in Balaji Institute of Surgery, Research and Rehabilitation for the Disabled (BIRRD), Tirupati. 28 patients were enrolled between December 2017 to December 2019. Patients less than 60 years of age with fracture neck of femur of more than or equal to 3 weeks since injury and with failed primary fixation were included. Patients >60 years of age, patients with avascular necrosis (AVN), and with resorption of femoral neck were excluded.
Results: Among 28 patients 12 had union within 6 months and another 12 within 12 months. 4 patients were lost for follow-up hence considered as non-union. Osteotomy site united by 6 months in 22 patients and by 12 months in 2. Harris hip score was fair to excellent in 24 patients and poor in 4.
Conclusions: Valgus osteotomy and DHS fixation is often a definitive one-time surgical procedure to achieve union in neglected and ununited fracture neck femur in young patients. It is simple and biological. In this study because of the delay in presentation and the young age of patients, Pauwels' osteotomy was performed as the head-salvaging procedure. Union was achieved in 86% of this study patients.

Keywords: Abduction osteotomy of Pauwel, Dynamic hip screw, Neglected fracture neck of femur

INTRODUCTION

Fracture neck of femur is one of the commonly encountered injuries in orthopaedics. It remains an unsolved fracture in young, to the orthopaedic surgeon as far as treatment and results are concerned.[1] The increase in high-energy trauma has contributed to the increased incidence of fracture neck of femur in younger patients. Young and active patients are generally treated by anatomical reduction and internal fixation as soon as possible. In developing countries, late and neglected presentation of femoral neck fractures is common because of many socio-economic reasons like local bone setters, lack of awareness and transport etc. Non-union is a frequent complication following femoral neck fracture. Due to precarious blood supply, difficulty in reduction, strong muscle force, flow of synovial fluid, no cambium layer in periosteum and amount of posterior comminution are the main reasons for non-union and avascular necrosis. To treat the femoral fractures in young adults it is

important to understand the osseous and vascular anatomy and mechanism of injury, associated injuries, fracture pattern.[2]

Despite improvements in the techniques of surgery and internal fixation devices, non-union is still reported in one-third of cases of femoral neck fracture with displacement.[3-5] Among the head-retaining procedures in such circumstances, various procedures such as fixation with muscle pedicle bone grafting, internal fixation with vascularized or free fibular grafting and valgus osteotomy and internal fixation with angle blade plate and dynamic hip screw are advocated. Valgus intertrochanteric osteotomy alters the biomechanical environment of the fracture site and restores limb length. Few reports have dealt with the results of this procedure internally fixed with dynamic hip screw and double angle barrel plate.

Very little literature is available to show the effectiveness of valgus osteotomy and fixation with dynamic hip screw (DHS) in neglected fractures of femoral neck. Here DHS provides rigid internal fixation of the femoral neck and osteotomy site and also provides a reproducible amount of valgus correction, allowing for preoperative planning and templating of the osteotomy.

METHODS

This was a prospective study on functional and radiological outcome of valgus osteotomy and fixation with dynamic hip screw in neglected fracture neck of femur in our hospital, Balaji Institute of Surgery, Research and Rehabilitation for the Disabled (BIRRD), Tirupati between December 2017 to December 2019.

There were 28 patients underwent valgus osteotomy and fixed with DHS. All the patients are evaluated as per the proforma prepared. annexure1.

Inclusion criteria

Inclusion criteria were patients less than 60 years of age with fracture neck of femur of more than or equal to 3 weeks since injury. Patients less than 60 years of age with failed primary fixation.

Exclusion criteria

Exclusion criteria of this study were elderly patients (>60 years of age), patients who had changes of avascular necrosis (AVN) on plain radiography, significant resorption of femoral neck with proximal fragment less than 2.5 cm were excluded from the study.

Management

Preoperative assessment

All the patients are first seen in the outpatient department. Then history regarding the co-morbidities, and assessment of general condition to decide whether patient can tolerate the surgical trauma. Proper counselling was given to patient regarding the surgery, its complications and the post-operative functional abilities and limitations of activity.

After admission, documentation of detailed history and clinical assessment done. Each patient was evaluated with routine blood investigations along with virology. Multidisciplinary approach for surgical fitness is sought by physician, cardiologist, diabetologist, nephrologist etc. Pre-anesthetic check-up is completed. An attempt is made to locate any focus of infection anywhere in the body and treated accordingly. Anti-coagulants, anti-platelet aggregator drugs were stopped before surgery. Informed consent was taken from patient and relatives for surgery pre-operatively.

An anteroposterior radiograph of pelvis with 20 degrees' internal rotation at hips was taken for documentation of fracture and comparison with other hip and to calculate the Pauwels angle.[7] Lateral view of the involved hip was taken to asses' angulation, displacement of fragments and to note the presence of posterior comminution. Pre-operative Harris hip score was recorded.[8]

Surgical technique

Under spinal anesthesia with epidural catheter, patient was put on a fracture table and with image intensifier control, with Watson- Jones approach capsulotomy of hip was done and all previous internal fixation devices were removed if any. Precise reduction of the femoral neck fracture was done and the head and neck angle were corrected.[9]

Osteotomy design, barrel plate insertion, osteotomy cuts, osteotomy reduction[10-12]

Richard's screw and derotation screws were introduced (Figure 1). Side plate was advanced onto the lateral aspect of the femur (Figure 2).

Figure 1: Richard and derotation screw in position.

Figure 2: Placement of Barrel and Pauwels osteotomy.

Figure 3: Reduction of barrel and closure of osteotomy.

The level of osteotomy was identified (at the level of the lesser trochanter to allow good bone healing). At the level of osteotomy proximal transverse cut and distal angle cut were made and predetermined size wedge (usually 30 degrees) was removed, lower limb was swung in to abduction to align the femur to plate and reduction clamp were applied (Figure 3). The barrel plate was fixed to femur using 4.5 mm cortical screw. The removed bone wedge was used as bone graft at osteotomy site. Suction drain was kept above iliotibial band after closure. Wound was closed in layers.

Post-operative management

Patient was mobilized with touchdown weight bearing for the first six weeks after surgery and then increased to full weight bearing. Active quadriceps, hip strengthening exercises were advised.

Follow-up

After hospital discharge, patients were observed periodically every six weeks until fracture healing, with periodical radiographs.

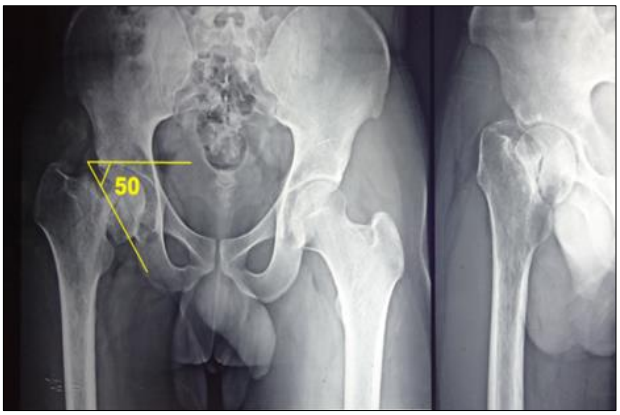

Figure 4: Pre-operative.

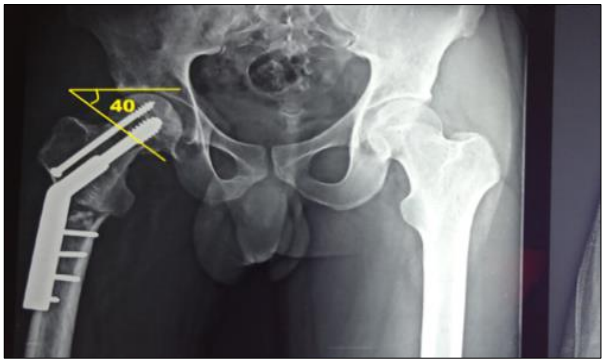

Figure 5: Post-operative follow-up.

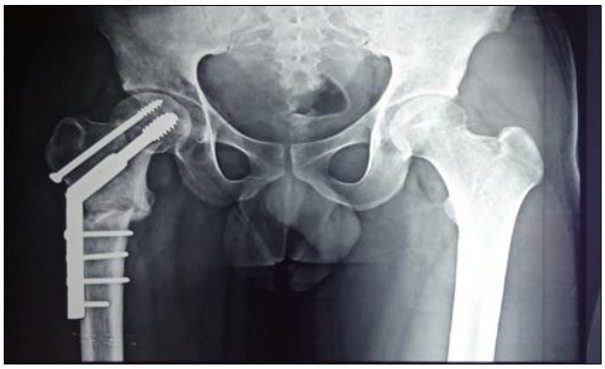

Figure 6: Post 6-week follow-up.

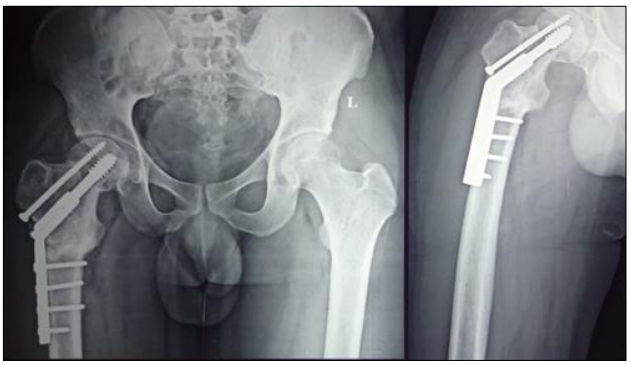

Figure 7: Post 3-month follow-up.

Figure 8: Post 6-month follow-up.

Figure 9: Post 1-year follow-up.

RESULTS

This study included total of 28 patients from age group 13 years to 48 years averaging about 30 years. Among them 26 were males and remaining 2 were females. Right side was involved in 10 patients and left side in 18 patients. Among 28 patients mechanism of injury was road traffic accident in 16 patients, fall from height in 10 patients, accidental fall in 2 patients. The type of fracture was Pauwels type I in 2 patients, type II in 14 patients, type III in 12 patients. All the data and radiographs were collected from the patients during follow-up at regular intervals. (Table 1 and 2).

Table 1: Age distribution.

Age in years	No. of patients
10- 20	6
21- 30	8
31-40	10
41-50	4
Total	28

Table 2: Mechanism of injury.

Mechanism of injury	No. of patients
Road traffic accidents	16
Fall from height	10
Accidental fall	2

Among 28 patients duration from injury to surgery was 3-6 months in 12 patients, 6-12 months in 12 patients. Average follow up was 12 months ranging from 3 to 21 months. Average age at the time of surgery was 30 years with range from 13 years to 48 years.

Table 3: Harris hip score.

Harris hip score	No. of patients
90-100- excellent	6
80-90- good	9
70-79- fair	9
60-69- poor	4
<60- failed	0

Table 4: Pauwels angle.

Pauwels angle	Pre-operative	Post-operative
30-50	2	16
50-70	14	6
>70	12	2

Preoperative median Harris hip score was 72 points (range 46 to 87). At 1-year post-op median Harris hip score was 80 points (range 61 to 93). The total Harris hip score was excellent (90-100) in 6 patients, good (80-90) in 9 patients, fair (70-79) in 9 patients, poor (60-69) in 4 patients (Table 3).

Pre-operative Pauwels angle was 30-50º in 2 patients, 50-70º in 14 patients, >70º in 12 patients. Post operatively Pauwels angle was in between 30-50º in 16 patients, 50-70º in 6 patients, >70º in 2 patients (Table 4).

Table 5: Union.

Duration (in months)	Fracture site	Osteotomy site
0-3	0	0
4-6	12	22
7-12	12	2

Among all the 28 patients osteotomy site united within 4-6 months in 22 patients, with in 1 year in 2 patients (Table 5) (clinical example Figure 4-9).

DISCUSSION

In developing countries, it is not uncommon to see patients with femoral neck fractures after a delay of several months because of poverty, lack of facilities, ignorance and faith in traditional healers. Salvage of the femoral head has been advocated for younger patients.

Valgus osteotomy converts a shearing force into compression force and fixation with DHS offers additional compression at fracture site. It also increases blood flow, increasing the chances of union. DHS fixation is a common procedure, in case of intertrochanteric fractures,

hence offers the feasibility of comfort to the operating surgeon.[12-14]

This study had 28 patients from age group 13 years to 48 years averaging about 30 years. Marti et al had 50 patients in their study with their average age being 53 years 9 (range 19 to 76).[14] Kalra et al had 20 patients with an average age of the patients was 37 years (range: 17-55 years).[4] Hartfold treated 8 patients with range from 30-43 years.[16] Majority of this study cases were secondary to road traffic accidents (RTA) (60%). Hartfold et al, had 50% of their cases due to RTA.[16]

Pauwels type II fractures were more common in this series where as both Marti et al and Hartfold et al had majority of their cases in type III group.[14,16] Post operatively 70% were in the Pauwels type I group in this study where as Hartfold et al had all their post op cases in type II group.[16]

Harris hip score improved from 46 to 93 in the current series. The average Harris hip score increased from 24 to 73 in the Hartfold group.[16]

Authors had an average time for fracture union was 6 months (range from 4-12) and average time for osteotomy union was 6 months. Hartfold series had their union by an average of 24 months. Major drawback of this study is a short follow-up of 2 years. As per the literature hip osteoarthritis secondary to AVN will be evident by 5 years follow-up (Table 6).

Table 6: Comparison with other studies.

Author	No. of patients	Minimum period of neglect	Implant used for treatment	Union (%)	Significant complication	Functional outcome
Marti et al[14]	50	2-60 months	Double angle blade plate	86	Technical difficulties in 6 cases	Good
Anglen[12]	13	4-54 weeks	Double angle blade plate	100	Avascular necrosis	Excellent
Kalra and Anand[4]	20	1-12 months	Double angle blade plate	85	Avascular necrosis	Good
Pruthi et al[15]	28	3-12 weeks	Double angle blade plate	88	Implant cut through	Good
Hartfold et al[16]	8	5-14 months	Hip screw	85	-	Good
Khan et al[17]	16	3-76 weeks	Double angle blade plate	87	Implant cut through	Good
Bansal et al[10]	30	4-30 months	Double angle blade plate	94	Implant cut through	Excelent
Current study	28	3-18 months	Hip screw	86	Non union	Good

CONCLUSION

Authors conclude that valgus osteotomy and fixation with dynamic hip screw has success rate of 80% in young patients with neglected and ununited intracapsular fracture neck of femur. As far as the union of fracture is concerned fixation with dynamic hip screw provides an additional advantage of compression at fracture site.

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