

Original Research Article

The role of valgus osteotomy with DHS fixation in the management of fracture nonunion of the neck of femur

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ABSTRACT

Background: Management of fracture non-union of the neck of femur is age specific and is quite demanding. There is a need to salvage the femoral head in younger individuals which demands a procedure which suits the requirements. The aim of this study was to evaluate the role of valgus osteotomy with dynamic hip screw fixation (DHS) in the management of these fractures and to compare the results with studies of other authors as available in literature.

Methods: This was a prospective study of 15 patients with fracture nonunion of the femoral neck conducted between January 2012 to January 2013 with a follow up period of 3 years.

Results: There were 9 males and 6 female patients in our study with the right side being more commonly affected. The mean age of the patients was 45.2 years ranging from 36 to 58 years. All fractures united at the end of 6 months. Post operatively the mean Pauwels angle was 34° while the neck shaft angle was 135.2° . There was a significant increase in the Oxford score from a mean of 20.4 preoperatively to 37.9 in the postoperative period. All patients were happy with the procedure and the functional outcome.

Conclusions: Valgus osteotomy with DHS fixation is a good option for the management of fracture nonunion of the neck of femur in younger patients where there is a need to salvage the femoral head and it gives good functional results.

Keywords: Neck of femur, Nonunion, Valgus osteotomy, DHS

INTRODUCTION

Fractures of the neck of femur are fairly common injuries seen in the elderly population with the most common causes for the injury being a simple slip and fall which results in a fracture due to the poor bone stock of the patient. Pathologic fractures are also associated with the elderly age group. In younger individuals with good bone stock, considerable force is required to overcome the strength of the bone in order to cause a fracture and they are often associated with causes such as road traffic accidents and fall from a height.¹ There are various forms of treatment available in the management of these fractures. These fractures are commonly associated with

complications such as nonunion which are technically demanding to treat. Various factors have been implicated in these fractures going in for nonunion as stated in literature. In our institution which is located in a rural area, we see a fair amount of patients coming in with fracture nonunion of the femoral neck as these patients tend to go in for native treatment with traditional bone setters rather than reporting to a hospital primarily for management. They undergo native treatment with the bone setters with splinting and immobilization for a period of 6 to 10 weeks and then present to us at a much later date with complications such as nonunion, myositis ossificans and stiffness of the affected hip and knee. The patients who present to us with established nonunion of

the femoral neck have functional limitations such as pain in the affected hip and lumbar spine, difficulty in walking, limp, and decrease in the range of movements of the affected hip and knee. Clinically these patients are found to have a Trendelenberg lurch with a positive Trendelenbergs test due to abductor weakness caused by an increased abductor lever arm with shortening of the abductor length. In elderly individuals, the treatment of choice in the management of these fractures would be a replacement arthroplasty in the form of a bipolar or total hip arthroplasty. However, in younger individuals the need to preserve the femoral head would be the priority and a procedure which meets the requirements must be adopted. In an acute fracture, treatment options such as internal fixation with cannulated cancellous screws would be the preferred mode of treatment but it would not be beneficial in the case of an established nonunion. In this scenario, Valgus osteotomy with DHS fixations has a vital role to play and gives good reproducible functional results.²⁻⁹ The aim of this study was to evaluate the role of Valgus osteotomy with DHS fixation in the management of fracture nonunion of the neck of femur in younger individuals and to compare the functional outcome with studies of other authors as available in literature.

METHODS

This was a prospective study of 15 patients with fracture nonunion of the neck of femur studied between January 2012 to January 2013 at the department of Orthopaedics, Saveetha medical college and hospital, Thandalam.

Patients with established nonunion of the neck of femur aged 20 to 60 years willing for treatment and for follow up were included in our study, while skeletally immature patients, patients with age more than 60 years, pathological fractures, patients with avascular necrosis of the femoral head, patients with active hip or systemic infection and patients not willing for follow up were excluded. All patients were seen either at the outpatient or the emergency department and following admission, a thorough history was taken with details regarding time since injury to presentation to the hospital, details regarding type of native treatment and the duration of treatment were elicited, and a physical examination was carried out. Local examination of the affected hip was done and findings such as attitude of the limb, amount of shortening, telescoping test, Trendelenbergs sign and the type of gait were recorded in the patients case records. The patients were then radiologically evaluated and standard x-rays of the chest antero-posterior view, pelvis with both hips antero-posterior view and x-ray of the affected hip with traction and internal rotation and lateral views were taken. Routine blood investigations were done. All fractures were classified according to Gardens classification. The preoperative Pauwels and neck shaft angles were recorded and documented in the case records. The patients were evaluated according to the Oxford hip score which evaluates factors such as pain, mobility, limp and function of the affected hip and the preoperative score was documented (Table 1). The patients were taken up for surgery after obtaining informed consent and anaesthetic fitness for surgery.

Table 1: Oxford scoring system.

During the past 4 weeks	Points
How would you describe the pain you usually had from your hip?	
None	1
Very mild	2
Mild	3
Moderate	4
Severe	5
Have you had any trouble with washing and drying yourself (all over) because of your hip?	
No trouble at all	1
Very little trouble	2
Moderate trouble	3
Extreme difficulty	4
Impossible to do	5
Have you had any trouble getting in and out of a car or using public transport because of your hip?	
No trouble at all	1
Very little trouble	2
Moderate trouble	3
Extreme difficulty	4
Impossible to do	5
Have you been able to put on a pair of socks, stockings or tights?	
Yes, easily	1
With little difficulty	2
With moderate difficulty	3
With extreme difficulty	4
No, impossible	5

During the past 4 weeks	Points
Could you do the household shopping on your own?	
Yes, easily	1
With little difficulty	2
With moderate difficulty	3
With extreme difficulty	4
No, impossible	5
For how long have you been able to walk before pain from your hip becomes severe (with or without a stick)?	
No pain/ more than 30 minutes	1
16-30 minutes	2
5-15 minutes	3
Around the house only	4
Not at all-pain severe on walking	5
Have you been able to climb a flight of stairs?	
Yes, easily	1
With little difficulty	2
With moderate difficulty	3
With extreme difficulty	4
No, impossible	5
After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your hip?	
Not at all painful	1
Slightly painful	2
Moderately painful	3
Very painful	4
Unbearable	5
Have you been limping when walking because of your hip?	
Rarely/ never	1
Sometimes, or just at first	2
Often, not just at first	3
Most of the time	4
All the time	5
Have you had any sudden or severe pain-shooting, stabbing or spasms from the affected hip?	
No days	1
Only 1 or 2 days	2
Some days	3
Most days	4
Every day	5
How much has pain from your hip interfered with your usual work (including housework)?	
Not at all	1
A little bit	2
Moderately	3
Greatly	4
Totally	5
Have you been troubled by pain from your hip in bed at night?	
No nights	1
Only 1 or 2 nights	2
Some nights	3
Most nights	4
Every night	5

All procedures were performed under regional/general anaesthesia under antibiotic cover. Injection Cefazolin 1 gram and amikacin 500 milligrams were given at the time of induction of anaesthesia and were continued for 3 days

postoperatively. The procedures were performed with the patient in the supine position on a fracture table under fluoroscopic guidance. Traction and internal rotation was given to reduce the fracture and the reduction was

confirmed on antero posterior and lateral views. A standard lateral approach was used for the exposure. The insertion angle for the guide wire was the implant angle minus the osteotomy wedge angle. The osteotomy wedge angle was the Pauwels angle minus 25° due to the forces acting on the hip. The standard wedge angle was 30° while the pin insertion angle was 105° since we used a DHS system with a standard 135° angle in all cases. The aim was to reduce the Pauwels angle to around 25 to 30° due to the fact that making the fracture line more horizontal converts the shearing forces to compressive forces at the fracture site. Once the guide wire was passed at the appropriate angle and checked in anteroposterior and lateral views, reaming was done using a triple reamer and the appropriate size screw was inserted. A 6.5 mm derotation screw was also inserted in all cases. The osteotomy was done at the level of the lesser trochanter and once the appropriate size wedge was removed, the limb was abducted to lateralize the shaft and traction was reduced to compress the shaft to the proximal fragment and was fixed with a short barrel 4 holed plate with four 4.5 mm cortical screws. The limb was then brought back to the neutral position and the restoration of the neck shaft angle was achieved. After ensuring haemostasis and placing a drain *insitu*, wound closure was done in layers and sterile dressing was applied.

The patients were made to sit up on the same evening of surgery and active ankle and knee mobilization and quadriceps exercises were started. The patients were mobilized on the 2nd postoperative day with strict nonweight bearing walking with either axillary crutches or walking frame support. The drain was removed on the 3rd postoperative day and suture removal was done on the 12th day. Post-operative x-rays were taken and the position of the implant was noted. The postoperative Pauwels angle, the neck shaft angle and the limb length were measured and documented in the case records. After discharge, the patients were asked to review for follow up at 1, 3, 6, 9 and 12 months and at yearly intervals thereafter. Radiological evaluations were done by taking serial x-rays at follow up and functional evaluation was done using the Oxford hip score and documented. Trendelenberg's test was performed in all patients to assess the integrity of the abductor mechanism. The data collected was analyzed using IBM SPSS Version 22.0. Armonk, NY: IBM Corp. Continuous variables were expressed as mean±SD and categorical variables were expressed as number and percentages. Chi square test was used in the comparison of categorical variables. A P value of less than 0.05 was considered to be statistically significant.

RESULTS

15 patients of fracture nonunion of the neck of femur treated with Valgus osteotomy and DHS fixation were studied between January 2012 to January 2013. There were 9 males and 6 female patients in our study with the right side being more commonly affected in 8 patients (Figure 1 and 2). The mean age of the patients was 45.2 years ranging from 36 to 58 years (Table 2). The most

common mode of injury was road traffic accidents followed by fall from a height (Table 3). The mean time since injury and presentation to the hospital was 4.7 months ranging from 3 to 7 months. The mean shortening noted was 2.6 cm ranging from 2 to 3.5 cm. According to Gardens classification type 4 was more common as seen in 8 patients (Table 4). The average duration of surgery was 67 minutes and the mean blood loss was 201 ml. The average duration of hospital stay was 14 days. The average time to clinical union of the fracture was 12.8 weeks ranging from 10 to 15 weeks. All fractures and osteotomy sites united well (Figure 3). The average preoperative Pauwels angle was 61.53° ranging from 57° to 71° while the average neck shaft angle was 98.2° ranging from 94° to 112°. Postoperatively the average Pauwels angle was 34° ranging from 31° to 37° achieving an average correction of 27.53° while the average neck shaft angle was 135.2° ranging from 130° to 140°. The average preoperative Oxford hip score was 20.4 ranging from 12 to 26 while there was a significant increase postoperatively to 37.9 ranging from 36 to 40 (Table 5). Postoperatively 3 patients had a limb length discrepancy of 0.5 to 1 cm which did not necessitate a heel or a sole rise. Two patients had a Trendelenberg lurch which was not troublesome to the patient and they were able to manage using a cane for support. All patients returned to their preinjury status after 15 weeks and were able to walk comfortably without pain. Superficial skin infection was seen in 2 patients which settled down well after treatment with antibiotics. There were no complications such as loss of correction, implant failure, screw back out or cut through or avascular necrosis encountered in our study (Table 6). None of our patients were lost to follow up.

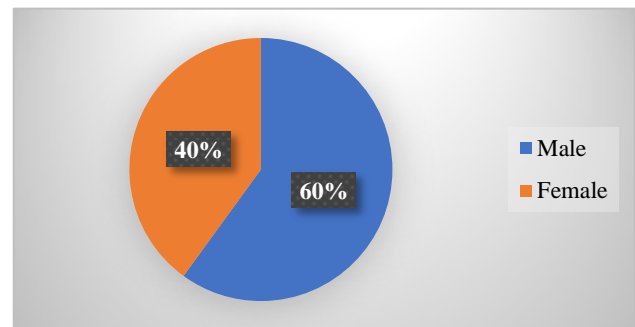


Figure 1: Sex incidence.

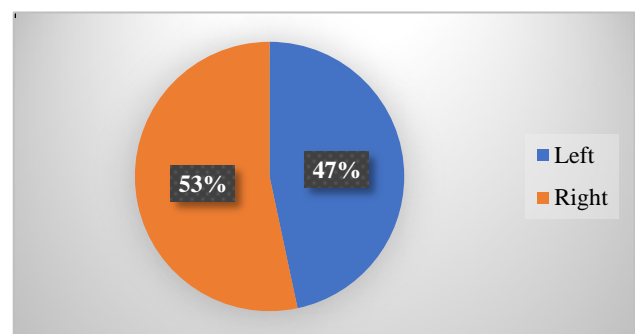


Figure 2: Side dominance.

Table 2: Age of the patients.

S. No	Age of the patients	Number of cases	Percentage (%)
1	30-40	4	26.66
2	41-50	7	46.66
3	51-60	4	26.66

Table 3: Mode of injury.

S. No	Mode of injury	Number of patients	Percentage (%)
1	Road traffic accident	7	46.66
2	Fall from height	5	33.33
3	Slip and fall	3	20

Table 4: Type of fracture.

S. No	Gardens classification	Number of cases	Percentage (%)
1	Type 3	7	46.66
2	Type 4	8	53.34

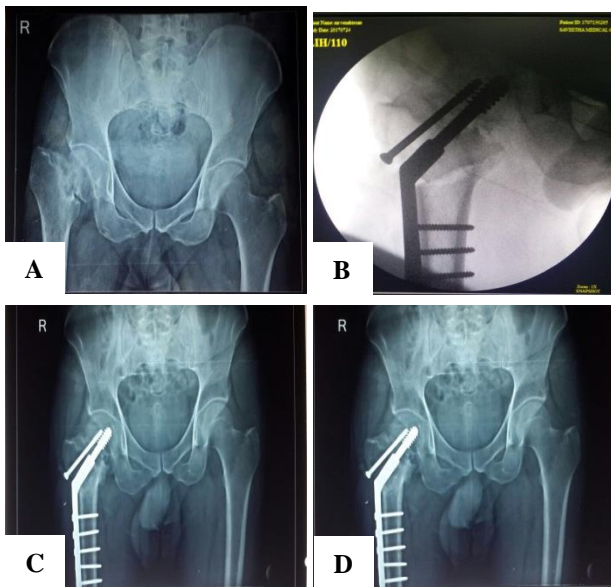


Figure 3: Patient X-rays. A: Pre-operative X-ray. B: Intra-operative fluoroscopic image showing subtrochanteric osteotomy and DHS fixation. C: 1 month follow up. D: 3 months follow up X-ray showing good union at both osteotomy and fracture sites.

Table 5: Results.

S. No	Parameter	Pre-op (average)	Post-op (average)
1	Pauwels angle	61.53 ⁰	34 ⁰
2	Neck-Shaft angle	98.2 ⁰	135.2 ⁰
3	Oxford score	20.4	37.9

Table 6: Complications.

S. No	Complication	Number of cases	Percentage (%)
1	Superficial skin infection	2	13.33
2	Loss of correction	0	0
3	Implant failure	0	0
4	Avascular necrosis	0	0
5	Screw backout/cut through	0	0

DISCUSSION

The management of fracture nonunion of the neck of femur is technically demanding and age specific. The treatment of choice in elderly individuals would be a replacement arthroplasty as in either a bipolar or total hip arthroplasty. In younger individuals, there is a need to salvage the femoral head and hence they would not be ideal candidates for replacement arthroplasty. Internal fixation with cannulated cancellous screws would be beneficial only in the acute set up and they do not have a role to play in cases of established nonunion. In such situations, Valgus osteotomy would be the procedure of choice as it would address all the parameters as required. In fractures of the neck of femur the Pauwels angle ranges from 30⁰ to 70⁰. With an increase in the Pauwels angle the fracture line becomes more vertical which increases the shearing forces acting on the hip leading to the formation of fibrous tissue at the fracture site leading on to the formation on a nonunion. The aim of surgery would be to make the fracture line more horizontal by ideally reducing the Pauwels angle around 30⁰ so that the shearing forces are converted into compressive forces. The neck shaft angle is also to be restored to around 130⁰ to 135⁰ in order to restore the normal anatomical lever arm of the abductors. Valgus osteotomy decreases the forces acting on the hip joint and restores the decreased neck shaft angle to normal values. It makes the fracture line more horizontal thereby converting the shearing forces into compressive forces. The osteotomy per se improves the vascularity at the fracture site and promotes fracture union while addressing the limb length discrepancy as well.¹⁰⁻¹³ Fixation following osteotomy can be done with either a DHS or an angled blade plate. We routinely used a DHS with a fixed 135⁰ angle as we found it to be technically easier to perform as compared to a blade plate which is more technically demanding.

All the patients in our study opted for native treatment initially and presented to us at an average of 4.7 months since the initial injury. They presented with hip and back pain, limp, shortening and an abductor lurch. There were treated with valgus osteotomy with DHS fixation. All fractures united at the end of 15 weeks. There was an average correction achieved in the Pauwels angle by 27.53⁰ and the neck shaft angle was restored to around 135⁰. There was a significant increase in the Oxford hip score from an average of 20.4 preoperatively to 37.9 in

the postoperative period. All patients returned to their preinjury status at the end of 15 weeks and were able to walk comfortably without pain. Shortening was seen in 3 patients ranging from 0.5 to 1 cm but it was not causing any functional disability for the patients and was well tolerated and so did not necessitate any heel or sole rise. No major complications were encountered in our study and none of our patients were lost to follow up. All of our patients were happy with the functional outcome following the procedure.

Roberto et al studied 42 patients with fracture nonunion of the femoral neck treated with valgus osteotomy with fixation methods which included both DHS and 130° angle blade plate and they reported good results in 90.4% of cases with complications such as screw cut out and avascular necrosis in two cases each.¹⁴ In a study by Siavashi et al 25 patients were studied and they reported a 100% union rate. They encountered complications such as screw penetration in the joint space in 3 patients and avascular necrosis in 2 patients.¹⁵ In Bahador et al study of 27 patients a union rate of 88% was reported with implant failure seen in 2 patients resulting in a nonunion of the fracture.¹⁶ We had a union rate of 100% in our study with no cases of implant failure or avascular necrosis at the time of the last follow up. The lack of major complication seen in our study could be due to the fact that proper surgical techniques and indications were followed and also the study sample was relatively small. We also reviewed studies of other authors and noted that there were good union rates reported in most of the studies which compares well with the results of our study.¹⁷⁻²³ We thereby conclude by stating that Valgus osteotomy with DHS fixation is a good option for the management of fracture nonunion of the neck of femur in younger individuals where the femoral head needs to be salvaged. It restores the neck shaft angle and the integrity of the abductor mechanism, addresses limb length discrepancy, promotes union at the fracture site and gives good functional results.

CONCLUSION

By this study, we conclude that valgus osteotomy with DHS fixation is a good option in the management of fracture nonunion of the femoral neck in younger individuals who are not ideally suited for replacement arthroplasty. It promotes union at the fracture site and gives good functional results. We strongly recommend its use in the management of these fractures.

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