# Management of Pauwels Type 3 Femur Neck Fracture by Open Reduction Internal Fixation with DHS System and Intertrochanteric Valgus Osteotomy: A Case Series

Neetin P. Mahajan[1], Pranay P. Kondewar[1], Lalkar Gadod[1], Akshay K. S[1]

## Abstract

Femur neck is anatomically weaker and prone for fractures in all age groups of population. Trauma is major cause of fracture in young individuals. Neck of femur fracture are classified based on anatomical location of fracture, pauwels classification system using orientation of fracture line and gardens system based on trabecular alignment in femur head and acetabulum.

In young patients open reduction and internal fixation is preferred choice but in elderly we perform arthroplasty. When fracture is more vertical there are chances of non-union due to shear forces across fracture site. In this case series all the patients are having neck of femur fracture pauwels type 3 and are managed with lateral closing wedge valgus osteotomy at level of lesser trochanter to convert shear forces into compression forces which promotes healing of fracture and fixation is done using DHS system and CC screws. All patients were mobilised with walker by nil weight bearing initially and followed up at 2 weekly interval later gradually weight bearing started as tolerated and all shows union of fracture and osteotomy site at 12 weeks post op.

**Keywords**: Neck of femur fracture, Pauwels type 3, Pauwels angle , DHS system, Valgus osteotomy , Compression forces

## Introduction

Femur neck is a connection link between femur head and shaft. Neck fractures are one of the most common fractures seen in elderly patient with osteoporosis. Junctions location makes it prone for fractures. These are also seen in young and athletically active individuals. It is more common in females than in males because of more chances of osteoporosis in females increases with age [1].

The chief source of blood supply is by medial circumflex femoral artery which is a branch of femoral artery. Ascending cervical branches are damaged in the fracture and it causes disruption of blood supply. This may compromise the healing ability of the fracture and causes nonunion and osteonecrosis [2]. Femur neck fractures are classified by various methods anatomical, gardens classification (based on trabecular orientation of femur head and acetabulum and displacement) and Pauwels classification (based on vertical orientation of fracture line).

Traditionally management of the fracture depends on the age of the patient. In elderly arthroplasty is preferred but in adults and middle-aged population a trial of fixation is given by fixation using CC Screws/DHS System before doing arthroplasty. If it fails and nonunion or avascular necrosis occurs, then arthroplasty is done. Operative methods to use to enhance vascularity and achieve healing at fracture site in lately presenting fractures are either by fixation with bone grafting, pedicle graft to provide blood supply [3] or valgus intertrochanteric osteotomy.

For Pauwels type 3 fracture, the fracture line is making an angle of >50 degrees with the horizontal and after fixation, failure is inevitable as shear forces are acting across fracture site and hence correction of the direction of forces is very important which is achieved using intertrochanteric valgus osteotomy which converts shear forces into compression forces. This was first given by Pauwel in 1976 which was modified by Muller [4, 5].

## Case Report

All the five patients have presented to us within 24-48 hrs. of trauma and we operated them earliest possible with DHS system and valgus intertrochanteric osteotomy under spinal and epidural anaesthesia on a traction table.

Plan of osteotomy: Pauwels angle of 25 degrees is the angle where compressive force will be at a right angle. The goal of osteotomy is to get a final Pauwels angle of 25 degrees. We planned a wedge of 0–30 degrees depending upon the fracture line orientation. The height of the base of the wedge is estimated using equation 360 degrees = 2∏R. It is nearly 10 mm for 10 degrees (actually it depends on the thickness of femur). Screw insertion angle is the angle between screw and lateral femoral cortex. The sliding hip screw is placed towards the centre of head or at inferomedial region at the pre-determined screw insertion angle. For 135 degrees DHS and 30 degrees wedge, the angle is 105 degrees and will increase if smaller wedge is needed. Osteotomy is created nearly 2 cm below the screw tip at lateral cortex. It's a lateral closing wedge type of osteotomy, upper horizontal cut is made and lower cut is taken so as to get determined correction of the angle. Both cuts meet at medial wall of the femur.

[1]Department of Orthopedics, Grant Government Medical College and Sir J.J Group of Hospital, Mumbai, Maharashtra, India.

**Address of Correspondence**
Dr. Pranay Pravin Kondewar,
Grant Government Medical College and Sir J. J Group of Hospital, Mumbai, Maharashtra, India.
**E-mail:** pranaypk1@gmail.com

Submitted: 20/4/2021; Reviewed: 22/5/2021; Accepted: 15/5/2021; Published: 10/5/2021

DOI: 10.13107/ti.2021.v07i02.20 | *www.traumainternational.co.in*

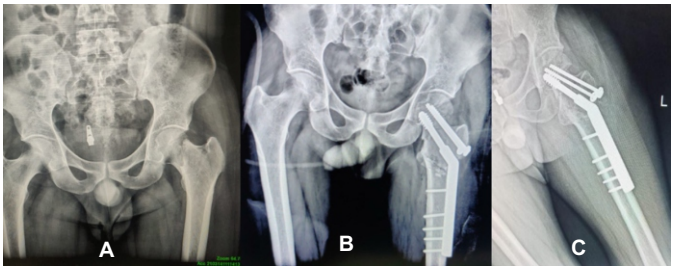


**Figure 1:** A. Showing pre op Pelvis X-ray with vertical oriented femur neck fracture B. Immediate post op X-ray and C. Follow up X-ray showing union at fracture site and osteotomy site.

**Case 1**

Patient is a 38 year-old-male presented with left hip pain after fall from ladder on investigation X-ray pelvis showed left sided neck of femur fracture trans cervical in location and Pauwels type 3 with Pauwels angle 70 degree. As patient was young male, open reduction and internal fixation was planned using 5 hole DHS and intertrochanteric lateral closing wedge type osteotomy at level of lesser trochanter. At first a guide wire is placed in anterosuperior and posterosuperior part of the head across the fracture site and one central guide wire along inferior part of neck at a predetermined screw insertion angle of 90 degree to stabilize fracture fragments and avoid mobility. Later 2 CC screws placed in anterosuperior and posterosuperior part. Finally using a angle guide central DHS screws is fixed (reaming done with triple reamer). After this fixation lateral closing wedge osteotomy is done using thick k wire and drilling multiple holes in the cortex. Osteotomy is completed with osteotome and DHS plate temporarily fixed over lateral cortex using plate holding clamp. Bicortical purchase of 5 screws in the femur cortex below osteotomy site was taken, drain not used, wound closed in layers. In post op period mobilisation started with nil weight bearing on post op day 2 using walker. Antibiotics given for 3 days and suture removal done on day 14. Follow up X-rays done at 2 weeks interval, full weight bearing started after complete union of osteotomy site. (Figure 1)

**Case 2**

Patient is a 45 year-old-male came with complaints of right hip pain and difficulty in weight bearing on right side after fall from first floor of home. X-ray PBH suggestive of right sided pauwels type 3 neck of femur fracture with pauwels angle of 50 degrees. Patient was kept on skin traction with pulley and 3 kg weight and analgesics given for pain. He was operated on day 3 of trauma with open reduction internal fixation using DHS system and lateral closing wedge valgus osteotomy. In this case neck was smaller so only one cc screw was used for rotational control over proximal fragment. The DHS screw placed at angle of 110 degrees using angle guide. DHS plate and 4 screws placed below osteotomy site with bicortical purchase. Post op nil weight bearing initiated on day 2 with walker and antibiotics given for 3 days. Suture removal done on day 14. Follow up X-ray at 6 week post op showed partial healing of osteotomy site so full weight bearing started. 3 month X-ray showed healing at fracture site and osteotomy site. (Figure 2)

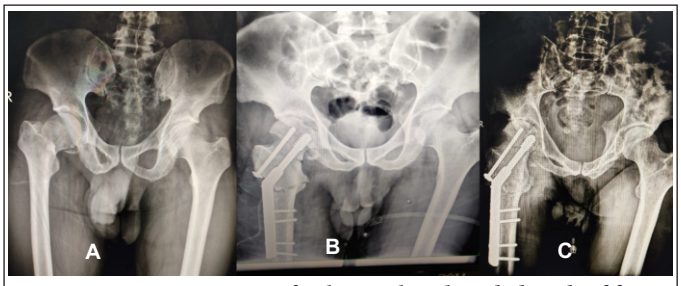


**Figure 2:** A. Pre op X-ray of pelvis with right sided neck of femur fracture. B. immediate post op X-ray and C. Follow up X-ray showing healing of osteotomy and fracture site .

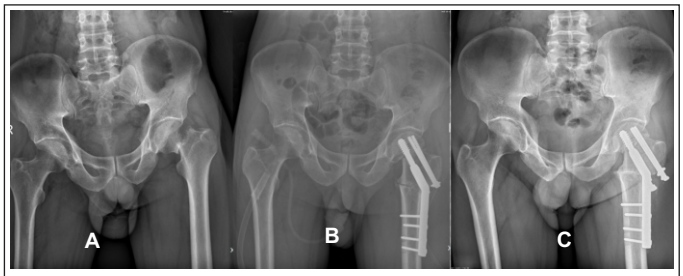


**Figure 3:** A. Showing X-ray of pelvis with left sided neck of femur fracture pauwels type 3 B. Immediate post op X-ray C. Follow up X-ray at 6 months showing complete bony healing at osteotomy and fracture site.

**Case 3**

Patient is a 40 year-old-male presented with left hip pain and inability to stand on left hip after road traffic accident. X-ray PBH Showed left femur neck of femur fracture pauwels type 3 with angle of 60 degree. Emergency fixation was done. Open reduction and internal fixation using 2 CC screw anterosuperior and posterosuperior in location and DHS screw placed at angle of 100 degree between screw and lateral border of shaft directed towards the centre of head. Osteotomy with nearly 3 cm base is done and care taken to maintain medial cortical continuity which is important for healing. DHS plate fixed and 4 screw placed below osteotomy site. (Figure 3)

**Case 4**

Patient is a 34 year-old-male presented with pain in left hip and inability to move left limb since fall from height at home. X-ray PBH showed left femur neck of femur fracture pauwels type 3 with pauwels angle of 60 degrees. Emergency fixation was done. Open reduction and internal fixation using 1 central cc screw washer due

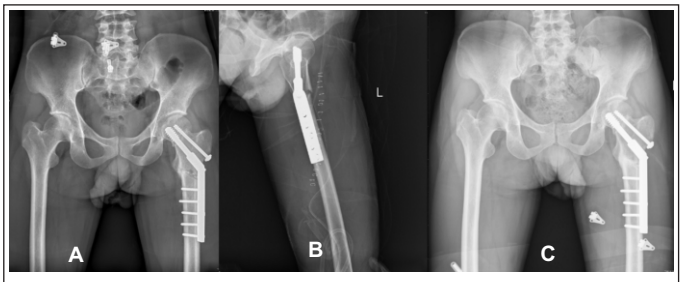


**Figure 4:** A. Showing immediate post op pelvis with femur X-ray B. Immediate post op left femur lateral view C. Follow up X-ray of pelvis at 6 months with complete union at fracture and osteotomy site .

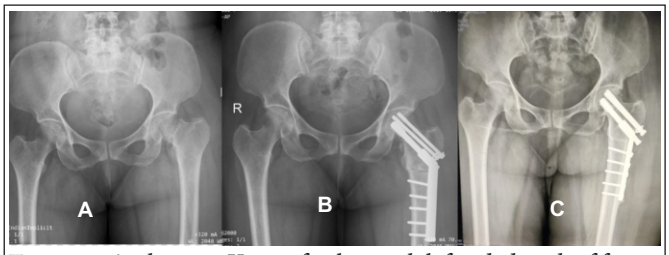


**Figure 5:** A. showing X-ray of pelvis with left sided neck of femur fracture pauwels type 3. B. Immediate post op X-ray of pelvis C. Follow up X-ay at 6 months showing complete bony healing at osteotomy and fracture site.

to small neck size and DHS screw placed at angle of 100 degree between screw and lateral border of shaft directed towards the centre of head. Osteotomy with nearly 3 cm base is done at level of lesser trochanter and care taken to maintain medial cortical continuity. DHS plate fixed and 5 screw placed below osteotomy site with bicortical purchase. Similar postoperative protocol and follow up is taken. Recent 6 months post op X-ray showed complete healing of fracture site and patient is doing all the daily activities. (Figure 4)

**Case 5**

Patient is a 40 year-old-female sustained trauma to left hip after fall at home in bathroom and presented with complaints of left hip pain and inability to stand on left limb. X-ray PBH showed left femur neck of femur fracture pauwels type 3 with pauwels angle of 70 degrees. Emergency fixation was done. Open reduction and internal fixation using 2 CC screw and washer. DHS screw placed at angle of 90 degree between screw and lateral border of shaft directed towards the centre of head. Osteotomy with nearly 3 cm base is done at level of lesser trochanter and care taken to maintain medial cortical continuity. DHS plate fixed and 5 screw placed below osteotomy site with bicortical purchase. Similar postoperative protocol and follow up is taken. Recent 6 months post op X-ray showed complete healing of fracture site and patient is doing all the daily activities. (Figure 5)

## Discussion

Management of neck of femur fracture is challenging specially in young and middle aged population,Attributed to shear forces at fracture site. There are more chances of nonunion and avascular necrosis. The options for treatment in young is fixation using 3 cannulated screws or using DHS system and a derotation screw. In younger individuals, there is a need to salvage the femoral head and hence they would not be ideal candidates for replacement arthroplasty.

All the patients were having pauwels angle more than 60 degree. 4 patients had trauma to left and one patient had right sided injury. 4 patients were male and one female patient. All the patients were operated within 48 hrs of trauma and were counseled about possible outcomes of surgery.

Chen Z, Wang G in their study to compare the effect of dynamic hip screw (DHS) with derotation screw and cannulated screw in treatment of Pauwels type II or III femoral neck fracture showed significant difference in reoperation and overall success rate with DHS being the superior choice. It gives better stability at osteotomy site [6].

It is imperative to fix the neck of femur fractures as early as possible to avoid development of avascular necrosis which is caused because of disruption of blood supply due to rupture of ascending arteries at neck or as a result of tamponade effect due to hematoma[7]. The type of internal fixation used does not significantly alter the incidence of avascular necrosis. The extent of vascular disruption produced at the time of trauma decides which patient will develop avascular necrosis Additional vascular damage may be caused at the time of internal fixation, especially due to malrotation of head [8]

In 2005 N. K. Magu and others in their study of 50 patient showed union in 94% cases with average time of 12 weeks and 100% union at fracture site, infection and implant penetration in nearly 4% cases[9]. In our study of 5 patients union was achieved in all the cases. No infection or joint penetration is seen. The wedge of the bone which is removed is used as bone graft in all cases. Average neck shaft angle achieved was 141 degree. Average union time was between 8 to 12 weeks. All patients are able to do their daily activities and are comfortable with squatting and crossed leg sitting which is part of various daily activities in Indian patients.

## Conclusion

We conclude that fresh femoral neck fractures in young individuals can be safely treated by open reduction and internal fixation with DHS system and de-rotation screws, supplemented primarily by valgus intertrochanteric osteotomy. Predictable healing is achieved if pauwels angle of less than 30 degree is restored after osteotomy and strict adherence to the post-operative rehabilitation is followed.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

**Conflict of interest:** Nil **Source of support:** None

## References

1. Koval KJ, Zuckerman JD. Hip Fractures: I. Overview and Evaluation and Treatment of Femoral-Neck Fractures. J Am Acad Orthop Surg. 1994 May;2(3):141-149.
2. Barney J, Piuzzi NS, Akhondi H. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jul 6, 2021. Femoral Head Avascular Necrosis.
3. M.H. Meyers, J.P. Harvey Jr., T.M. Moore Treatment of displaced subcapital and transcervical fractures of the femoral neck by muscle-pedicle-bone graft and internal fixation. A preliminary report on one hundred and fifty cases .J Bone Joint Surg Am, 55 (1973), pp. 257-274
4. Pauwels F. Biomechanics of the normal and diseased hip. Springer Science and Business Media: 1976.
5. Muller ME. Intertrochanteric osteotomy: indications, preoperative planning, technique. Berlin: Springer-Verlag; 1984. pp. 25–66.
6. Chen Z, Wang G, Lin J, Yang T, Fang Y, Liu L, Zhang H. [Efficacy comparison between dynamic hip screw combined with anti-rotation

screw and cannulated screw in treating femoral neck fractures]. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. 2011 Jan;25(1):26-9. Chinese. PMID: 21351604.
7. Bachiller, Fernando Gómez-Castresana MD, PhD*; Caballer, Antonio Perez MD, PhD**; Portal, Luis Ferrández MD, PhD* Avascular Necrosis of the Femoral Head After Femoral Neck Fracture, Clinical Orthopaedics and Related Research: June 2002 - Volume 399 - Issue - p 87-109
8. Calandruccio RA, Anderson WE 3rd. Post-fracture avascular necrosis of the femoral head: correlation of experimental and clinical studies. Clin Orthop Relat Res. 1980 Oct;(152):49-84. PMID: 7438624.
9. N.K. Magu, R. Singh, R. Mittal, et al.Osteosynthesis and primary valgus intertrochanteric osteotomy in displaced intracapsular fracture neck of femur with osteoporosis in adults Injury, 36 (2005), pp. 110-122, 10.1016/j.injury.2004.02.017

**How to Cite this Article**

Kondewar PP, Lalkar G | Management of Pauwels Type 3 Femur Neck Fracture by Open Reduction Internal Fixation with DHS System and Intertrochanteric Valgus Osteotomy: A Case Series | July-December 2021; 7(2): 18-21.