

# Implications of Surgery or Fracture Related Morbidity Factors in the Outcome of Pertrochanteric Fractures Managed by Dynamic Hip Screw

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**Abstract:** Background: Pertrochanteric fractures are the most commonly operated fracture type globally but have the highest fatality rate post-operatively. The conservative management of these fractures is associated with almost double the rate of fatality. The dynamic hip screw (DHS) plate system continues to be the preferred implant as “collapse to stability” remains a distinct advantage. This study was to analyze the implications of “surgeon unrelated” morbidities like age, gender, fracture type, degree of comminution, osteopenia and “surgeon related” morbidities like fracture reduction, screw placement and tip apex distance (TAD).

Methods: 96 fractures in mean 68.43 years subject age were selected, the fractures classified. The uninjured hip used to grade pre-existing osteopenia by Singh's index and compare neck shaft angle restored after surgery. All fractures operated by a standard lateral proximal femoral approach and fixed with 135° DHS. Post-operative skiagrams done to assess union and complications like varus mal-union or unacceptable fracture collapse and implant related complications like loosening, cut-out, intra-articular migration, impingement or breakage.

Results: 55.21% presented with medial, posterior or lateral wall comminution. 75.86% had grade 3 and 4 osteopenia and 18 patients had grade 1, 2 or 5 osteopenia. Valgus (68) and anatomical (14) reduction was the commonest choice of acceptance by operating surgeon in both stable and unstable fractures and this type of reduction showed least varus collapse or screw cut out risk as compared to varus (3) and medialized (11) reduction.

Conclusion: The 'surgery unrelated' morbidity factors did not affect the risk of varus collapse or screw cut out. The overall varus collapse, malunion or cut out risk correlated significantly with 'surgery related' factors related to screw placement and quality of reduction accepted. The central-central screw placement was found ideal for minimum 'cut out risk'.

Key Words: morbidity factors, pertrochanteric fractures, DHS, TAD.

## THESIS SUMMARY

### Introduction:

The term extra-capsular fracture neck femur is now better defined as pertrochanteric fracture which extends from extacapsular basal neck to lesser trochanter before the anatomical differentiation of the medullary canal. The

evolution of surgical expertise and implant design makes surgery the choice in the management of these fractures. The conservative management of these fractures is associated with almost double the rate of fatality as compared to the operative group. Even in those who survive the risk of mortality

by conservative treatment, the inevitability of complications like uncontrolled shortening and varus collapse leave behind considerable morbidity. Even with the advantage of other modified sliding hip screw systems and cephalo-medullary nail, the use of dynamic hip screw (DHS) is preferred worldwide as

“collapse to stability” remains a distinct advantage. The goal of surgery is strong and stable fixation to maintain reduction during union. Varus collapse and associated implant cut out in head region and intraarticular penetration remain the major unacceptable outcome especially in fractures rendered unstable due to posteromedial or lateral wall comminution, subtrochanteric extension, reverse oblique type, and intracapsular extension of fracture line.

### Aims and Objectives

This study was conducted to analyze whether the personality of a pertrochanteric fracture treated with DHS in all types of these fractures is related to the patient, the fracture or the surgery by studying:

1. The surgery unrelated factors like fracture instability, degree of comminution, osteopenia, femoral neck shaft angle, irrespective of age and gender, which should concern the surgeon as possible factors influencing clinical and radiological outcome and to correlate their contribution in possibly increasing the morbidity.
2. The surgery related factors like implant placement, compromised reduction, inability to take care of comminution and provision of lateral buttressing.

### Methods

Out of 1350 internal fixations by DHS done, between 2007 to 2012 for pertrochanteric fractures, 111 patients above the age of 50 years (mean age 68.43 years; range 50-100 years) were randomly selected for this study; 15 were excluded from the study (14 had died a natural death following post operative recovery; 1 had early post-operative infection). Remaining 96 fractures were operated by a standard lateral proximal femoral approach by 5 senior surgeons after optimizing existing medical illness in the patient and were studied over a period of two years. The exclusion criteria were:

1. Patients with significant medical or neuro-psychiatric comorbidity.
2. Contralateral hip disease or deformity.
3. Any significant postoperative complication, e.g. infection, wound dehiscence, intra-operative nerve damage.
4. Intertrochanteric fractures managed with an implant other than DHS.
5. Patients who expired or were lost in followup.

The preoperative underlying morbid factors related to age, gender, smoking habit, alcohol excess, drug intake, fracture type, displacement and its plane, degree of comminution and osteopenia were observed to study the fracture personality. The pre-operative anteroposterior (AP) skiagram of pelvis with both hips and lateral (Lat) skiagrams of the fractured hip were studied to assess if the fracture was unstable, by authors individually to minimize inter-observational variance. Boyd and Griffin, Evans, Kyle's and Gustilo and AO/OTA classification systems were all used to identify instability related to posteromedial and lateral wall comminution and reverse obliquity. The image of uninjured hip was used to grade pre-existing osteopenia by Singh's index and comparison of neck shaft angle restored after surgery. The post-operative skiagrams in AP/Lat projection were studied to observe:

1. Type of reduction preferred by the surgeon – whether anatomical, medialized or valgus.
2. Screw placement in the quadrant of the head as accepted by the surgeon and seen in the AP/Lat post operative skiagram. The central placement of screw i.e. that placed in the axis of femoral neck in both AP/Lat skiagram was taken as the reference in assessing the quadrant of screw placement in the femur head.
3. TAD index achieved was measured as a sum of the distance between the tip of implant and head of femur in AP/Lat views. The change in magnification of the images was accounted for by the method standardized by Baumgartner et al.
4. Any post-operative change in neck shaft angle from that measured on the contralateral side for comparing the restored angle after surgery.
5. The ability of the implant to support any existing comminution of the lateral wall and to stabilize any major comminution in the medial wall especially a large displaced lesser trochanter fragments.

Post operative follow up and evaluation

Whether the fracture remained stably reduced and the implant did not migrate during union were evaluated by assessing post operative skiagrams for:

- Occurrence of any union related complications like varus malunion or unacceptable fracture collapse.
- Implant related complications like loosening, cut-out, intra-articular migration, impingement or breakage.

Correlations of the observed outcome with the surgery related or unrelated morbidity factors were done using statistical tools like Chi-square test, Z test for proportion and ANOVA single factor test to establish their role.

### Results

By the different classification system, 53 fractures were labelled ‘unstable’ and 43 fractures were ‘stable’ and out of 86 fractures in the 50-80 years age group, 48 were unstable and 38 were stable and 67 (77.01%) patients were in Singh's index osteopaenia grade 3 and grade 4. Only 8 (8.33%) fractures had lateral wall comminution. Medial and posterior wall comminution of various magnitudes, although their degree of comminution could not be quantified, was seen in 53 fractures (55.21%). The neck shaft angle ranged from 1180 to 1400 (average 129.010), that in females ranged 1180 to 1400 (average 129.230) and in males from 1200 to 1400 (average 128.830). The surgeons “accepted” 68 fractures in valgus reduction, 14 fractures in anatomical reduction, 11 fractures with medialization and 3 fractures in varus reduction. In the 8 (8.33%) fractures which had lateral wall comminution, no mechanical or biological reconstruction of the lateral wall was done. Medialization was done in these patients for stability. No bone grafting was done for biological augmentation of comminution. Augmentation with a derotation screw or wire done as the need be. A correlation of the TAD with screw tip position in the quadrant of femoral head was observed. Among the 79 patients who had ideal (<25mm) TAD, the best accepted position was central-central (47) followed by inferior-posterior (19) followed by superior-anterior (8), central-posterior (5) in this order. Only two cases had unacceptable TAD (>30mm).

**Follow up**

The neck shaft angle achieved after reduction and its shift from the target contra-lateral neck shaft angle was evaluated along with the difference of TAD achieved from the ideal (<25 mm) in early follow up before union (average 6.84 weeks) and after clinical union (average 11.7 weeks). The shift from ideal TAD at union in the fractures with no change in neck shaft angle in the anatomical reduction group clearly indicated a controlled collapse. In the valgus reduction group, 61% fractures showed some loss in their valgus reduction but only 17.6% showed further shift in TAD at union, none with a cut out. In the varus reduction group, whether or not medialized, all fractures progressed to further varus with progressive shift of TAD with consequential 'cut out risk' in 20% fractures. In fractures with medialized reduction with valgus neck-shaft angle there was initial loss of valgus and shift in TAD but none further at union. In the group of 79 fractures with TAD < 25mm, 74 (93.7%) showed satisfactory union without varus collapse, 4 (5.06%) fractures showed union with varus collapse all with initial medialization, and 1 patient showed non-union with screw migration after initial medialization. In the group of 15 fractures with 'acceptable' TAD of 26-30mm, 11(73.3%) satisfactory union with 2 fracture showing some varus collapse was observed and 4 had non-union with screw migration. In the 2 patients with 'unacceptable' TAD more than 30mm, both with initial medialization, non-union with screw migration was seen.

The non-union observed in 7 (7.29%) fractures strongly correlated to two factors:

- a) medialized reduction and
- b) TAD >25mm (85.7%).

### Conclusion

Despite variations in the normal neck shaft angle, a 135° DHS is a preferred solution for stabilization of peritrochanteric fractures. A larger angle would risk the placement of screw tip in superior quadrant and a narrower angle would interfere with control of collapse by getting jammed. Good stable reduction in both anteroposterior and lateral view, valgus positioning, if required in maintaining good screw position even in osteoporotic situations, the target of central screw placement, non-acceptance of varus or medialization, central or inferior screw positioning in the anteroposterior view, use of contra-lateral un-fractured hip image as a template for post-operative reconstruction and the judicious use of adjuvant, derotation cancellous screw are some of the important strategies the surgeon must use to achieve a good TAD and successful union without the risk of varus collapse and cut out. For the fractures with reverse obliquity, the use of DHS remains debatable. The limitations of this study are that the study of factors related to pre-existing osteoporosis in affecting the results is not feasible in this short-term study of associated morbidity, and the role of smoking, alcohol intake, associated medical co-morbidities in affecting outcome also needs a different study module.

### Clinical Message

The risk of varus collapse or screw cut out relate to 'surgery related' factors concerned with reduction and screw placement. 'Surgery unrelated' morbidity factors like age, gender, fracture type, degree

of comminution and osteopenia do not affect the outcome. The central-central screw placement is ideal for minimum cut out risk.

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