

# Treatment of Unstable Intertrochanteric Fractures: A Comparative Study of Anatomical Reduction Versus Wayn County Reduction Fixed With Dynamic Hip Screw (DHS)

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## ABSTRACT

**Background:** Unstable intertrochanteric fractures pose a challenging problem. Severe comminution in elderly osteoporotic patients renders internal fixation difficult. Several methods, techniques and fixation devices have been advocated for treating these difficult fractures but each one has different rate of complications. The purpose of conduction of this study was to compare the results of Wayn county (valgus) reduction with anatomical reduction by using dynamic hip screw (DHS) in unstable intertrochanteric fractures. **Material and methods:** This was a prospective randomized study. Forty patients of unstable intertrochanteric fractures were treated with anatomical and Wayn county reduction, fixed with DHS. AO type A2 and A3 were included. Out of 40 cases 20 were treated by anatomical reduction, 20 cases included in Wayn county reduction group. All cases were followed up for 6 months and assessed with Larson's evaluation score for hip. **Results:** Out of 40 patients 23 (67.5%) were male and 17 (42.5%) were female. Average age was 64.25 years having higher incidence between 60 to 70 years (23 patients), 18 (45%) patients had associated diseases, 33 (82.5%) patients had A2 type fracture and 7 (17.5%) had A3 type fractures. 36 patients out of 40 were fully followed, there was no death during hospital stay, 4 patients died during follow up. All 4 patients were of Wayn county reduction group. Average delay in surgery was 10 days, average postoperative hospitalization was 11.6 days. Average operating time was 56 minutes in Wayn county reduction and 70 minutes in anatomical reduction. Average healing time was 14 weeks in Wayn county reduction and 13 weeks in anatomical reduction group. Implant placement in femoral head 27 were central – central and 13 were posterior-inferior. Overall results were excellent and good 87% in Wayn county reduction and 80% in anatomical reduction, mechanical failure was present in 0% in Wayn county and 20% in anatomical reduction group. **Conclusion:** Result showed that Wayn county reduction had better results than anatomical reduction with less chance of mechanical failure,  $p < 0.05$ .

**Key words:** Unstable intertrochanteric fracture, Wayn county reduction, anatomical reduction and dynamic hip screw.

## INTRODUCTION

**H**ip fractures in elderly have tremendous social, economic and orthopaedic impact.<sup>1</sup> The continuous rise in the number of hip fractures has put an increasing demand on orthopaedic trauma

departments. This rise seems to be more pronounced for trochanteric fracture types than for femoral neck fractures. The unstable intertrochanteric fractures present a challenging problem. Severe comminution in elderly osteoporotic patients renders internal fixation difficult. Restoration of normal functional

anatomy is the goal common to the management of the fractures. For inter trochanteric fractures this goal is made difficult by the fact that approximately 75% of these fractures are unstable.<sup>2</sup>

In addition to two major fragments, comminution along the calcar and posterior cortex leads to collapse in varus and mal positioning of the fracture after internal fixation.<sup>3</sup>

The primary goal in the treatment of an elderly patient with an intertrochanteric fracture is to return the patient to his or her pre-fracture activity as soon as possible.<sup>4</sup> Stable reduction of the fracture and early mobilization, all contribute to this aim.<sup>5</sup> Trochanteric fractures do well if the fracture fragments at surgery are reduced to a stable position with good bone contact. However the patients are usually old with fragile osteoporotic bones, which makes it difficult to obtain and maintain stable fracture reduction.<sup>6</sup>

Several methods, techniques and fixation devices have been advocated for treating these difficult fractures but each one has different rate of complications so still it is called an unsolved fracture.

The anatomic reduction is usually the aim but posterior-medial fragment is difficult to reduce so anatomic reduction with or without fixation of posterior medial fragment is recommended method<sup>7</sup> and this reduction is most frequently used.<sup>8</sup>

Wayn county or valgus or lateral reduction is achieved by altering the position of fragments i.e. medial displacement of proximal fragment where by calcar femoral remaining on the proximal fragment impinges medially on cortical shaft by providing a bone contact to resist further shortening, varus displacement and potentially increasing mechanical stability.<sup>1,4,6,8,9</sup> Very little work has been done on Wayn county reduction. Stover et al<sup>10</sup> first described it in 1971 and Parker<sup>9</sup> in his study concluded that reduction of fractures in slight degree of valgus appears to offer the optimum position with advantage over anatomical reduction and have minimal cutout rates.

This study was conducted with aim to compare the results of Wayn county (valgus) reduction with anatomical reduction by using DHS in unstable intertrochanteric fractures.

## MATERIAL AND METHODS

Total 40 cases of unstable intertrochanteric fractures were fixed with DHS in the department of Orthopaedic at Lahore General Hospital, Lahore in 3 years period. Out of 40 cases 20 patients were fixed in anatomical reduction and 20 in Wayn county reduction. Cases were arranged at random into two groups, odd numbers to anatomical and even numbers to Wayn county reduction groups.

AO international classification of intertrochanteric fractures were followed. A2 and A3 types of fracture were included in this study. No compound fractures were included in this study. All non ambulatory patients before fracture were excluded. Patients were admitted from accident and emergency department and out patient clinic. X-ray pelvis including both hip joint AP view and X-ray of fractured hip with proximal femur AP and lateral views were obtained in all patients. All patients were admitted in the ward, skin was applied patients were fully investigated and evaluated for any systemic disease, and made fit for anaesthesia. X-rays of the fractured hip were checked to see the behaviour and pattern of fracture while x-ray of contralateral hip was checked for degree of osteoporosis and for appropriate size of implant.

All patients were operated on routine operation list after their stabilization and fitness regarding anaesthesia. All patients were given intravenous antibiotic 1 gram of cephalosprim group (velosef) half hour before surgery and then continued for five days postoperatively. Fracture was reduced and than operated on orthopaedic table under image intensifier control. For Wayn county reduction lateral traction to thigh was applied with sling before internal rotation of extremity. If closed reduction was not adequate then fracture was reduced by open method. After satisfactory reduction proximal femur was approached through approach and then guide wire was inserted with drill aiming it with the help of angle guide in central or posterior-inferior portion of head of femur at angle of 135°, 2cm below the flare of greater trochanter just opposite to lesser trochanter. After confirming the position of pin with C-arm in AP and lateral view the appropriate length of lag screw (10mm less from subchondral bone) was measured.

After reaming and tapping, lag screw was appropriate size was inserted and fixed, then its position was confirmed on C-arm. Then 135° side plate of appropriate size was glided over the leg screw and fixed to the lateral side of the femur with 4.5mm cortical screws after releasing bone traction. In anatomical reduction posterior fragment was hold by an additional screw whenever possible. Then compression screw was applied. The final position was checked on image intensifier and wound was closed in layers over suction drain. Drain was removed after 48 hours and stitches were removed on 14<sup>th</sup> day of surgery.

Patients were encouraged to sit on bed on next day of surgery, and on side of bed with exercise of lower extremities. Depending on the patient's condition and stability of internal fixation toe touch walking with two crutches or walker was began on the fifth postoperative day. After removal of the stitches patient was reviewed clinically and radiologically after every four weeks for three months and than every two months for six months.

Patients were allowed partial weight bearing with walker or crutches after six weeks of surgery as pain decreased. Full weight bearing walk with two crutches or walker after 10-12 weeks of surgery. Progressing to full weight bearing walk with one cane or one crutch and without aid after 20 weeks. At six months after surgery all patients were assessed on Larson's evaluation score for hip.<sup>11</sup>

### LARSON'S CRITERIA FOR HIP EVALUATION

#### One Hundred point scale for hip evaluation

- |                                                                    |   |
|--------------------------------------------------------------------|---|
| <b>A. Function (35 points)</b>                                     |   |
| • Does most of house work or job that requires moving about        | 5 |
| • Dresses unaided (included tying shoes and putting on socks)      | 5 |
| • Walks enough to be independent                                   | 5 |
| • Picks up object from floor by squatting                          | 3 |
| • Sits without difficulty at table or toilet                       | 4 |
| • Baths without help                                               | 3 |
| • Negotiates stairs foot over foot                                 | 3 |
| • Negotiates stairs in any manner                                  | 2 |
| • Carries objects comparable to suitcase                           | 2 |
| • Gets into car or public conveyance unaided and rides comfortably | 2 |
| • Drives a car                                                     | 1 |

- |                                            |                           |
|--------------------------------------------|---------------------------|
| <b>B. Freedom from pain (35 points)</b>    |                           |
| • No pain                                  | 35                        |
| • Pain only with fatigue                   | 30                        |
| • Pain only with weight bearing            | 20                        |
| • Pain at rest but not with weight bearing | 15                        |
| • Pain on sitting or on bed                | 10                        |
| • Continuous pain                          | 0                         |
| <b>C. Gait (10 points)</b>                 |                           |
| • No limp no support                       | 10                        |
| • No limp using cane                       | 8                         |
| • Abductor limp                            | 8                         |
| • Short leg limp                           | 8                         |
| • Needs two canes                          | 6                         |
| • Needs two crutches                       | 4                         |
| <b>D. Absence of deformity (10 points)</b> |                           |
| • No fixed flexion over 30°                | 3                         |
| • No fixed adduction over 10°              | 3                         |
| • No fixed rotation over 10°               | 2                         |
| • Not over 2.5cm shortening                | 2                         |
| <b>E. Range of motion (10 points)</b>      |                           |
| • Flexion – extension                      | (normal 140)              |
| • Abductor – adduction                     | (normal 8)                |
| • External – internal rotation             | (normal 80°)              |
| • Total degree points                      | (1 point /30°)            |
| • Excellent                                | = Over 90 score           |
| • Good                                     | = Between 80 and 90 score |
| • Fair                                     | = 70 – 80 score           |
| • Unsatisfactory/poor                      | = Less than 70 score      |

### RESULTS

Out of 40 patients 23 were male (57.5%) and 17 were female (42.5%). Male to female ratio was (1.35:1), average age was 64.25 years (20-90 years) there was high increase in 60-70 years of age (23 patients).

Four patients had associated injuries (10%). Eighteen patients had associated diseases such as diabetes mellitus, hypertension, CVA, bronchial asthma, myocardial infarction, viral hepatitis and peptic ulcer. Thirty three patients had A2 type of fractures (82.5%) 7 patients had A3 type fractures (17.5%). The mode of injury was fall in 31 patients (77.5%), vehicular injury in 7 patients (17.5%) and direct injury to two patients (5%).

Thirty six patients out of 40 cases for full follow up, 4 patients died during follow up. All 4 were of Wayn county group and none of them died during hospitalization. Mortality rate was 10%, cause of death was CVA, hypostatic pneumonia & MI.



WAYN COUNTY REDUCTION WITH DHS



WAYN COUNTY REDUCTION WITH DHS



WAYN COUNTY REDUCTION WITH DHS

Average delay in hospital arrival was 10.2 days. Average delay in operation from date of admission was 10 days and a average postoperative hospitalization was 11.6 days. Average operating time 56 minutes in Wayne county reduction and 70 minutes in anatomical reduction group. Peroperative problems were 25%, over reaming in one patient, difficulty in holding lesser trochanter in 7 patients, fracture of greatertrochanter in one patient and

breakage of drill bit in one patient. Average healing time was 14.2 weeks in Wayne county reduction and 13.4 weeks in anatomical reduction group.

Postoperative general complications were in 18 patients (45%), haematoma formation in 6 patients, superficial infection in 2 patients, deep infection in 2 patients, chest infection in one patient, delayed wound healing in 3 patients, crutch palsy one patient and CVA in 2 patients.

Table 1: Ambulatory status.

	Before injury	After injury	
		Wayn County	Anatomical
Independent	36	8 (50%)	8 (40%)
With one cane	4	6 (37.5%)	8 (40%)
With two canes	0	2 (12.5%)	2 (10%)
With two crutches	0	0	2 (10%)
Bed ridden	0	0	0

Table 2: Hip score (total 100 points)

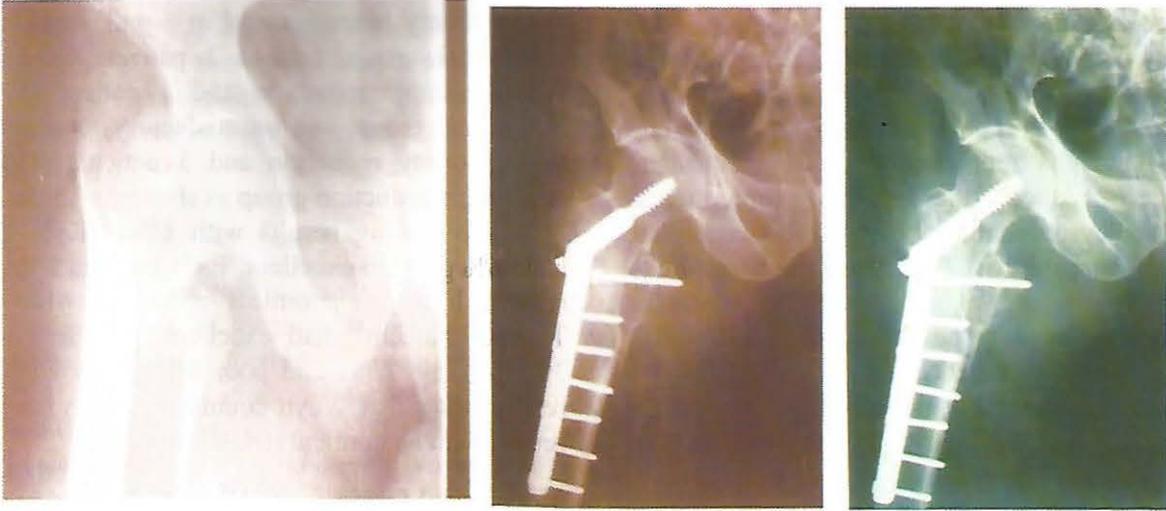
	Wayn county	Anatomical
Excellent >90 score	8 (50%)	10 (50%)
Good (between 80-90 score)	6 (37.5%)	6 (30%)
Fair (between 70-80 score)	2 (12.5%)	1 (5%)
Unsatisfactory/poor (< 70%)	0	3 (15%)

Table 3: Postoperative complications

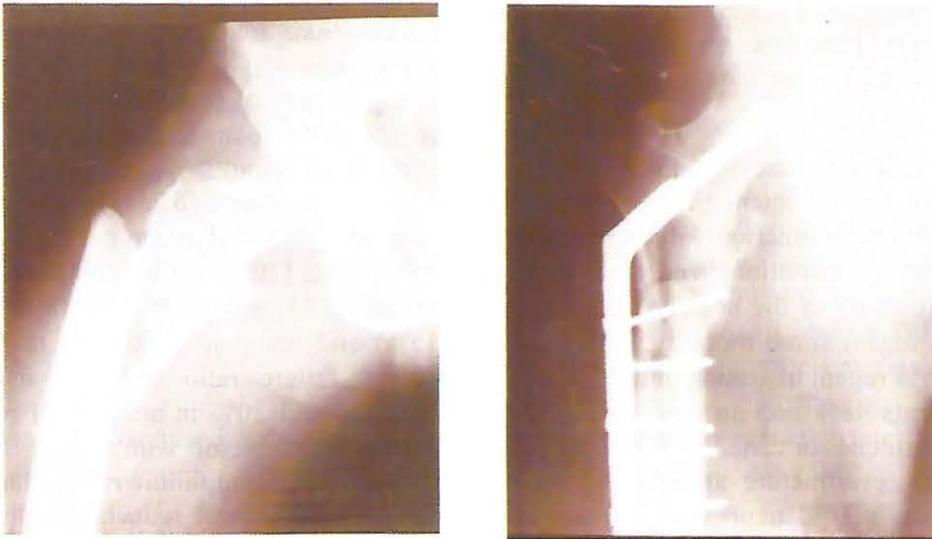
	Wayn county	Anatomical
Varus deformity	1 (6.25%)	3 (15%)
Cutting out of head	0	2 (10%)
Pulling off plate from shaft	0	1 (5%)
Revision of surgery	0	1 (5%)
Pain	1 (6.25%)	4 (20%)
Lengthening	2 (12.5%)	0
Shortening	2 (12.5%)	8 (40%)
External rotation	2 (12.5%)	0

## DISCUSSION

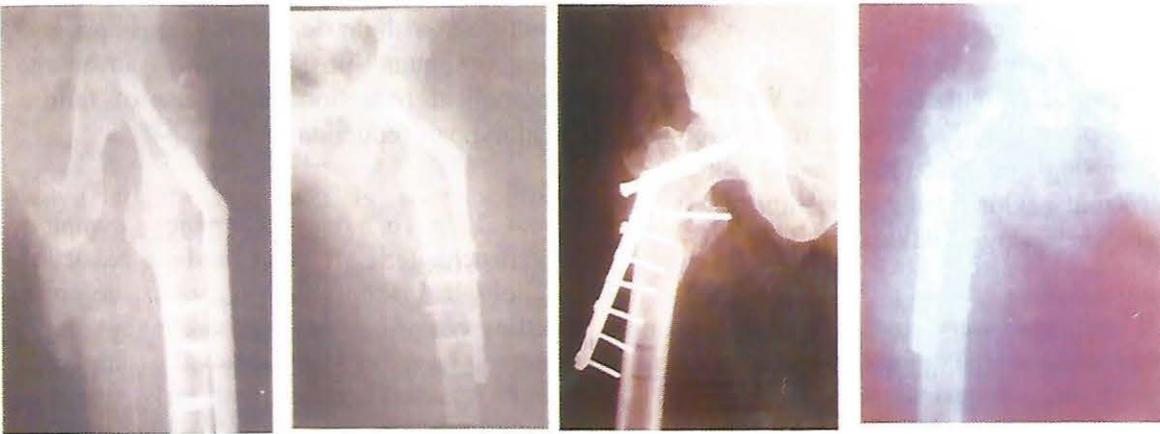
In Wayne county reduction shaft of femur is displaced laterally to medial cortex of femoral neck thereby creating a buttressing force to resist varus displacement. This reduction places emphasis on medial stability of fracture and provides progressive



**ANATOMICAL REDUCTION WITH DHS**



**ANATOMICAL REDUCTION WITH DHS**



**ANATOMICAL REDUCTION WITH DHS**

**PULLING OFF FROM SHAFT**

**SUPERIOR CUTOUT**

controlled collapse of the fracture with medial continuity being restored in a valgus position, weight bearing will encourage this collapse and valgus position will reduce the chance of shortening of leg. A valgus reduction also has mechanical advantage of reducing the deforming force, across the fracture by reducing the distance between plate and weight bearing axis. The reduction of fracture to a slight degree of valgus appears to offer the optimum position with advantage over anatomical reduction and it is recommended that fracture should be reduced to achieve a trabecular angle between  $160^\circ$  and  $170^\circ$  ( $160^\circ$  is normal trabecular angle).<sup>9</sup>

Biomechanically the shearing components is greater than normal in coxa vara and smaller than normal in coxa valga. In coxa valga there is no shearing components if the line of action of resultant force coincides with axis of the femoral neck.

#### Ambulatory functions

Preservation of ambulatory function is most important tissue in the treatment of hip fractures. Severe loss in ambulatory function will increase the risk of patients being institutionalized and causes socioeconomic problems in the society.<sup>1</sup> Larson et al<sup>6</sup> reported 80% regain some mobility, Pitsar and Sameul<sup>12</sup> had 47.5% regain of walking ability. Rao et al<sup>13</sup> had 124 patients 48% had no need of support 44% need walker crutches or cane.

In our study pre-fracture ambulatory status was without support in 36 patients and with support of one cane in 4 patients and results were independent 8 patients (50%) in Wayne county reduction and 7 patients (35%) in anatomical group. With 1 cane 6 patients (37.5%) in Wayne county group and 8 patients (40%) in anatomical group. With two canes 2 patients (12.5%) in Wayne county group and 2 patients (10%) in anatomical group. In anatomical group 3 patients (15%) had 2 crutches as shown in Table 1. Our results are comparable to all western studies having same results.

#### Functional outcome

All patients were assessed by Larson's criteria for hip score at six months after surgery.

Our results were excellent in 8 patients (50%) in Wayne county reduction and 10 patients (50%) in anatomical group, good in 6 patients (37.5%) in

Wayne county reduction and in 6 patients (30%) in anatomical group, fair in 2 patients (12.5%) in Wayne county reduction and 1 patient (5%) in anatomical group, and unsatisfactory results 0% in Wayne county reduction and 3 patients (15%) in anatomical reduction group as shown in Table 2.

Comparing results with others Kyle et al<sup>14</sup> had 96% good to excellent, 1.4% fair and 2.6% poor results, having anatomical reduction with DHS, Tanveer Saleem<sup>15</sup> had excellent in 53%, good in 30.75%, fair 7.7% and poor 7.7% with DHS. Our result shows that Wayne county reduction has better results than anatomical reduction group.

#### Mechanical failure

Internal fixation of unstable intertrochanteric fracture is not always successful.<sup>16</sup> The main complications are cutting out femoral head, bending or breakage of plate, pulling off plate from shaft, disengagement of components, varus deformity and loosening of implant in femoral head.<sup>4,17,18</sup>

In our results Wayne county reduction group has only 1 patient (6.25%) with varus deformity while in anatomical group cutting out of head were in 2 patients (10%), pulling off plate from shaft in 1 patient (5%) and varus deformity in 3 patients (15%) and revision of surgery in 1 patient (5%). Overall failure ratio was 0% in Wayne county reduction and 20% in anatomical reduction group. Comparing the result with others. Butt et al 1995<sup>19</sup> had 12.5% fixation failure ratio. Clark Ribbison<sup>5</sup> had series of anatomical reduction with DHS reported cutting out and varus deformity in 12.7%. Parker<sup>9</sup> having Wayne county reduction with DHS had 4.2% cutout rate. I agree with Parker<sup>9</sup> that reduction of fracture to a slight degree of valgus appears to offer the optimum position with advantage over anatomical reduction and mode of failure varies with type of reduction.

#### Pain

Pain is one of major symptom with intertrochanteric fracture and is associated with radiological failure.<sup>20</sup> The varus deformity with cutting out of nail or screw are main source of pain and can be relieved by removal of implant.<sup>21</sup> Orosz et al<sup>22</sup> reported less pain with early surgery. Ecker<sup>23</sup>, Essar<sup>24</sup> and Laros<sup>25</sup> had 35%, 39% and 6.8% pain respectively in their studies. In our study Wayne

county reduction group had 1 patient (6.25%) with fatigue pain while in anatomical reduction group 4 patients (20%) have pain (out of four one has fatigue pain) and others have superior cutout, varus deformity.

#### **Length discrepancy**

The leg length discrepancy in intertrochanteric fractures is due to impaction at fracture site which is dependent on degree of comminution, type of reduction achieved and choice of implant. Shortening is more marked with DHS due to its sliding property.<sup>1</sup>

Leg lengthening is marked with Wayne county reduction because of its mechanical stability.<sup>6</sup> Chow et al<sup>26</sup> reported 1 to 3cm shortening in 6.19 patients, Davis et al<sup>16</sup> shortening in 25.5% of patients, in his series. Hornby et al<sup>27</sup> reported leg lengthening discrepancy in 25% of his patients with DHS, Laghari<sup>28</sup> reported 2.22% shortening in his series. In our study Wayne county reduction had shortening in 2 patients (12.5%) and lengthening in 2 patients (12.5%). In anatomical reduction shortening was in 8 patients (40%) and lengthening in 0%. Our result showed shortening was more marked in anatomical group and lengthening in Wayne county reduction group only.

#### **External rotation**

External rotation occurred with tendency to fix the side plate with in neutral position on traction table. It can be avoided by fixation of plate to shaft of a femur in 15° of internal rotation.<sup>26</sup> Davis et al<sup>29</sup> reported 15° in 2.4% and Laghari<sup>28</sup> reported 4.44% external rotation in their series. Our series show 2 patients (12.5%) in Wayne county reduction group and (0%) in anatomic reduction group.

#### **CONCLUSION**

Wayne county reduction is superior than anatomical reduction because of its mechanical stability providing buttressing effect and resistance to varus deformity irrespective of bone quality and placement of implant. Mechanical failure ratio is more marked in anatomical reduction than Wayne county reduction.

Wayne county reduction should be the first choice in the management of unstable

intertrochanteric fractures but if during anatomical reduction postero-medial fragment can not be held then should be left alone and it should be assured that reduction is stable and there is maximum bone contact.

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