



## Clinical Study of Osteosynthesis in Fracture Neck of Femur

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### Abstract

*The aim of the study is to analyse a viable treatment option for fracture neck of femur – considered to be difficult in achieving union.*

**Objectives:** *To evaluate the efficacy of multiple cancellous screws as a treatment for fracture neck of femur.*

**Materials and Methods:** *A prospective study of 40 cases of fracture neck of femur treated by multiple cancellous screw fixation was followed up and clinically evaluated.*

**Result:** *Early surgical intervention using multiple cancellous screws gave good results.*

**Conclusion:** *It is an easy less invasive produce with fewer complications.*

**Keywords:** *Fracture neck of Femur, cannulated cancellous screws, early fixation, anatomical reduction.*

### Background

Intracapsular fracture of neck of femur is one of the difficult problems for orthopaedic surgeons all over the world.

The incidence of these fractures are increasing because of increased incidence of high velocity injuries. Femoral neck fracture can occur in any age group even though it is common among elderly.

There is a high frequency of nonunion and avascular necrosis in these fractures. The reasons are at the time of injury itself the circulation to the proximal fragment is interrupted or diminished, most of these fractures are unstable, absence of cambium layer of periosteum and bathing of the fracture site by synovial fluid.

Various surgeons have been trying different modalities of internal fixation since 1850 and the process is still evolving.

The peculiar blood supply, lack of cambium layer, trabecular formation and the altered shearing

forces after fracture fixation adds to the complexity of the problem.

Healing of fracture neck of femur differ from that of long bones. Because of the absence of cambium layer of periosteum in the femoral neck within the joint capsule, it heals by intra medullary endosteal callus, so called primary union or creeping substitution, which is evident in undisplaced and impacted fractures.

Fractures heals from the viable distal fragment to the proximal head provided that the fracture is anatomically reduced and stably fixed. In majority of displaced fractures either part or the entire head is avascular. It is obvious that the meduallary vessels within the metaphysis are severed and the source of blood supply to the head depends on the integrity of lateral and medial epiphyseal vessels. In completely displaced fractures the lateral epiphyseal vessels also are sometimes damaged.

In about 70% of cases the nutrition of the head is partly or almost entirely preserved by the

remaining retinacular vessels and arteries of ligamentum teres. When vascular deficit is partial it usually involves a larger area of the head at the upper outer quadrant. Until recently it was not possible to know how much of the head is avascular. But to some extent the radio isotopic studies using MDPTc99 give some clue about the integrity of vascular supply of the head.

Bony union of fracture normally takes about 3 to 4 months period which is evident by absence of pain during active movements of hip and on weight bearing and can be confirmed usually by x-rays.

The incidence of avascular necrosis varies from 5% to 84% and it can occur even in impacted fractures. After bony union of the fracture it usually causes late segmental collapse involving the weight bearing part. In displaced fractures, the incidence of avascular necrosis is high. Delay in treatment increases the incidence of avascular necrosis. In children the pattern of avascular necrosis is different from that of adults, this is because of the differences in vascular pattern and presence of growth plate barrier.

To summarise the prognosis depends on the initial displacement of the fragments, viability of the head, degree of comminution of the posterior cortex and rotation of the head at the time of injury and during reduction. Vigorous, repeated forcible manipulations, improper reduction and selection of implants all contribute to the outcome in these fracture.

### Materials and Methods

A prospective study of 40 cases of fracture neck of femur treated by multiple cancellous screw fixation was followed up and clinically evaluated. All Pauwel and Garden types of fractures in adults below 60 yrs of age was taken up for the study.

The common classification of femoral neck fractures are those based on

1. Anatomical location of the fracture
2. Direction of the fracture line
3. Displacement of the fracture fragments

Sir ASTELY COOPER classified the femoral neck fractures into intra capsular and extra

capsular fracture. Later intracapsular fracture were anatomically divided into

1. Subcapital
2. Transcervical and
3. Basicervical

The fracture line in majority of intracapsular fractures begin in the superior cervico-capital junction and extends obliquely through the neck to the inferior cortex producing a beak in the proximal fragment.

### PAUWEL'S classification

He classified the fracture according to the inclination of the fracture line with reference to a horizontal line in the postreduction film. Direction of the fracture line could be altered by change in the direction of the shaft of femur, position of the limb and pelvis. These are the disadvantages in this classification. But it is more useful for both prognostic and management purpose.

**Type 1:** Where the angle of the co inclination of the fracture line is below  $30^{\circ}$ . Here the shearing component is less, hence the fracture is having inherent stability. Resultant forces at the hip acts vertical to the fracture plane which promotes union by compression.

**Type II:** The angle of inclination is  $30$  to  $70^{\circ}$ , shearing forces act to some extent and the fracture is unstable.

**Type III:** The angle of inclination of the fracture site more than  $70^{\circ}$ , fracture is biomechanically unstable as shearing forces are enormous at the fracture site. Even after anatomical reduction, impaction and adequate fixation, the fracture may go in for nonunion and deformity.

### GARDEN'S classification

In 1964 Garden classified femoral neck fracture according to the degree of the displacement of the fracture.

**Stage 1 :** Incomplete or impacted fracture. In this the trabeculae of the inferior neck are intact.

**Stage 2:** Fracture is complete without displacement. The trabeculae are interrupted by the fracture. The fracture line runs across the entire neck.

**Stage III:** Fracture is complete with partial displacement. Distal fragment is rotated

externally. Posterior retinaculum is partially intact holding the fragments together. The head is in varus position.

**Stage IV:** Fracture with complete displacement of proximal fragment which return to normal position, and the trabecular pattern of the neck is in alignment with these of acetabulum. The distal fragment is rotated laterally and displaced. The posterior cortex of the neck is collapsed and posterior retinaculum is fully torn. Stage I and II have good progress and stage III and IV have poor prognosis

#### **AO / ASIF classification**

B1 - undisplaced sub capital fracture

B2 - transcervical fracture

B3 - displaced subcapital fracture

Undisplaced subcapital fractures are stable and vascular damage is less which offers good prognosis. Displaced subcapital fractures are unstable and vascular damage is more, which offers poor prognosis.

#### **Clinical Evaluation**

The clinical presentation of the femoral neck fractures depend on the type of fracture. In incomplete fractures the patient may be able to actively move the hip and walk with little pain and limp. Pain is sometimes referred to the medial aspect of thigh. There may be some limitation of movement, especially internal rotation and adduction, if there is valgus and retroversion of the head due to impaction.

In displaced fractures patient complains of pain over the groin after injury and patient may not be able to walk immediately after injury. Active movements are not possible and attempted passive movements are painful. Impacted fractures may displace on it's own in due course. Diagnosis is confirmed by x- ray evaluation. X-ray pelvis AP view showing both hips will show the fracture site. X-ray of pelvis with both the hip joints keeping the affected limb in traction and 10 to 20° internal rotation, is a must to evaluate these fractures. Lateral view of the affected hip is usually taken pre-operatively to assess the rotation of the head and posterior cortex comminution.

X-rays are useful to study the type of fracture, quality of bone, degree of posterior cortical comminution and associated fractures around the hip. Reduction film is essential for preoperative planning. If traction films show the head in extreme valgus position. one should think of capsular interposition. In an already operated case on successive x-rays if there are increasing varus displacement of head, retroversion, obvious gap in the fracture line and sclerosis of the margins of the fractured fragments, they clearly indicate instability and are early signs of failure of union.

Plain radiograph may be normal or equivocal in 8% of patients suspected of hip fracture. CT scan can be diagnostic, because of high sensitivity Radio nuclide bone scan has been used more frequently. A delay has been recommended to increase sensitivity. Recent studies report a superior sensitivity of MRI over bone scan.

Steps of reduction are disimpaction, reduction, maintenance of reduction and checking the reduction in the antero posterior and lateral x-rays. Many methods of closed reduction have been described.

1. WHITMAN'S TECHNIQUE
2. LEAD BETTER
3. SMITH PETERSON
4. DEYERLE
5. McELEVENNY
6. FLYNN

#### **Evaluation of reduction**

Garden's alignment index; in antero posterior x-ray the angle formed by the central axis of the medial trabecular systems of the capital fragment and the medial cortex of the upper femoral shaft is normally around 160°. On the lateral x-ray the central axis of the head and central axis of the neck normally lie in a straight line of 180°. Garden believed an alignment index within the range of 155° to 180°, on both frontal and lateral views is an acceptable reduction resulting in a high percentage of union and low rate of segmental collapse.

To summarise valgus or varus over reduction up to 20° is acceptable, and anteversion or

retroversion' up to 20° is acceptable, if more than this the incidence of non union is high.

Fracture neck of femur in adults below the age of 60 years with good bone stock were included in the study.

### Operative Procedure

Surgery was performed using fracture table. Patients were in supine position with a padded counter traction perineal post and the injured leg held in extension in a foot plate and the uninjured in flexion and adduction in a well leg holder. The lower abdomen, hip, thigh and knee are scrubbed, painted and draped.

Watson Jones lateral approach is used with plane between tensor fascia lata and gluteus medius. Greater trochanter identified. Anteversion guide wire placed and position confirmed with image intensifier. Second guide wire introduced and position confirmed. Over the guide wires 6.5 mm cannulated screws were passed after drilling and tapping. Three cancellous screws were used whenever possible.

### Post Operative Management

Patients were allowed to sit in bed and asked to perform static knee exercises from the second post operative day onwards.1

Patients were allowed to walk with a pair of axillary crutches with partial weight bearing from 6 weeks post operative period onwards. But, full weight bearing was deferred till there was radiological union. It usually took about 12 weeks. Results were assessed according to ASKIN & BRYAN'S CRITERIA.

**Excellent:-** Full range of motion and strength, little or no pain with essentially normal appearing X. rays.

**Good:-** some limitations of motion, mild discomfort and mild joint space narrowing or alteration of normal head neck relationship or both.

**Fair:-** Some limitation of motion with moderate pain and degenerative joint changes or avascular necrosis.

**Poor:-** Severe restriction of movement and function, with corroborative X.ray findings, requiring salvage procedures.

### Results

**Table 1.**

Severity of violence	No. of case	Percent
Trivial Violence	4	10
Moderate violence	16	40
Severe violence	20	50

**Table. 2**

Age group	No. of case	Percent
Below 20 years	8	20
20 to 40 years	20	50
40 to 60 years	12	30

**Table. 3**

Time of surgery	No. of case	Percent
With in 1 day	20	50
Within 1	12	30
More than 1 week	8	20

**Table. 4**

Pauwell's Type	No. of case	Percent
Type I	10	25
Type II	24	60
Type III	6	15

**Table. 5**

Garden's Stage	No. of case	Percent
Type 1	10	25
Type 2	12	30
Type 3	12	30
Type 4	6	15

All patients were put on pre operative skin traction. Fracture table was used in all cases and fixation was done with 2 or 3 cancellous screws. All patients were discharged within 2 weeks. Follow up period ranges from 8 months to 24 months. All patients were assessed clinically radiologically and functionally

**Union:** Union was obtained in 34 fractures. Fracture site united in 12-18weeks. Union was confirmed both clinically and radiologically with x-rays. Four cases of non union were observed which included one case with infection.

**Pain:** No pain at rest and normal activity was present in the majority of cases when osteosynthesis was achieved without any complications. 6 cases had pain on walking some distance 2 cases with avascular necrosis had persistent pain at rest at 1 year follow up

**Hip function:** Sufficient range of movement in the hip for daily activities like dressing, walking was possible in majority of patients. Three patients with avascular necrosis and 3 with non union had limitation of movement and difficulty in squatting and sitting cross legged.

**Gait:** Unassisted movement was possible in 31 cases.

Three patients with non union was unable to walk without support. Two patients with avascular necrosis also needed support to walk.

**Limb Length discrepancy:** Among the cases of successful union 20 had no limb length discrepancy. 16 cases had less than 1 cm shortening

**Avascular necrosis:** 4 cases developed avascular necrosis of which 2 patients had pain at rest.

Based on ASKIN and BRYAN's Criteria the result in this series were

**Table. 6**

Result	No. of case	Percent
Excellent	16	40
Good	12	30
Fair	10	25
Poor	2	5

**Table. 7**

Complication	No. of case	Percent
Avascular necrosis	4	10
Non union	4	10
Infection	2	5
Length discrepancy >1cm	4	10

## Discussion

This series comprised of 40 case of intra capsular fracture neck of femur treated with internal fixation using multiple cancellous screws.

Though femoral neck fractures is a surgical emergency we were not able to do the fixation within 6 hours as advised but almost all cases were done within 24 hours after admission. Cancellous screws were the only mode of internal

fixation used as it has now become one of the best options of treatment for fracture neck of femur. We found the procedure to be relatively easy, with minimal soft tissue dissection, minimal operating time, hence decreased chance of infection and bleeding.

The use of cannulated system of screws under Carm control gave a good assessment of reduction and also ideal positioning of the implants.

The patients who developed avascular necrosis and non union had displaced fractures.

## Conclusion

Fracture neck of femur in younger age group is usually a result of high energy trauma. The incidence of these fractures are on the upswing due to increase in road traffic accidents. Proportion of male patients more in younger age group because men are more involved in high energy trauma. Older patients are usually females due to increased incidence of osteoporosis .

Cannulated cancellous screw fixation gives a more accurate positioning and fixation of the fracture with minimal dissection and lesser operative time and faster rehabilitation time. Initial displacement of fracture (type of fracture) accurate reduction, stable fixation and very early surgery are major variables affecting fracture union. Along with early good fixation, a good post operative rehabilitation programme is also essential for optimal functional result. It can be concluded from this study that multiple cancellous screw fixation for fracture neck of femur in age group under 60 years is an effective surgical option.

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