

Original Research Article

Surgical management of basicervical fracture neck of femur with dynamic hip screw and de-rotation screw: a prospective study

Vijaykumar S. Kulambi¹, Ajay Shringeri Satish^{2*}, Prathik Rangaraja²

¹Professor, ²Junior Resident, Department of Orthopaedics, J. J. M. Medical College, Davangere, Karnataka, India

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*Correspondence:

Dr. Ajay Shringeri Satish,

E-mail: ajayshringeri@gmail.com

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ABSTRACT

Background: Basicervical region of femur is that part of femur which is intermediate between neck and intertrochanteric region. Fracture in this region carry substantially higher chances of failure due to greater fracture angle and are rotationally unstable. If treated inadequately they carry very high chances of fracture non-union and theoretically risk of osteonecrosis. The objective of the study was to analyse functional outcome of basicervical fracture neck of femur fixation with dynamic hip screw and de-rotation screw in a tertiary care hospital.

Methods: 35 cases of basicervical fracture neck of femur admitted in Chigatteri General Hospital and Bapuji Hospital affiliated to JJM Medical College Davangere, in the period of October 2015 to October 2018. Functional outcome was assessed according to Modified Harris Hip Score after one year of follow up.

Results: The fracture union was found in 100% cases, average time period for fracture union was 12.28±3.71 weeks (11-15 weeks range). The results according to Modified Harris hip score were excellent in 70%, good in 11.4%. Fair in 5.7% and poor in 2.8% at the end of one year. The correlation analysis with Pearson's correlation coefficient (r) was 0.74 which show a highly positive correlation between the union of basicervical fracture neck of femur with dynamic hip screw and derotation screw.

Conclusions: With the study of 35 cases of basicervical fracture neck femur we conclude that these are a unique type of fractures mid-way between neck and intertrochanteric fractures with rotational and axial instability, and also risk of osteonecrosis. DHS allows for controlled collapse of the fracture for uneventful healing, and de-rotation screw gives rotational stability.

Keywords: Basicervical fracture, Dynamic hip screw, De-rotation screw, Modified Harris hip score

INTRODUCTION

Basicervical region of femur neck represent that part of femur which is along the intertrochanteric line or just proximal to it, and fractures in these regions represent an intermediate form between neck of femur and intertrochanteric fractures.¹ These fractures are biomechanically unstable than a stable inter trochanteric fractures.¹ The location of these fracture also carries a higher risk of avascular necrosis of femur head. There has been considerable controversy in recent decade as to the

treatment aspect of this fracture. In comparison to other types of proximal femur fractures, in these fractures, capsule gets entrapped between the fragments and results in failed closed reduction and inevitably leads to open reduction and internal fixation, which again increases the chances of avascular necrosis of femur head. Poor functional outcome is expected when fixed with DHS alone.²

DHS allows for controlled collapse of the fracture fragments, de-rotation screw gives rotational stability.

The aims of this study were to identify a group of basicervical fracture neck of femur with rotational and axial instability fixed with DHS and de-rotation screw.

METHODS

A prospective study was carried out between October 2015 to October 2018 with 35 cases of basicervical fracture neck of femur which were admitted in JJM Medical College, Davangere.

The patients more than 18 years with basicervical fracture neck of femur as defined by AO type 31B2.1, patients with closed type of fractures and patients who were willing for surgical management were included in the study. The patients with intracapsular fracture neck femur, intertrochanteric fracture in which the head – neck fragments has connection with the trochanter, or has inferior cortical extension that can tether it to the distal fragment and prevent its spinning around the DHS lag screw, patients with pathological fractures and patients with advanced arthritis or degenerative disease of femur head were excluded in the study.

Operative technique

A closed reduction was obtained under spinal anaesthesia and reduction in both AP and lateral view (Figure 1A and 1B) was confirmed by image intensifier. A straight lateral incision from greater trochanter and extending distally along the thigh, blunt soft tissue dissection done. tensor fascia Lata and vastus lateralis was split in line of skin incision to expose the proximal femur. Using an angle guide, a threaded guide pin was inserted from trochanteric flair till 10 mm short of subchondral bone of femur head positioning centrally in both AP and lateral radiographs. Second guide pin was inserted 13-15 mm proximal and parallel to first pin (Figure 2). This provides a temporary rotational stability which prevents head from spinning around triple reamer or lag screw. A suitable length cannulated cancellous screw 6.5 mm was inserted with washer (Figure 3). Lag screw insertion (Figure 4B) and barrel plate (Figure 4C) was fixed to the shaft. Coupling screw insertion after releasing the traction for adequate compression at fracture site.

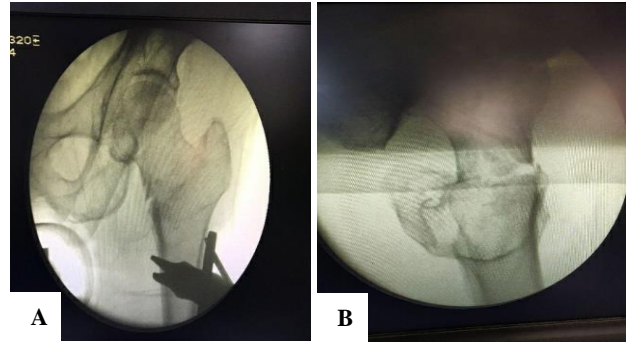


Figure 1: Closed reduction achieved in both (A) AP and (B) lateral view under image intensifier guidance.

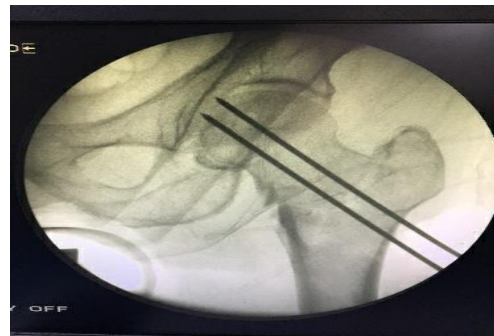


Figure 2: Two guide pins 13-15 mm apart and parallel to each other for lag screw and de-rotation screw.

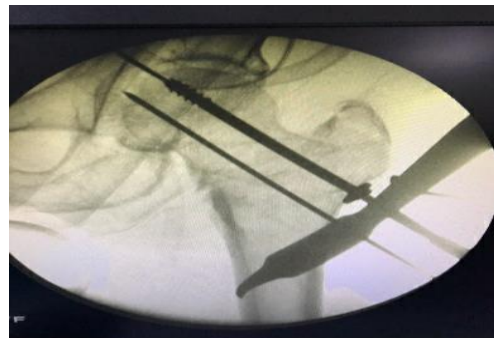


Figure 3: De-rotation screw is fixed before reaming for lag screw to give rotational stability during reaming and post operatively.

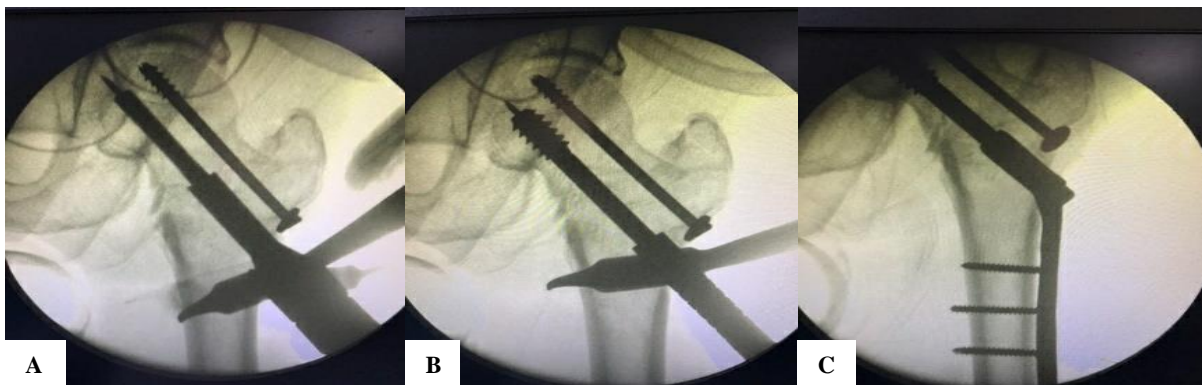


Figure 4: (A) Triple reaming for lag screw followed by (B) lag screw fixation and (C) side plate.

The prophylactic injectable antibiotics injection Ceftriaxone 1000 mg BD and Amikacin 500 mg BD was started, on first post-operative day sitting was allowed and active quadriceps and ankle pump exercises were taught and encouraged within the limits of pain, dressing was changed on 2nd post-operative day along with drain removal, sutures removed on 10th post-operative day. The complete weight bearing was deferred till the callus bridges the fracture gap on serial follow up according to the protocol.

Follow-up

Post operatively management is individualized based on the fracture pattern and stability of reduction obtained.

Individuals with good reduction were allowed to do partial weigh bearing until good amount of callus appreciated on X-rays, and then progressive weight bearing was started. If reduction was considered as not good, weight bearing was deferred till callus bridged the fracture gap. Prophylactic antibiotics till the wound heals and low molecular weight heparin as prophylactic doses were given. Active quadriceps and ankle pump exercises were taught and proper postoperative counselling was given. Follow up reviews were undertaken at 6, 12 weeks, and then at 6 and 12 months interval. Outcome functional assessment was assessed at 12 months post operatively.

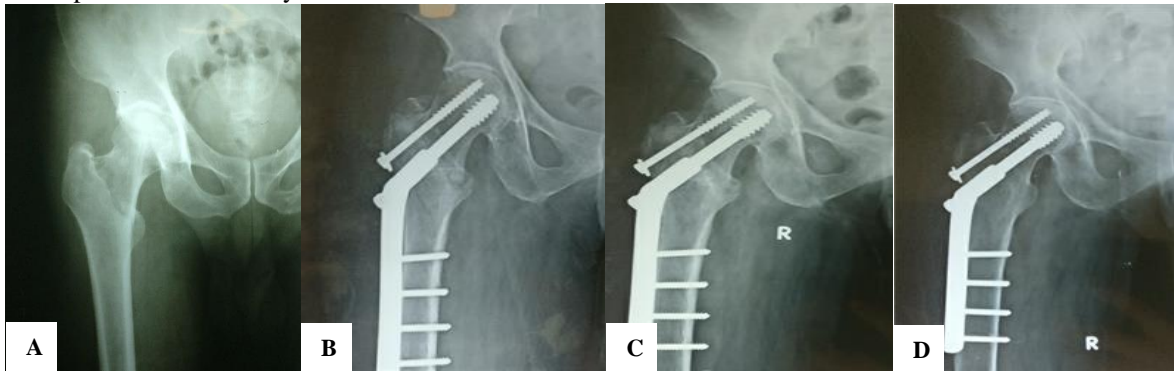


Figure 5: (A) Pre operative, (B) 6 weeks follow up, (C) 3 months follow up, (D) 1 year follow up.



Figure 6: (A) Cross legged sitting; (B) hip flexion; (C) internal rotation.



Figure 7: (A) External rotation; (B) abduction; (C) adduction.

Radiological assessment

The assessment of adequate screw fixation was based on the position of lag screw within the femoral head, adequate fixation if the lag screw is placed in

The reduction of fracture was considered good if there is <10 degrees of varus or <15 degrees of valgus and displacement between the fracture fragments was <3mm on AP and lateral views of X-ray. The parallelism between the screw is considered good and it also helps as a prognostic marker in the serial follow up visits for assessing the maintenance of reduction. Lost parallelism in follow up x rays indicates the impending implant failure.⁵

Fracture collapse was defined as the length of protrusion of the compression screw from the lateral edge of the barrel in relation to entire length of the lag screw. Percentage collapse was calculated at six months postoperative and a categorisation system was developed. Mild collapse was defined as <10% shortening, while severe collapse was defined as >10% shortening.^{6,7}

Radiologically, the implant failure was defined when there was lag screw cut out, loosening of screw, medialization of shaft, non-union, excessive displacement on follow up X-rays of either fragments, time to fracture union was assessed by serial follow up X-rays to look for bridging of callus in the fracture gap and trabecular continuity across the fracture site.⁷ Fracture non-union if no bridging trabeculae at the end of six month post operatively.⁶

Clinical assessment

On regular follow-up hip joint motion, limb length discrepancy and limp, extent of use of walker was assessed, at the end of one-year follow-up functional assessment was made as per the modified Harris hip scoring and the results were compared.

The data were statistically evaluated with IBM SPSS Statistics for Windows, Version 20.0, IBM Corp, Chicago, IL.

RESULTS

A total of 35 patients were included in the study and their baseline data is listed in Table 1. Youngest age of the patient was 20 years and oldest being 72 years. The mean age of patients in our study was 59.29±8.02 years. Most of the cases were affected on right side (20) and being

central/central, inferior/central, or inferior/posterior (in AP/lateral views). Placement in the superior and/or anterior third of the femoral head was considered inadequate.³ Tip apex distance or TAD should be less than 20 mm in both AP and lateral radiographs.⁴

more common among males (22). The average time lag before surgery was 4 days (ranging from 1-9 days). The adequate reduction was achieved in 32 cases and inadequate reduction in 3 cases as the neck shaft angle exceeded 15 degrees of valgus and displacement of >3 mm between the fragments in 2 cases.

The adequate fixation was achieved with TAD < 20 mm and proper placement in femoral head in 32 cases, inadequate in 3 cases as TAD exceeded > 20 mm and the lag screw was placed superiorly. A total of 33 cases had parallel placement of screws and 2 were converging. The fracture union was found in 100% cases and the average time period for fracture union was 12.28±3.71 weeks (11-15 weeks range).

We observed the distance of lag screw sliding distance of <10% in 31 cases and >10% in 4 cases. The mean sliding distance was 5.5 mm (0-12 mm). 100% of cases had fracture union and no case of non-union or AVN were noted. The average limb shortening was 5 mm compared to normal limb. A total of 33 cases had near normal range of motion of hip joint at the end of one year.

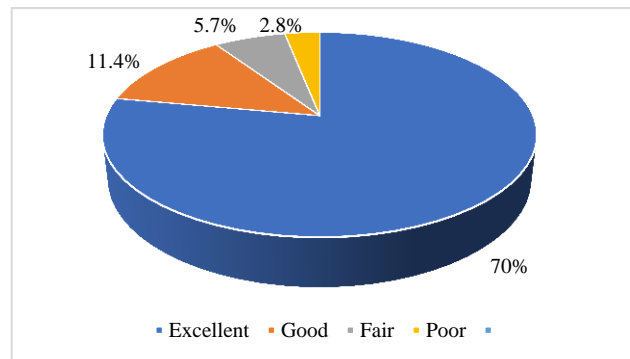


Figure 8: Functional outcome analysis as per modified Harris hip score.

According to modified Harris hip score, excellent in 70%, good in 11.4%. Fair in 5.7% and poor in 2.8% were achieved. The correlation analysis with Pearson’s correlation coefficient (r) was 0.74 which show a highly positive correlation between the union of basicervical fracture neck of femur with dynamic hip screw and derotation screw (as shown in Figure 8).

Table 1: Demographic data.

Type of fracture	Mean age	Gender		Side		Total cases
		Male	Female	Right	Left	
Basicervical fracture neck of femur	59.29±8.02	22	13	20	15	35

DISCUSSION

Basicervical region occurs in an area of differentiation between neck and intertrochanteric region, they don't have an exact definition or classification systems. Even now this region is under numerous discussions with respect to treatment aspect in order to treat it as a neck or intertrochanteric fractures.¹⁰ It has been characterized as an extra capsular location of fracture line.¹¹ These fractures have high fracture angle, absence of any muscle attachment to proximal segment, these characteristics are applicable to AO type 31B2.1.¹² These fractures have rotational and axial instability and hence these fractures are at theoretically higher chances of osteonecrosis of femur head.¹³

DHS has been a conventional implant for the fixation of extra-capsular neck of femur fractures, the lag screw has potential to rotate the rotationally unstable head of femur during the lag screw insertion, this can increase the chances of aseptic loosening and fracture non-union. For this reason, we inserted a second pin superior to the guide pin for DHS before doing triple reaming and lag screw insertion. post operatively also, the compression screw does not give enough rotational stability for the separated fragments, hence presence of a de-rotation screw will give an additional rotational stability.^{2,14} Excessive shortening of femoral neck due to compression at fracture site was not a problem in this study, mean sliding distance was 6mm. The mean shortening of the injured limb was 5mm (range 0-15 mm). Pajarinen et al. reported an average 4.7 mm (range 0–25 mm) shortening of the femoral shaft in a group of patients (n=41) treated with DHS.¹⁵ De-rotation screw also can control the inferior translation of proximal fragment and provide axial stability at fracture site when compared to using DHS alone.

Massoud et al found the average time for union to be 11.5 weeks in his cases treated with DHS and De-rotation screw with no cases of non-union.⁸ Enocson et al found 0.02% of non-union in his basicervical fracture cases treated with DHS and an antirotation screw.⁹ Massoud et al in their study evaluated using kyles et al modification criteria and found 92.86% excellent results, 4.76% good and 2.38% fair results with no poor results.⁸

One case had superficial wound infection in second post-operative week, which was controlled by daily dressing and injectable antibiotics according to the sensitivity. There was no screw cut out or breakage noted. Heterotopic ossification was noticed in 2 patients; however, they regained their walking ability at the end of 7 months with proper training. Non-specific hip pain was noted in 5 cases. 2 cases had >1 cm limb shortening due to >10% of lag screw sliding distance, they were treated with sole rise on affected side.

CONCLUSION

With the study of 35 cases of basicervical fracture neck femur we conclude that these are a unique type of fractures mid-way between neck and intertrochanteric fractures with rotational and axial instability, and also risk of osteonecrosis. DHS allows for controlled collapse of the fracture for uneventful healing, and de-rotation screw gives rotational stability. We conclude that this method of fixation for basicervical fractures have an excellent outcome and renders a low-cost construct for treatment in developing countries.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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