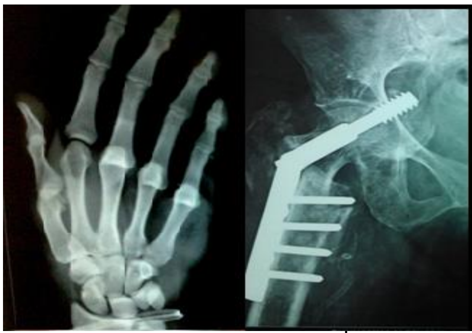

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Comparison of radiological and functional outcome in patients with femoral neck fracture operated with dynamic hip screw versus multiple cannulated screws

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Abstract

Introduction: Intracapsular fractures of neck femur have always presented a great challenge to orthopaedics surgeons and remain in many ways the unsolved fracture as far as treatment and results are concerned especially in younger population. Intracapsular fracture neck of femur is regarded as an orthopaedic emergency and needs to be reduced with rigid internal fixation which is believed to improve the circulation of femoral head and prevent the nonunion and avascular necrosis. In our country sliding hip screw is not commonly used for intracapsular neck femur fracture fixation as compared to cannulated screw fixation, we have undertaken this comparative study to assess the outcome of both fixation modalities as well as factors influencing the results of these fixations in our population.

Materials and Methods: This is a prospective randomized study conducted at tertiary care hospital in department of Orthopaedics consists of 62 patients which were randomized into 2 groups. Group A(n=31) patients were operated with 3 cannulated cancellous screws and Group B(n=31) patients were operated with Dynamic hip screw.

Results: We have found DHS not only to be to be more stable but also allows better compression across the fracture, allowing early mobilization and early union. There was no complication of non-union in patients managed with DHS while 3 patients managed with CC screw progressed to non-union. Average time for union in our study was 14 weeks for patients managed with DHS while it was 18 weeks for patients managed with CC screw.

Conclusion: We recommend use of DHS with derotation screw for managing all the patients of fracture neck femur i/v/o early mobilization, early union and reduced risk of non-union.

Keywords: fracture neck femur; young patients, DHS; CC screw

Introduction

Intracapsular fractures of neck femur have always presented a great challenge to orthopaedics surgeons and remain in many ways the unsolved fracture as far as treatment and results are concerned [1] especially in younger population. With increasing frequency of high energy trauma, the incidence of fracture of neck of femur is increasing in young adults [1, 2]. Fractures of the femoral neck are devastating injuries that most often affects the elderly and have a tremendous impact on the health Care system and society in general.

The worldwide incidence of femoral neck fractures has continued to increase. From an estimated 1.3 million hip fractures in 1990. This number is predicted to rise to 2.5 million by 2025 and 4.5 million by 2050, assuming there is no age specific increase.

Operative management consists of fracture reduction and stabilization, which permits early patient mobilization and minimizes many of the complications of conservative management with prolonged bed rest, such as chest infections, bed sores, muscle atrophy etc. has become the treatment of choice. The available options for the stabilization of femoral neck fractures in today‘s time include fixation using either cannulated cancellous screws or sliding hip screw. Earlier options like juvet nails, Knowles pin, asnis screws, etc were given up because of high failure rate and lack of dynamism The commonest Complications while treating intra capsular fracture neck of femur are non union and avascular necrosis [3-7].

Furthermore avascular necrosis is more likely to be symptomatic and have poor functional outcome in the younger population [3].

The fracture is regarded as a vascular injury to the bone‘s blood supply [3-8]. The degree of vascular compromise is thought to directly correlate with the Displacement of the fracture which affects fracture union an leading to complications. Hence intracapsular fractureneck of femur is regarded as an orthopaedic emergency9 and needs to be reduced with rigid internal fixation which is believed to improve the circulation of femoral head and prevent the non union and avascular necrosis.

The simple and less traumatic technique of fixation with multiple cannulated screws placed in parallel by was introduced for intracapsular fractures of the hip in 1980 10 by Ansis *et al*, in an attempt to increase the accuracy of fixation and to decrease the rate of complications.

Internal fixation with cannulated cancellous screws after good anatomical reduction has the advantages of decreased blood loss and operative time, lower transfusion requirements and decreased length of hospital stay [9]

Richards *et al* has quoted basic advantages of using sliding hip screws in terms of strength greater than multiple cancellous screws, minimization of risk of subsequent subtrochanteric fracture secondary to a stress riser effect, and placement of compression across the fracture at the time of reduction. Disadvantages of the sliding hip screw for femoral neck fracture stabilization include a larger surgical exposure and the potential to create rotational malalignment of the femoral head at the time of screw insertion [11].

In our country sliding hip screw is not commonly used for intracapsular neck femur fracture fixation as compared to cannulated screw fixation, we have undertaken this comparative study to assess the outcome of both fixation modalities as well as factors influencing the results of these fixations in our population.

Material and Methods

The ethical clearance for this study has been obtained from this institution ethical Committee. The total number of cases studied were [62].

The total patients were divided into two subgroups

A. Patients treated with multiple cancellous screws [31].
B. Patients treated with dynamic hip screw and derotation screw [31].

The intention of this dissertation was to study the functional and anatomical outcome in patients of osteosynthesis of fracture neck femur with Dynamic Hip Screw and derotation screw versus Multiple Cancellous Screws.

Type of study –Nested Prospective study Period of study – May 2015 – Nov 2017.

Criteria for selection of the cases

Inclusion Criterion

1. Age group: after fusion of epiphysis till age of 60 yrs
2. Sex: both
3. Type of fractures: transcervical and subcapital fracture neck femur Exclusion Criterion:
    1. Age Group: Before the Fusion of Epiphysis and age More Then 60 Yrs.
    2. Pathological Lesion If Any E.G- Osteomalacia, Aneurysmal Bone Cyst
    3. Bascicervical Fracture Neck Femur

All the patients were explained about the aims of the study, the methods involved and an informed written consent was obtained before being included in the study.

As soon as patients were admitted, the history was recorded and a thorough clinical examination was conducted. In our series, spinal anaesthesia was given to all cases. Patient was transferred to a radiolucent fracture table. The pelvis was rested on the perineal supports and foot was tied to foot rest to facilitate 'C-arm examination (Fluoroscopic image intensifier) especially the lateral view.

Closed reduction was done mostly with Swiontkowski‘s method. Those not reduced were reduced by the Lead better method/ Flynn method.

Reduction was confirmed with AP and lateral views under 'C‘-arm exposure on T.V. screen. Further correction or reduction was done wherever necessary to achieve accurate reduction.

The pauwels classification is practised based on fracture line visualised on c arm image.

Need for pauwels valgus osteotomy is assessed. The adequacy of reduction was evaluated clinically by the heel-palm test and radiologically by Garden‘s alignment index. In heel-palm test, the heel is placed in the palm of an outstretched hand. If reduction is complete, the leg will not rotate spontaneously externally.

The affected limb was scrubbed with Betascrub solution from abdomen to knee joint, then painted with betadine solution and drape applied exposing the ASIS and proximal end of lateral part of thigh for the intended procedure.

Procedure

Dynamic hip screw fixation

For this procedure, patient positioning, fracture reduction, and draping of the surgical site are performed. After fracture reduction and draping are performed, we use a lateral approach to the femur. The skin incision is made distal to the greater trochanter, and the length of the incision depends on the length of the chosen implant. The vastus lateralis muscle is elevated off the lateral intermuscular septum, and perforating branches of the profunda femoris artery are ligated.

With the use of a fixed angle guide, a pin is driven into the subchondral zone of the femoral head. The entry point of guide wire is at the level of lesser tochanter. If valgus osteotomy is planned then entry point is shifted proximally. The appropriate angle is determined preoperatively. The 135-degree plate is most commonly used for this procedure. The angle guide must be placed parallel to the lateral cortex to ensure an accurate angle. The guide pin is aimed toward the distal third of the femoral neck (Centrally in the axial view). A second pin parallel to the first one and approximately 15 mm proximal to it ensures temporary fixation and diminishes the risk of rotational malalignment when the lag screw is inserted. The same second wire is also used as a guide for Derotation screw.

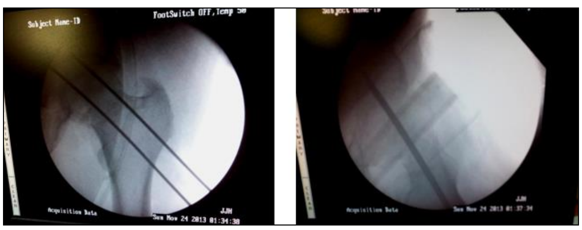

Fig A: Arm images showing proper guide wire placement

After the guide pin has been placed satisfactorily, the length of the lag screw is determined. The chosen length is 5 mm less than the actual measured length so as to allow for compression across the fracture site when the top screw is tightened. Lag screw length usually ranges between 85 and 105 mm. The bore is then prepared using the step drill. To avoid loosening of the guide pin, we took care not to ream over the tip- threaded portion of the K-wire.

Generally, screws inserted into osteoporotic bone do not need tapping. Tapping was done in young patients and in patients with highly sclerotic bone, however, to avoid excessive torque and to minimize the risk of malrotation of the femoral head fragment. We then attach the T-handle to the lag screw tap and sets it for the measured screw length.

At this point, the lag screw is driven in, and the thread must be placed completely within the head fragment to allow compression on the fracture. A fully inserted lag screw that equals the length of the measuring gauge allows 5 mm of compression. A 180- degree turn represents an advancement of 1.5 mm. The position and depth of the lag screw are then verified using biplanar fluoroscopic guidance. When the lag screw is placed, the handle must be perpendicular to the shaft to allow proper keying of the screw.

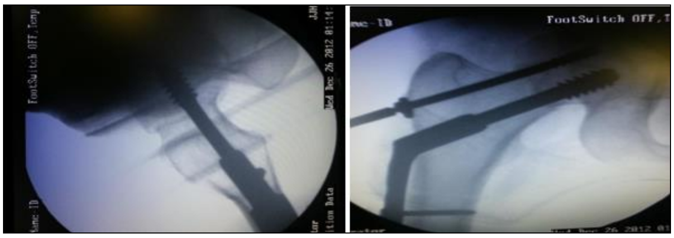

Fig B: Arm images showing final tightening of top screw and derotation screw

Following this the proximal guide wire is reamed using a 6.5 mm cannulated drill bit. Derotation screw is then inserted as close (min 2mm inferior) to the superior border of neck. The length of derotation screw is usually 10 mm less than the DHS screw. The plate is advanced to the lag screw, and a plate temper usually is needed to seat the plate fully.

The plate is then fixed with cortical screws. Finally, after all screws have been inserted, traction is released, and the top screw and Derotation screw is tightened simultaneously to allow for compression across the fracture site.

For multiple cancellous screw fixation

A lateral longitudinal incision in line with the greater trochanter measuring about 6cm starting at the flare of the greater trochanter and extending distally is made. The superficial fascia, Tensor fascia latae and vastus lateralis were then split in the line of skin incision. The origin of vastus lateralis was elevated subperiosteally at the base of trochanter.

Insertion of guide wire

A drill hole was made in the lateral cortex of femur just below the level of vastus lateralis ridge midway between the anterior and posterior cortices using a 3.2 drill bit. A 2mm threaded guide pin of 9 inches (22.5cm) length was inserted through this hole with the 135° angle guide using universal T -handle through the trochanter, neck and head.

Confirming the position of the pin with C arm, it is placed accurately in the proximal femur, calcar and head. This pin stabilized the head and prevented displacement or rotation of head during insertion of other guide pins.

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Now the parallel guide was placed over this guide pin through the central inferior hole of the inverted triangle pattern. Second guide wire was placed in the posterior-superior hole. Third guide wire was placed in the antero-superior hole of the angle guide. The screws were placed as far as possible close to the cortical bone. The parallel guide was removed. The position of guide wires was confirmed in C-arm image intensifier in both AP and lateral views. All the guide wires were threaded into the subchondral bone of the femoral head using T-handle.

Using the direct measuring device, the insertion depth of the three guide wires was determined. The drilling depth was calculated by subtracting 10mm from this

Reading. This prevented penetration of the joint. 4.0 mm cannulated drill bit and the drill sleeve was inserted over the guide wire.It permits drilling without loss of provisional stability. Drill sleeve protected surrounding tissues during drilling. Drilling was done to the depth determined as above and confirmed with image intensifier. Care was taken not to direct drill bit but rather to let it follow the guide wire. Because of their hollow cross section and long length, cannulated drill bits are more susceptible to breakage than solid drill bits. The cannulated tap was passed over the guide pin and tapped the near cortex.

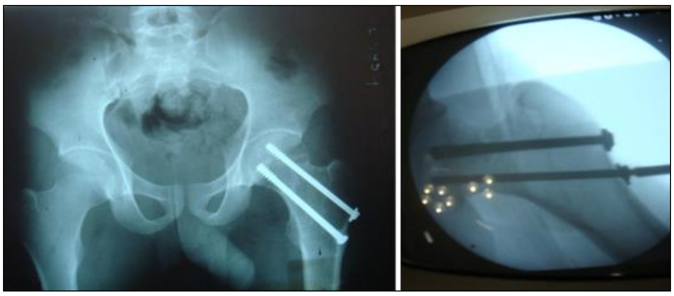

Fig C

A screw was selected so that the thread portion crosses the fracture line and engages the proximal fragment. The screws were used with washers to prevent screw head penetration into the bone and allowing the com pression effect. Using the cannulated hexagonal screw driver, the cannulated screws were inserted over the guide wires till 5-10mm of screw is outside the lateral cortex. All the screws are tightened simultaneously for final purchase into the subchondral femoral head. It provides excellent torque transfer into the neck and subchondral bone of the femoral head. The position of screws were confirmed in C- arm image intensifier in both AP and lateral views. Thorough wash of the wound was given with betadine solution and normal saline.

The wound was closed in layers over a suction drain tube. Sterile dressing was done. Acom pression bandage was given, traction released and the patient shifted to ward.

Post-operative management

- IV fluids were infused as appropriate.
- An antibiotic consisting of cefotaxim or ceftriaxone IV was given.
- Appropriate analgesics were also given
- The suction drain was removed after 48 hours, wound was inspected, cleaning and dressing of the wound done.
- Sutures were removed on 10th day, depending on condition of the wound.
- The patient was mobilized using a walker with toe touch nil weight bearing on affected limb before discharge from hospital.
- The patient was discharged with instructions not to bear weight on the affected limb till further instructions, to do active quadriceps exercises and to come for follow up after 4 weeks.

Follow-Up

In our study, patients on discharge were advised to report after 4 weeks,2, 3, 4 & 6 months and 1 year. At the follow-up a detailed clinical examination was done and patient was assessed subjectively for symptoms like pain, swelling and restriction of joint motion.

Modified Harris Hip scoring system was used for evaluation. Clinical examination was done regarding the pain, tenderness, active range of movements of hip and limb length discrepancy.

Radiographs of affected hip in AP and frog leg lateral view was taken and looked for progressive signs of union or any complications like the appearance of any coxavara or screw backing out or breaking or signs of avascular necrosis. If trabecular continuity at the fracture site was present, patient was advised partial weight bearing with walker for a further period of 6 weeks. After this period X- rays were taken and once fracture union was confirmed, patients were permitted to walk full weight bearing on the affected limb.

Results and Observations

- **Age and Sex Distribution.**

In our series, 62 cases of fresh fracture neck of femur treated surgically by internal fixation at JJ hospital, Mumbai during the period from May 2005 to november 2013 were included for this comparative study.

In our series, majority of the cases 32 (51 %) were in the age group of 31-40 years, even though distribution was from 19 yrs to 57 years. The mean age was 35.5 years.

Also males (67%) were more commomly involved as compared to females (33%) right side was involved in 35 (56.45%) cases and left hip in 27 (43.54%). There was no much difference in the laterality of fracture.

Mode of injury

Road traffic accident was the most common mode of injury in our study. Other causes for fracture neck femur is enlisted below.

Table 1

Mode Of Injury	no. of cases	Percentage
road traffic accident	31	50.0
fall	28	45.2
sports injury	3	4.8
Total	62	100

Associated injuries

The distribution of associated injury is as follows.

Table 2

Nature of injury	No. of Cases	Percentage
Head injury	5	8.0
Shaft Femur	2	3.2
Multiple Fractures	2	3.2
Others	5	8.0
No other injuries	48	77.4
Total	62	100

Fracture type – pauwel‟s Classification

In the present study, majority of the cases were Pauwels Type II (64.5 %) and I (22.5 %), followed by Type III (13%). We have stressed the assessment of classification on intaoperative c -arm image intensifiers, accordingly decision for pauwels osteotomy was taken in 3 cases

Pauwel‘s

Table 3

Pauwel‘s Classification	No. Of cases		Percentage
	DHS	CC screw	
I	4	10	22.5
II	22	18	64.5
III	5	3	13
Total	62		100

- **Time interval between injury and surgery**

In this study, most of the cases were operated in less than 24 hrs (61%) while 15 Patients (21%) were operated after 72 hrs which was either due to late presentation or associated injuries like head injury, which was primarily managed and then patients were operated once they got stable and fit for spinal anesthesia.

Capsulotomy

Other than those patients undergoing open reduction, prophylactic capsulotomy was performed in 15 patients managed with CC screw fixation. Capsulotomy was not required in patients managed with DHS with derotation screw as the joint got decompressed while using DHS reamers.

Table 4

Capsulotomy performed	No. of patients		Percentage
	DHS	**CC screw**	
Yes	0	15	24.2
No	31	16	75.8
Total	31	31	100

Length of screws used: The most common length of DHS screw used was 85mm (75 to 100 mm range) while that for CC screws was 75 mm (70 to 85 mm range).

- **Type of barrel used in DHS**

We have tried to correlate the outcome of fractures managed with DHS with the type of barrel used (long/ short) and following data was obtained.

Table 5

Capsulotomy performed	No. of patients		Percentage
	DHS	CC screw	
Yes	0	15	24.2
No	31	16	75.8
Total	31	31	100

Average intra-operative blood loss as mentioned in the intra-operative notes was 150 cc in DHS group while it was 50 cc in CC screw group.
Compression across the fracture site was achieved in all the patients managed with either modality of treatment. Postoperative Blood transfusion was given in 8 patients (both groups included) mostly because of low pre-operative haemoglobin levels.

Post-operative mobilization

Static quadriceps strengthening exercises and bed side active and active assisted range of motion exercises were started in both groups on post op day 0.

DHS group

Toe touch partial weight bearing was started on post op day 2.
Full weight bearing was advised after radiological union and was determined on case by case basis.

CC screw group

Patients were kept nil weight bearing for 10 weeks after which partial weight was advised as tolerated by patient.
Full weight bearing was advised after radiological union and was determined on case by case basis.

- **Wound complications**

5 patients developed superficial infection which recovered with IV antibiotics.
None of the patients developed deep infection or required debridement of operative site.
Reoperation in the form of screw removal was required in 3 cases managed with CC screw. Off this 2 patients developed trochanteric bursitis due to screw backout while one patient had gone into non-union.
No patient managed with DHS was reoperated for implant removal.

- **Hospital stay**

All the patients were discharged after suture removal and starting of appropriate physiotherapy. The average stay in hospital was 10 to 14 days managed with either modality of fixation.

- **Time taken for union**

All the patients were followed up and union was assessed radiologically in the form of cortical continuity and trabecular continuity in both AP and Lateral x rays.
Average time for union in DHS group was 14 weeks while that in CC screw group was 18 weeks.
Delayed union was seen in 4 cases managed with CC screw and 1 case managed with DHS screw.

Results: according to modified Harris hip score

In the present study, 62 patients with intracapsular fracture neck of femur were treated surgically. Excellent results were achieved in 27 cases (43.5%), good in 24 cases (38.70%), fair in 8 patients (13 %) and poor results in 3 case (4.8 %). All patients returned to preinjury activity levels and none of the patients required change of job

Table 6

Result		No. of cases	Percentage
	Dhs	**Cc screw**	
Excellent	19	8	43.5
Good	9	15	38.70
Fair	3	5	13
Poor	0	3	4.8

Discussion

Age, sex and laterality of fracture: With multiple factors associated with outcome of fracture neck femur, it is very difficult to assess the role of age and gender of patient and laterality of fracture in the outcome of fracture. We have found no studies suggesting the role of these variables in the outcome of fracture treatment.
In our study as well, we have not found these factors to play any role in the outcome of fracture treatment.

Modality of treatment: A number of studies as that by Watson *et al* 113, Kaplan *et al* 114 and Chen z *et al* 115 have found no difference in outcome of patients managed with either DHS or CC while others like Stiansy *et al* 116 have found DHS to be more stable and hence allows early mobilization of patient.
On assessment of patients on follow up with Harris hip score, we found excellent result in 61.3 % of our patients managed with DHS while only 25.8 % of patients managed with CC screw showed excellent result. On the other hand 9.7 % patients managed with CC screw showed poor results while none of the patients managed with DHS showed poor result. This difference is statistically significant with p value of 0.024 as calculated by Chi-square test. Also overall Harris hip score of patients managed with DHS was higher as compared to the score in patients managed with CC screw. As calculated by Mann-Whitney test, the difference between the average Harris
Hip scores between the two groups of patients is statistically significant with p value of 0.003.
We have found DHS not only to be to be more stable but also allows better compression across the fracture, allowing early mobilization and early union. There was no complication of non-union in patients managed with DHS while 3 patients managed with CC screw progressed to non-union. Average time for union in our study was 14 weeks for patients managed with DHS while it was 18 weeks for patients managed with CC screw.
We recommend use of DHS with derotation screw for managing all the patients of fracture neck femur i/v/o early mobilization, early union and reduced risk of non-union.

Fracture type: We have classified the fractures based on anatomical classification, gardens classification and Pauwel‘s classification. However, Pauwel‘s classification was considered to be more important as it affected the outcome.

Pauwel‘s type-3 femoral neck fractures are problematic to treat, with non-union rates higher than those reported for historical controls. In one of the studies on Pauwel‘s type III fractures 92non-union rate of 16% was reported with cannulated screws and 8 % with fixed angle device and supports the theory that these type-3 fractures experience shear and may demonstrate a higher rate of varus, shortening, and non-union. In our study, 8 patients had Pauwel‘s type III fracture of which 5 patients were managed with DHS while 3 patients were managed with CC screw. Complications like delayed union and varus were seen in patients managed with CC screw. However no patients with type III fracture ended up in non-union.

Biomechanically, it has been shown that a sliding hip screw device is stronger than three parallel cancellous screws for the treatment of Pauwel‘s type III intracapsular neck femur fractures. A recent biomechanical study showed the construct stiffness of fixed-angle devices to be superior to that of cannulated screws alone for the fixation of a Pauwel‘s type-3 fracture in cadaveric femora 93. Stability and the quality of reduction appeared to influence the rates of adverse outcomes in our series. Baitner *et al*.94 found that fixation with DHS resulted in less inferior femoral head displacement, less shearing displacement, and a greater load to failure when compared with the findings following fixation with three cannulated cancellous screws. Bonnaire and Weber 95 evaluated four different methods of fixation of Pauwel‘s Type-III femoral neck fractures in cadavers; these methods included a sliding hip screw with a derotational screw, a sliding hip screw without a derotational screw, cancellous screws, and a 1300 angled blade-plate. They concluded that the sliding hip screw with the derotational screw is the best implant for this fracture pattern.

We recommend use of DHS with derotation screw in Pauwel‘s type III fractures as adequate compression is achieved intraoperatively by placing 5 mm shorter lag screw in inferior quadrant of the neck and placing the derotation screw wider apart in superior quadrant. This construct is best for achieving optimum compression as it also incorporates concept of angle bisector line in achieving lag effect across the fracture site. We have found limitation of this construct in high subcapital fracture where DHS threads won‘t have enough purchase in femoral head.

Time interval between injury and surgery: The timing of surgery for femoral neck fractures remains controversial, and the available data remain inconclusive. Advocates of early surgery suggest that the main advantages of prompt reduction of a displaced femoral neck fracture are unkinking of the vessels and performance of an intracapsular decompression to remove the hematoma that increases intracapsular pressure 106, 107, 108. This improves and restores blood flow to the femoral head, minimizing the risk of femoral head osteonecrosis. Jain *et al*. 109 did not find a difference in the functional results between the patients in whom osteonecrosis developed and those in whom it did not. They concluded that delayed treatment was associated with an increased rate of osteonecrosis but did not affect the functional outcome. Haidukewych *et al.* 110 on the other hand demonstrated no difference in the rate of osteonecrosis following surgery that was delayed for more than twenty-four hours.

In our study majority of our patients were treated within twenty-four hours after the injury. However, the exact time to treatment is difficult to ascertain. In our study however higher risk of non-union was seen in patients managed with CC screw who underwent surgery more than 72 hrs after trauma. The probable reason is that when surgery is delayed for more than 72 hrs there is resorption at fracture ends and compression across the fracture site is poor, more so with CC screw as compared to DHS.

Method of reduction (open vs. closed): We have achieved closed reduction in 87 % cases using Swiontkowski manoeuvre. Studies have shown increased risk of AVN with hip in extension and internal rotation but we have found swiontkowski‘s manoeuvre, which is an extension type of manoeuvre, very useful in reduction without any increased risk of AVN. Upadhyay *et al*. 111 performed a prospective randomized study comparing open reduction and internal fixation with closed reduction and internal fixation in 102 young adults with a Garden Grade- III or IV femoral neck fracture. There was no significant difference in the osteonecrosis rate between the two groups (15% in the closed-reduction group and 18% in the open-reduction group) at two years postoperatively. Risk factors such as age, sex, time to surgery (less than or more than forty-eight hours), and posterior comminution did not appear to affect the development of osteonecrosis.

In our study only 13 % (8 patients) required open reduction of which 1 patient developed AVN. Hence we do not consider open reduction as a risk factor for AVN.

Role of capsulotomy: The role of capsulotomy in the treatment of femoral neck fractures remains controversial, and the practice varies by trauma program, region, and country. Animal studies 96, 97 have shown that increased hip intracapsular pressure results in a tamponade effect and may reduce blood flow to the femoral head. Clinical studies98-102 have shown that decompressing the intracapsular hematoma by means of a capsulotomy or aspiration reduces the intracapsular pressure. This decrease in the intracapsular pressure results in improved blood flow to the femoral head and may reduce femoral head Ischemia96-102. These studies suggested that intracapsular distension of the hip may be one cause of femoral head osteonecrosis. Other studies, however, do not support the concept of increased intracapsular pressure as a major factor in the development of Osteonecrosis 103, 104. Maruenda *et al*. 105 suggested that osteonecrosis may be a result of the vascular damage that occurred at the time of injury and not of the tamponade effect.

In our study the difference in the rate of osteonecrosis between those who had and those who had not received a capsulotomy was small; however, our sample size was too small for us to make definitive conclusions about the value of capsulotomy. Capsulotomy was not done in patients managed with DHS as reaming for lag screw placement was considered to decompress the femoral head.

Post-operative radiological reduction: Portzmann RR *et al.* 117 and Lee ch *et al.* 118 and several others have found increased complications like non-union and AVN in patients with non- anatomical post-operative reduction.

In our study more than 75 % of patients were reduced anatomically or in valgus impacted position. Complications like non-union, AVN, shortening and post-operative poor functional outcome were seen more commonly in patients who were fixed in malalignment. Hence it is recommended by us to reduce the fractures anatomically or in valgus impacted position.

Positioning of Lag screw and type of barrel: The positioning of lag screws with the use of the sliding hip device has been studied thoroughly, particularly in the treatment of trochanteric fractures. However, not as much study has been done on the positioning of screws for the fixation of intracapsular femoral fractures. Screw position can be assessed with implant-cortical bone purchase by evaluating the distance from the implant to the cortex. Baumgaertner *et al*. 112 proposed what has become the well-known concept of the tip-apex distance (TAD), as measured on an anteroposterior and lateral radiograph. In our study the exact distance was not measured due to variable magnification of available x-rays and lack of proper scaling of the x rays and hence the stability of reduction and the relation of TAD with the outcome could not be commented. Similarly, we have found that placement of DHS lag screw in the inferior quadrant along the calcar and use of long barrel plate increases the stability of fixation and hence is recommended by us. We have not found any references specifying the placement of lag screw in management of intracapsular neck femur fractures.

Placement of lag screw in inferior quadrant and derotation screw in superior quadrant allows for uniform compression across the fracture site. We have also found DHS with derotation screw to have greater ability to compress across the fracture site as compared to CC screw. However, further biomechanical studies are recommended for confirmation.

Duration of surgery and blood loss: Average duration of surgery in patients managed with CC screw was 50 mins while that in DHS group was 90 mins. Incision for CC screw group was smaller as compared to DHS group. Average blood loss for CC group was 50 cc while that of DHS group was 150 cc.

Thus complications related to prolonged anaesthesia and blood loss are expected to be less in CC group as compared to DHS group. However, none of our patients developed anaesthesia related complications or complications due to blood loss.

Complications: In this study, the risk factors for fracture non-union after internal fixation of intracapsular femoral neck fractures, we found that a displaced fracture, borderline and unacceptable reduction, and more centralized screw position were risk factors for non-union and implant failure.

The factors that have been most consistently found to be predictive of non-union after fixation of intracapsular femoral neck fractures are poor reduction and fracture displacement. Age and sex are not risk factors for non-union in most studies, including our study.

Fracture site, fracture level, and bone density were not found to be related.

The major limitation of the study is that it was not a randomized trial. We found, however, no difference in baseline characteristics between the patient groups, and, consequently, systematic selection of patients into one of the two treatment groups seems unlikely. Also, adjustments for age, sex, and co morbidity were done when the results of the treatment groups were compared.

As had been observed in the vast majority of studies on the subject. we found that the quality of the reduction had an impact on the risk of non-union. Of the 3 patients managed with CC screw that went into non-union, 2 patients were fixed in borderline retroversion and 1 was fixed in varus.

AVN: AVN was seen in 6 cases (9.7 %) in our series. Of this 4 cases were managed with DHS while 2 patients were managed with CC screw. Increased occurrence of AVN with DHS may be due to increased destruction of metaphyseal blood supply.

Of the patients who developed AVN, none of the patients required further surgical management in the form of hip replacement till follow-up. Further collapse was prevented in these patients with the use of bisphosphonates.

None of the patients that have achieved union required any further intervention in the form of implant removal or hip replacement. Union was confirmed radiologically by corticalization across the fracture site in AP and lateral views and filling of earlier bone defects with remodelling of bone.

Minor complications like superficial infection and bursitis were encountered but these complications were managed with oral/ IV medications. None of these minor complications were found to affect the overall functional outcome.

Conclusion

Femoral neck fractures in young adults are uncommon. They usually occur as a result of high-energy trauma and are often associated with other injuries. Osteonecrosis of the femoral head and non-union are the two most common and challenging complications associated with femoral neck fractures. Initial fracture in our study we have achieved union rate of 100 percent with DHS while it is 90 % in patients managed with CC screw. High rate of union in DHS group was due to significant compression and impaction achieved across the fracture site.

Displacement and disruption of the femoral head blood flow are contributing factors that are outside of the surgeon‘s control. However, there are multiple factors within the surgeon‘s control that can minimize and prevent these complications. The key factors in the treatment of femoral neck fractures include early diagnosis, early surgery, anatomic reduction, capsular decompression, and stable internal fixation.

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