

Research article
Orthopaedics

RADIOLOGICAL EVALUATION OF FRACTURE NECK OF FEMUR TREATED WITH CANNULATED SCREW (CCS) FIXATION WITH RESPECT TO UNION AND AVASCULAR NECROSIS OF FEMORAL HEAD

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Article submitted on: 19 January 2018

Article Accepted on: 25 January 2018

Abstract:

Background of the study-The neck of femur fractures in young population is associated with high energy trauma. Osteosynthesis with Cannulated Cancellous Screws (CCS) is a described technique and helps in preserving head of femur. The outcomes of neck of femur fractures treated with Cannulated cancellous screws are debatable with respect to union and occurrence of Avascular Necrosis of head (AVN).

Aim- This aim of the study is to assess the union rate and occurrence of AVN in fracture neck of femur fractures treated with CCS.

Materials and Methods- All patients satisfying the inclusion criteria with femoral neck fractures planned for osteosynthesis were included in the study at a single institute. The patients underwent osteosynthesis with 6.5mm CCS after achieving satisfactory anatomical reduction. All patients were allowed toe- touch weight bearing after post- operative pain subsidence. Serial radiographs were taken at 6 weeks, three months, six months and at one year to assess for fracture union and signs of AVN.

Statistical Analysis

Chi-square analysis

Results- A total of 43 patients were included in the study. The mean age in the study is 47 years. There were 23 males and 20 females. There were 11 basicervical, 23 transcervical and 9 subcapital fractures. Radiological union was found in 8 of basicervical fractures, 17 in transcervical fractures

and 8 in subcapital fractures at the end of follow-up. There were three cases of AVN each in subcapital and transcervical fractures. Out of 23 patients with acceptable reduction there were two cases of AVN and out of 20 unacceptable reductions four had AVN. There were 10 cases of non-union and had direct relation to the reduction of fracture intra-operatively. **Conclusion-**The incidence of fracture neck of femur is common in younger age group. Achieving Satisfactory anatomical intraoperative fracture reduction is a single most important determinant factor in achieving good results. The incidence of AVN and non-union is found to be less with good reduction in long term follow ups.

Keywords: Fracture neck of femur, Non-union, AVN, Hemiarthroplasty

Introduction

Fracture neck of femur is commonly seen in elderly population, although a good number of patients are young adults. The management of this fracture depends on the age at presentation and degree of displacement.

Although prosthetic replacement frequently is considered for the treatment of displaced fracture in elderly patients, efforts are focused on preserving the femoral head in physiologically younger patients¹⁻⁶. Osteosynthesis with Cannulated Cancellous Screws (CCS) is a time tested method of fracture fixation in young population with minimal displacement.

There is surprisingly paucity of data regarding the outcomes of treatment of femoral neck fractures in young patients treated with CCS, perhaps because young and mobile patients are difficult to follow up regularly.

Complications such as osteonecrosis and nonunion have been reported to occur in 10% to 45% and 10% to 30% respectively of patients with femoral neck fracture treated with osteosynthesis⁴⁻⁹.

The purpose of the present study was to evaluate patients with femoral neck fractures treated with CCS and assess outcome with respect to radiological union and incidence of Avascular Necrosis of the femoral Head (AVN).

Materials and methods

This is a retrospective review of all patients with femoral neck fractures, treated with Cannulated screw fixation from 2012 to 2016 with a minimum follow up period of one year done at SDM Institute of Medical Sciences and hospital, department of orthopedics. Review

of all case records and radiological surveys of all the patients was carried out. The inclusion criteria are Age < 60 years of all stages in Garden classification and previously normal hip joint. The exclusion criteria being age > 60 years, suspected or confirmed pathological fractures.

The fractures were analyzed using the Garden's staging and Anatomical classification. Garden's Alignment Index was used to assess fracture reduction intra-operatively, with 155° - 180° in both antero-posterior and lateral view as the criterion for adequate reduction.

Operative procedure

Closed reduction and CCS fixation of the femoral neck fractures were performed in all patients under general, spinal or epidural anaesthesia. During the procedure, the patient was positioned supine on a traction table with the foot secured to the footplate. The fracture was then visualized with an image intensifier. Undisplaced fractures were fixed in-situ, while displaced fractures were reduced by closed manipulation by first externally rotating the hip joint followed by abduction, then applying longitudinal traction to the limb and the fracture subsequently reduced by internal rotation and adduction of the hip joint. Three standard cannulated (7mm cancellous) screws were inserted using 3 point principle in an inverted triangle pattern.

Follow up

Post operatively the patients were advised to ambulate strictly with toe-touch weight bearing, until there was radiological evidence of union. Post-operative hip radiographs were subsequently analyzed for acceptability of fracture reduction and

fixation using the Garden's Alignment Index. Documented X-ray incidence of non-union and avascular necrosis was noted.

Results

There were 43 patients included in the study who satisfied the inclusion criteria. There were 23 males, 20 females with age distribution as depicted in table 1. The fracture pattern in the study is described in table 2. Most common type of fracture seen in our study was transcervical (53.5%), followed by basic cervical (25.6%) and subcapital which was seen in (20.9%) of patients. There were 33 (76.7%) cases of union and 10 (23.3%) cases of nonunion. Satisfactory anatomical reduction was achieved in 23 (53.5%) of patients (Table 3). Out of ten cases of nonunion, six (60%) were found in transcervical fractures. The incidence of nonunion is not statistically significant with respect to fracture pattern (Table 4).

There were six (13.95%) cases of AVN in the present study. The incidence of AVN with age distribution is in (table 5), found no statistical difference of occurrence of AVN with age. The incidence of AVN was then compared with fracture pattern (Table 6). There was no statistically difference with incidence of AVN with fracture pattern. Satisfactory anatomical reduction achieved intra-operatively was single most important determinant factor in the occurrence of AVN (Table 7).

Discussion

The surgical management of femoral neck fractures depend on the age at presentation and displacement of the fracture. Hemiarthroplasty or Total hip replacement remains gold standard management in displaced

fractures and elderly patients⁵, on the other hand, retention of head and fixation of fractures with cannulated cancellous screws (osteosynthesis) becomes necessary in young individuals. The treatment goals in young patients include preserving femoral head, decrease the incidence or prevention of non-union, AVN and faster rehabilitation^{7,9}.

The femoral neck has its unique blood supply and early treatment with fixation with appropriate implants is of high importance⁹. The majority of blood supply to the proximal femur is supplied by the medial and lateral circumflex arteries. The incidence of AVN is reported to occur in around 10-30%^{10,11} of cases in a young individual treated with CCS, which is comparable to our study (13.9%). It remains a major concern in the long term postoperative period with respect to functional status of the patient. The occurrence of AVN is dependent on variety of factors like the type of fracture configuration, time of presentation after injury, intraoperative reduction, stability of the fixation and patient compliance¹³. Avascular necrosis of the head leads to segmental collapse of the head which predisposes to secondary hip joint degenerative changes, necessitating subsequent revision or replacement surgeries¹².

Numerous studies have compared occurrence of the AVN and age of the patient. It was of belief that the incidence reduces as age increases, as shown Graham and Barns^{13,14}. However Shih and Wang¹⁵ concluded there was no significant relation between the age and occurrence of AVN. Our studies are comparable with Shih and Wang and no statistical difference was found.

Union in fracture neck of femur depends on anatomical reduction and

stable internal fixation. Nonunion of fracture neck is high due to its precarious blood supply, synovial fluid bathing of the fracture site with its angiogenesis inhibiting factors and absence of the cambium layer of periosteum. Considering the blood supply to the neck of femur, it is observed that there are two watershed areas, one at the junction of femoral neck and shaft, other at the subcapital region of the femoral neck. In transcervical and basicervical fractures, segment proximal to the fracture line up to subcapital region contributes to watershed zone as this zone is within the hip joint capsule and also lacks periosteal covering. In our study we have observed 6 out of 10 nonunion are of transcervical fractures, 3 out of 10 nonunion from basicervical fracture pattern and one case from subcapital fracture pattern, though this observation is not significant statistically.

Overall In a meta-analysis by Lu-Yao¹⁷ et al nonunion occurred in 23 to 37 %, in our study of 43 patients, we have observed 10 patients i.e. 23.3 % had nonunion which is comparable with above study.¹⁸

The nonunion was characterized by painful limp and restriction of hip joints movements. Three of our patients were treated with re-exploration with muscle pedicle grafts. Five other patients were lost to follow up and two patients underwent hemiarthroplasty at our centre. The patients with muscle pedicle grafts had union at the end of follow-up. Among the AVN group, the patients had painful restriction of movements of the affected hip with disturbance in their day routine activities. There were six cases of these, of which four patients were planned for total hip replacement and two other patients

were lost to follow-up.

This study is not without limitations. Larger sample size and longer follow-up would have given better for analysis.

Conclusion

In our retrospective study of fracture neck of femur treated with cannulated cancellous screw fixation, we have observed no significant association in incidence of nonunion with respect to type of fractures.

We have also observed that the Incidence of AVN in femoral head does not have significant relation to type of fractures, age of patients or adequacy of fracture reduction.

In conclusion with 76.7% fracture union and AVN incidence of 13.95%, cannulated screw fixation remains a viable treatment option for fracture neck of femur.

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