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Surgical management of fracture neck of femur using CCS in patients aged more than 50 years

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Abstract
Background: 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. Patient who have presented with fracture neck of femur over the age of 60 but has been performing from a functional point of view as a younger individual have been excellent candidates for reduction with internal fixation.
Methods: Thirty cases of fracture neck of femur in patients above the age of 50 years treated by closed reduction and internal fixation with cannulated cancellous screws in the Department of Orthopaedics at The Oxford Medical College and Hospital, Bangalore, were selected on the basis of purposive sampling method. The cases were followed up for 6 months and the short term functional results were analyzed by using Harris hip scoring.
Results: Most of the patients were in the age group of 50-70. Majority (40%) of fractures were Garden type III on radiographs. 96.7% of them had minimal trauma.
Of the 30 cases one patient died and one patient was lost for follow up. Thus the functional results were assessed in the remaining 28 patients.
85.7% of the hips were classified as having a satisfactory to excellent result and 14.3% of the patients had a poor result. No cases of AVN were observed, one case of non union was seen.
Patients were made to walk with partial weight bearing after six weeks and were discharged within two weeks of surgery.
Conclusion: Osteosynthesis with cannulated screws fixation provides the patient a healed fracture with a living femoral head that is always better and less invasive than a replacement in elderly patients; The mortality and morbidity rates are less with high rates of union, operative procedure is simple, economical, complications are less disabling and early functional results are satisfactory.

Keywords: fracture neck of femur, internal fixation, cannulated cancellous screws**,** harris hip score.

Introduction
Fractures of the femoral neck are debilitating injuries and have a tremendous impact on the health care system and society. With an increase in the life expectancy, the pool of population living in their eighties is increasing and the chances of them getting fractures is also increasing. Taking the aging population into account, it has been estimated that there will be between 7.5 and 21.3 million hip fractures annually by 2050. Much of this increase will occur in Asia and developing countries [1].
Patients who have presented with fracture neck of Femur over the age of 60 but has been performing from a functional point of view as a younger individual have been excellent candidates for reduction with internal fixation [2]. Several studies have suggested that reduction and fixation of an intracapsular fracture of the hip with multiple pins or screws is associated with a lower rate of morbidity and mortality than treatment with prosthetic replacement [3-8].
Decision to perform Internal Fixation with Cannulated Cancellous Screws or Prosthetic replacement in elderly remains controversial with proponents on either side.
Hence we decided to perform a study with an aim to study the efficacy of internal fixation as a surgical option in fracture neck of femur in patients aged between 50 and 70 years in terms of survival of the implants, complications, the survival of the patients, and the function of the patients in whom the fracture had healed without the development of osteonecrosis.

Materials and Methods

We studied 30 cases of fracture neck of femur in patients above the age of 50 years presenting in emergency and out-patient department (OPD) within 30 days of injury treated by AO Cannulated Cancellous Screws, in the Department of Orthopaedics at The Oxford Medical College, Hospital & Research Centre between June 2017 to May 2019, selected on the basis of purposive sampling (Judgment sampling) method. The clearance has been obtained from ethical committee. Patients with pre-existing lesions of hip such as osteonecrosis of femoral head and degenerative arthritis, Malignancy, Neurological disorder like seizures, psychosis or mental deterioration and femoral neck fractures with severe posterior comminution were not selected in the study. At the end of 1 year following surgery one patient died and one patient was lost to follow up.

There were 17 female (56%) patients and 13 male (34%) patients. The range of the age of patients of either sex was from 50 to 70 years. Detailed patient's notes were taken according to orthopaedic protocols. Patients were thoroughly assessed in the in-door for any associated injury. Pre-operative roentgenograms were taken to access the fracture geometry in two planes. The fractures were classified accordingly with Garden's classification of fracture neck of femur. Routine investigations were carried out. No attempt was made to access the viability of the femoral head by bone scanning or MRI studies. Skin traction was applied, the patients were prepared and procedures were carried out in Spinal Anaesthesia. Fractures were managed by closed reduction and internal fixation performed with three cannulated screws in inverted triangle. All patients were given first generation cephalosporins pre and postoperatively for three to five days.

Operative technique: All fractures were fixed in supine position. Under spinal anaesthesia, fracture was manipulated and reduced anatomically under C-arm control by closed method usually by Leadbetter method. Operating limb prepared with routine standard antiseptic method by painting and draping. A small 1 cm incision was made at a site determined under C-arm with the help of wires. Guide wires were passed with the control in anterior posterior and inferiorly, in an inverted triangle orientation, through the shaft to the neck and head of femur. Cannulated drill bit of 4.5 mm was used to drill over the wire and measured. 6.5 mm partially threaded 32 mm and 16 mm cannulated screws were used to fix the fracture in compression mode. Skin traction was applied to prevent rotation for one week. Procedure time was 30 minutes on an average.

Post-operative management: Postoperative analgesia and antibiotics 3 to 5 days were given as in the protocol. The operated limb was protected for about 6-8 week non-weight bearing and patient was encouraged isometric exercise of thigh in bed.

Clinical and Radiological follow-up: After one week, sutures were removed, and rehabilitation program began strengthening of the thigh muscles started and check x-rays were obtained. At six weeks, hip and knee range of motion was checked. Partial weight bearing encouraged after six weeks which was increased gradually over a couple of months to full weight bearing. Maximum follow-up was twenty-four months duration.

At each follow up, detailed clinical examination was done systematically. Patients were evaluated according to Harris hip scoring system for pain, limp, the use of support, walking distance, ability to climb stairs, ability to put on shoes and socks (in our study for some patients ability to cut toe nail was enquired) sitting on chair, ability to enter public transportation, deformities, leg length discrepancy and movements. All the details were recorded in the follow up chart. The radiograph of the operated hip was taken at regular intervals, at each follow up.

Harris hip scoring system [9]: Total functional outcome was graded as following depending on the total Harris Hip Score calculated: Poor: Harris hip score less than 70. Fair: Harris hip score between 71-80. Good: Harris hip score between 81-90 Excellent: Harris hip score between 91-100

Observations and Results

The following observations were made from the data collected during the study of treatment of intracapsular fracture neck of femur in elderly above the age of 50 years by using the AO Cannulated Cancellous Screws in the Department of Orthopaedics, at The Oxford Medical College, Hospital & Research Centre between June 2017 to May 2019.

Type of Fracture: Majority (40%) of fractures were Garden type III on radiographic examination. There were 11 patients with Garden type II fracture and 4 patients with Garden type I fracture. 3 patients had Garden type IV fracture.

Time of operation from initial trauma: 40% (13) Patients were operated in the first week and 93.3% (28) were operated within 2 weeks. Remaining patients had long pre-operative hospital stay because of their associated medical problems and delayed presentation and were operated after treating and controlling the associated medical disorders by appropriate medications.

Complications: Subtracting the one patient who was lost to follow-up and the one patient who died before union of the fracture could have occurred, we have twenty-eight patients who are available for complete analysis. Three patients (10.7%) had backing out of one of the screws, one had delayed union, and one (3.6%) had non-union (shown in fig 1).

Fig 1: Six months post-operative X-ray showing Non-Union

Assessment of Functional Results: Functional results of Internal Fixation with A.O. cannulated screws were assessed by using Harris hip scoring system. By this system assessment was done under the following headings.

1. Pain, 2. Limp, 3. Use of support, 4. Walking distance, 5. Climbing of stairs, 6. Put on shoes and socks, 7. Sitting in chair, 8. Enter public transportation, 9. Deformities, 10. Leg length discrepancy, 11. Range of motion

Functional results at the end of six months post fixation.

Fig 2a: Squatting

Fig 2b: Flexion is full

Total Functional Result: The functional outcome after Internal Fixation for intracapsular fracture neck of femur was graded as excellent (Figure 2a and 2b), good and fair after adding the scores given for each criterion for assessment of hip. In our series total Harris hip score at the end of six months ranged from 41.4 to 100. Six (21.4%) patients had hip scores from 90 to 100 (excellent). Seven (25%) had hip scores 80 to 89 (good). Eleven hips (39.3%) were rated 70 to 79 (Fair) and four (14.3%) were rated less than 69 (poor). Thus 85.7% of the hips were classified as having a satisfactory to excellent result and 14.3% of the patients had a poor result. Table 1 shows the observations made regarding the functional results. Figure 3a to 3d shows a series of x-rays pre operatively and 6 months post-operative period.

Table 1: Distribution of cases by functional results at the end of 6 months in terms of Harris Hip Score

	Frequency	Percent	Results
<69	4	14.3	Poor
70-79	11	39.3	Fair
80-89	7	25.0	Good
90+	6	21.4	Excellent
Total	28	100.0	-

χ^2 =3.714: P<.294(NS)

Radiographic Results: In our series following radiographic observations were made and are shown in table 2.

Table 2: Distribution of the sample by radiographic results at the end of 6 months

Number of months for signs of union	Frequency	Valid Percent
Three	21	75.0
Four	5	17.9
Six	1	3.6
Non-Union	1	3.6
Total	28	100.0

χ^2 =38.857: P<.000 (HS)

Fig 3a: Pre-operative X ray

Fig 3b: Three months post-operative radiographs

Fig 3c: Six months post-operative radiographs AP view

Fig 3d: Six months post-operative radiographs Lateral view

Discussion

Type of Fracture: Depending on the anteroposterior radiographic view available they were grouped into Garden's classification. Majority (40%) of fractures were Garden type III. There were 11 patients with Garden type II fracture and 4 patients with Garden type I fracture. 3 patients had Garden type IV fracture. We further grouped type III and type IV as displaced fractures which accounted for 50% of the fractures. The preponderance of the undisplaced fractures is probably due to the selection bias in selecting more of undisplaced fractures in our study as compared to other studies [10-13].

Complications: The complications following the internal fixation with cannulated cancellous screws for fracture neck of femur is reported in varying incidences

Avascular necrosis of femoral head: Phemister [14] first reported an incidence of 10 – 20% in undisplaced fractures and 15 to 35% in displaced fracture. Ratliff reported a incidence of 42% (30 of 70 cases) while Allende-Lezama 25% (2 of 8 cases), Carrel and Carrel 35% (4 of 11 cases), Ingram and Bachinsky 55% (13 of 24 cases), Mc Dougal 58% (14 of 24 cases). KBL Lee [15] reported an incidence of 6%, E.M. Toh [12] 11% (11 of 100 cases), Chen [16] *et al*. reported an incidence of 67.57%. In contrast to the above statistics we do not see any case of AVN. Revascularisation of the femoral head is a very slow process and the Avascular change can take place up to two years and sometimes beyond, our study period is not sufficient in regard to comment on the AVN.

Mortality: One patient in our study who was suffering from hypertension and aortic stenosis was lost in the follow up due to death; however, the death was not directly related to the operative procedure and occurred three months postoperatively. Several studies have suggested that reduction and fixation of an intracapsular fracture of the hip with multiple pins or screws is associated with a lower rate of morbidity and mortality than treatment with prosthetic replacement [3-7]

Lu-yao showed that the thirty day mortality rate was higher (10%) in Hemiarthroplasty as compared to 8% in internal fixation group. Holmberg [6] *et al*. reported 5% incidence (134 of 2441 cases) at three months following internal fixation as compared with an incidence of 14% (13 of 95) in the Hemiarthroplasty group, Arnold *et al*. [17] reported a 1 per cent in-hospital rate of mortality (ten patients) in 750 patients who had had internal fixation of a fracture of the femoral neck compared with an 11 per cent rate (eighteen patients) in 160 patients who had had a primary prosthetic replacement.

Non-Union: There was only one case (3% incidence) of non-union reported in our series probably due to the improper positioning of the implant where the threads of one screw were crossing the fracture site. This incidence is much lower as compared to that reported in other series. This incidence is much lower as compared to that reported in other series [12, 13, 18, 19].

Functional Assessment

Pain: We observed that 5 patients (18%) in our series had no pain. Eight patients (28.6%) had slight pain and fourteen (50%) of our patients had mild pain on ambulation requiring NSAIDs. None of the patients had severe pain. All patients in the present study were elderly, and they seemed to be more sensitive to pain after surgery. Even though pain existed, it was hard for them or their families to consider undergoing a secondary operation to resolve this discomfort, most of which was tolerable with conservative management or simple analgesics use, and daily activities were not affected.

This is in accordance with Chen [16] *et al*. who reported that Pain occurred in almost all patients within 1 month after osteosynthesis with cannulated screws fixation, and in 19 patients (51.35%) at 3 months and 9 patients (24.32%) at 6 months post-primary surgery.

Limp and use of cane: Majority (71.4%) of the patients in our series had slight limp. In 28.6% of patients limp was moderate. Limping is a common consequence of internal fixation. It is mainly due to the alteration in the abductor mechanism due to the impaction of neck on weight bearing. Exact cause cannot be attributed to this.

Total functional results: Various criteria were used to assess the functional results following internal fixation. How best the patient could be returned to the premorbid functional status has been the main criteria. In India our customs demand squatting and sitting cross legged without difficulty. To achieve this patient should have good range of flexion, abduction, adduction, and external rotation at the hip and full flexion at the knee. The distance patient could walk with or without support and the amount of movements at the hip are the major factors determining results in the western series whereas ability to squat and sit cross legged was principally emphasized by Indian series.

The final results at 6 months after internal fixation with cannulated cancellous screws in our series were analysed by Harris hip scoring system [9]. The majority of our patients had good premorbid functional status: 97% were independent in their ADL, 3% (one case) were independent with assistive device.

The primary aim of surgery was to return them to this high level of function. This objective was achieved with 78.6% of patients returning to their premorbid ambulatory status and 96.4% of patients having good pain relief at six months of follow up.

The poor results in our series were due to slight to moderate pain in the hip or thigh and limp after Internal fixation and were found more commonly in patients who had backing out of the screws. We did not emphasised on exact parallel placement of screws in our study nor on the number of screws, in spite of this satisfactory results were seen in our study which is also supported by other studies. [12, 18]

Table 3: Showing the overall Radiological results in two other studies.

Number of months for signs of union	Our series	Chen [16] *et al.*	Toh [12] *et al.*
Three	75% (21 patients)	75.68% (28 patients)	76% (76 patients)
Six	96.4% (6 patients)	94.59% (35 patients)	
Non-Union	3.6% (1 patient)	5.41% (2 patients)	13% (13 patients)
Avascular necrosis	-	-	11% (11 patients)
Total	100% (28 patients)	100% (37 patients)	100% (100 patients)

The marked contrast between the functional results and the radiological results (Table no:3) is mainly because of the pain

and limp which form major criteria in Harris hip scoring system, thus bringing down the number of good and excellent results in our study. Since pain and limp were present in most of our cases but none were severe enough to demand for any secondary surgical procedure.

Conclusion

Osteosynthesis with cannulated screws fixation provides the patient a healed fracture with a living femoral head that is always better than a replacement; this can be achieved for a majority of patients with a procedure that is less invasive than arthroplasty. In patients who have treatment failure, total joint replacement or hemiarthroplasty can still be performed with results as good as or better than those of primary hemiarthroplasty. The mortality and morbidity rates are less compared to prosthetic replacement with high rates of union, operative procedure is simple, economical, complications are less disabling and early functional results are satisfactory.

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