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A prospective study of AO multiple cannulated cancellous screws fixation for intracapsular fracture neck of femur

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Abstract
Cannulated screw fixation is a generally approved surgical approach for treating femur neck fractures, particularly in patients with poor premorbid conditions, fractures that are minimally displaced, and those who are younger in age. Between 2019 and 2021, a one -year prospective study was conducted on 13 consecutive patients to investigate the pattern of injuries, care, radiological and functional outcomes, and associated predictive factors. Timing of surgery in our study did not affect the outcome in our short period of follow-up ranging from 4 months to 1 year. Most of the cases (54.4%) were operated between days 4 to 7. All patients were followed up on till their fractures healed for two years and any problems arose. Only one patients (3.33%) had a bad prognosis, that is one non-union. There is some link between the age of the patient, fracture displacement, the number of cannulated screws utilised, fracture reduction acceptance, or the anatomical location of the fracture and the outcome. The time delay between injury and surgery, as well as the existence of posterior comminution, appeared to increase the rate of complication, although the effect was not statistically significant due to the limited number of patients. We conclude that cannulated screw fixation is a promising therapeutic option for femoral neck fractures.

Keywords: multiple cannulated, intracapsular fracture

Introduction
Intracapsular fractures are uncommon in young people with healthy bones. Because of the high energy trauma associated with road traffic accidents, the incidence of intracapsular fractures is on the rise in the modern world [6]. Intracapsular fractures are uncommon in young people with healthy bones. Because of the high energy trauma associated with road traffic accidents, the incidence of intracapsular fractures is on the rise in the modern world. Internal fixation is still the preferred treatment for these fractures in all age groups, especially in displaced fractures [7, 12] in younger patients when preserving the femoral head is a top goal. However, the best time to treat these fractures surgically is still up for dispute. It is recommended that fracture reduction and fixation be performed as a surgical emergency in order to restore the femoral head's unstable blood supply and avoid consequences such as non-union and avascular necrosis [8, 10].
In our institution, we did a study to assess the outcome of cannulated screw fixation for femoral neck fractures. The period between injury and surgery was studied in relation to union and the occurrence of complications such as avascular necrosis and non-union. we also wanted to assess the various factors which contribute to the union and functional outcome [5].The researchers wanted to see if there was a difference between early surgical fixation (within 1 to 3 days) and delayed surgical fixation (within 4 to 7 days), as well as determine the prognostic factors for avascular necrosis and the conversion rate to hip replacement in our patients who eventually developed complications.

Materials and Methods
This is a prospective study of all instances of femoral neck fractures treated with cannulated screws at our centre between 2019 and 2021. With independent observers, including a prominent orthopaedic doctor, reviewed all case records with the help of a questionnaire and radiographs. The Garden Classification and the Pauwel Classification were used to assess the displacement and stability of all of our patients' fractures. Garden's Alignment Index was used to examine fracture reduction after surgery, with the criterion for acceptable reduction being 155° - 180° in both antero-posterior and lateral views.

Operative Procedure

All of our patients had emergency closure reduction and percutaneous cannulated screw fixation of their femoral neck fractures under general, regional, or epidural anaesthesia. The patient was positioned supine on a traction table with the foot attached to the footplate during the treatment. An image intensifier was then used to visualise the fracture. Undisplaced fractures were left alone, while displaced fractures were treated with closed manipulation, which involved first externally rotating the hip joint, then abduction, then applying longitudinal traction to the limb, and finally internal rotation and adduction of the hip joint to reduce the fracture. Except in situations where the femoral neck was tiny in diameter and could only hold two screws, all of our patients had three conventional cannulated (6.5mm cancellous) screws implanted, following the "3 Point Principle." In none of the patients, a capsulotomy of the hip joint was performed.

Follow UP

The patients were instructed to walk with non-weight bearing crutches until there was radiographic evidence of union following surgery. Post-operative hip radiographs were collected, and the Garden's Alignment Index was used to assess the acceptability of fracture reduction and fixation. These patients were then followed up on until radiological union was confirmed. Non-union and avascular necrosis rates were recorded and analysed separately in relation to the following risk factors: patient age, period between injury and surgery, presence of posterior comminution, and fracture displacement at presentation. The number of cannulated screws utilised, the acceptability of fracture reduction, and the anatomical placement of fractures are all factors to consider. or on plain radiographs after surgery, as it is sometimes difficult to detect on the initial radiograph. Fracture displacement was characterised as either displaced (Garden Classification of Neck of Femur Fracture Type III and IV) or undisplaced (Garden Classification of Neck of Femur Fracture Type III and IV) (Garden Classification of neck of femur fracture Type I and II). The Garden Alignment Index was used to determine fracture reduction acceptability by measuring the angle of the compression trabeculae on AP and lateral views relative to the longitudinal axis of the femoral shaft and deeming it acceptable if it fell between 155° and 180°. The fracture site was classified as subcapital, transcervical, or base of neck.

The Ficat & Arlet Classification was used to diagnose avascular necrosis (AVN) of the femoral head based on radiographic evidence and clinical characteristics.

Radiologically, a good outcome was defined as fracture union with no signs of non-union or avascular necrosis.

The patient's age was determined by his or her age on the day of admission to the hospital. From the time of injury to the start of surgery, the elapsed time was calculated. During surgery, posterior comminution was found using an image intensifier.

Results

In our series, 13 cases of fresh fracture neck of femur in young adults treated surgically by internal fixation with AO cannulated cancellous screw at our Institute, during the period from November 2019 to may 2021 were studied. The following were the observations made and the available data are analyzed as follows.

Age distribution

In our series, majority of the cases 6 (42.4%) were in the age group of 31-40 years, followed by 4(30.3%) cases in the age group 41-50 years. The youngest patient was 23 years old and eldest patient was 46 years.

Table 1

Age (in years)	18-30	31-40	41-50	>50
No. Of Cases	3	6	4	-
Percentage (%)	27	42.4	30.3	-

Sex Distribution

In the present series, males were more commonly involved. Majority of the patients were males 8 (60.67%) and 5 (39.33%) were females, with Male: Female ratio of 2:1.

Table 2

Sex	No. Of cases	Percentage
Male	8	60.67
Female	5	39.33

Side Involvement

Right side was involved in 7 (54.45%) cases and left hip in 6(45.55%). Both the hips are involved equally. There was no much difference in the laterality of fracture.

Mode of Injury

17 cases (51.5%) affected were due to road traffic accident, 13 cases (39.3%) due to fall, and 3 case (9%) due to sports injury. Road traffic accident was the most common mode of injury.

Table 3

Mode of injury	No. of cases	Percentage
Road traffic accident	7	51.5
Fall	5	39.3
Sports injury	1	9

Associated injuries

There were 4 cases (13.33%) of associated injuries, of which one patient had head injury, one had ipsilateral distal radius fracture, one patient had contralateral clavicle fracture and the other had ipsilateral humerus shaft fracture. Radius # was treated with external fixator, humerus # with LCP while head injury and clavicle # were managed conservatively.

Table 4

Nature of injury	No. of Cases	Percentage
Head injury	1	3.33
Distal Radius #	1	3.33
Clavicle #	1	3.33
Humerus #	1	3.33

Fracture type – Garden's Classification

In the present study,all of the cases were Garden's Type I and II, 23 cases each followed by Type I1, 10 cases of Type I..

Time Interval Between Injury and Surgery: In this study, most of the cases were operated between 4^{th} – 7^{th} days of trauma (54.54%). This was because the patients presented late to the hospital in majority of situations.

Number of screws used

In majority of the cases we used 3 screws for each hip fixation. In 12 patients we used 3 screws and in 1 patients used 4 screws.

Complications

In our study, 1 (3.33%) patients had complications. 1 had Non-union. There were no cases of any post-operative infections in our series.

Results –according to modified harris hip Score

In the present study, 13 patients with intracapsular fracture neck of femur were treated surgically. Excellent results were achieved in 9 cases (75%), good in 3 cases (21%) and poor results in 1 case (3.03%). Excellent results were observed equally irrespective of timing of surgery in our series i.e; within 7 days. The patient with poor results was a known epileptic and on treatment with Phenytoin. He had severe pain even during rest, diminution in his abilities to walk unaided and to do her work.

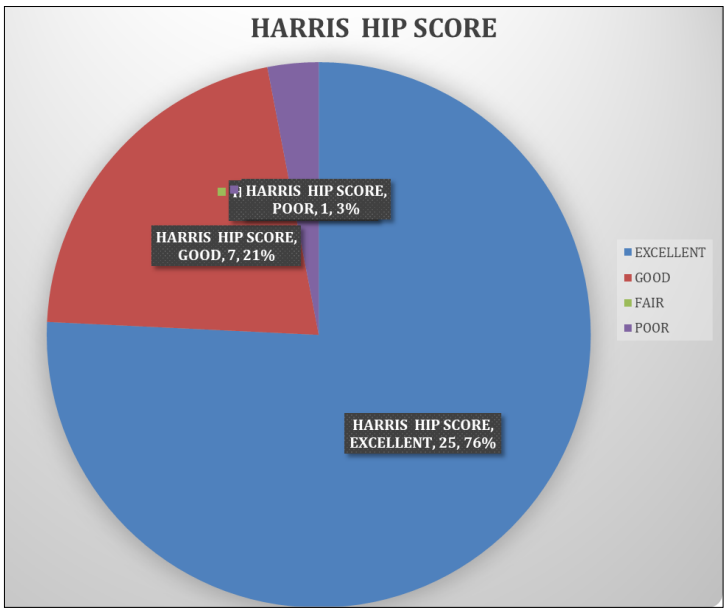

Fig 1

Table 5

Result	No. of cases	Percentage
Excellent	9	75
Good	3	21
Fair	0	0
Poor	1	3.03

Post OP Images

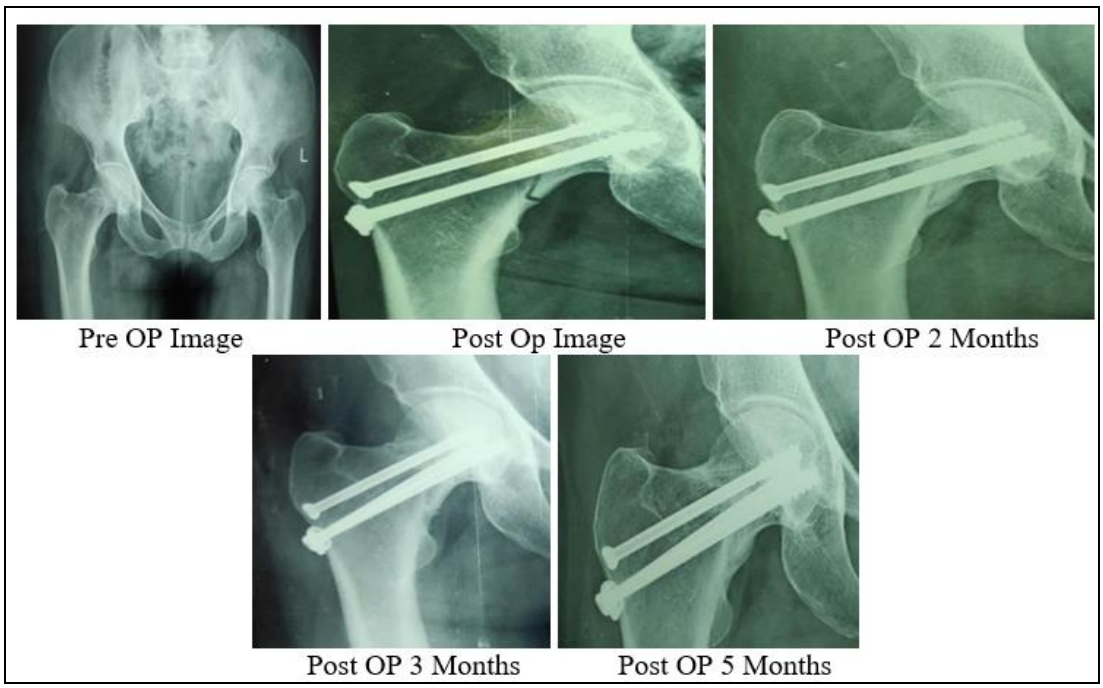

Fig 2

Fig 3

Discussion

Femoral neck fractures are still unresolved fractures, and therapy standards are continually evolving. It is a common skeletal injury that occurs in the osteoporotic bone of older patients as a result of slight trauma. It occurs in younger patients as a result of high-velocity trauma and may be part of polytrauma, which includes numerous fractures, including the ipsilateral femur.

This fracture's treatment has progressed dramatically. It began in the early twentieth century[6,7] with closed reduction and immobilisation in POP hip spica in abduction and internal rotation (Whitman Abduction plaster)[8]. The high rate of non-union, AVN, bed sores, and respiratory problems prompted researchers to look into internal fixation methods. The introduction of the SP nail provided new hope for fixing the condition, but many surgeons were dismayed by the high failure and complication rates. Newer devices, such as the SP nail plate and the McLaughlin nail plate, were introduced as implant designs improved, but they, too, failed to stand the test of time. The use of partially threaded cancellous screws and insertion over preparatory wires led to the development

of cannulated variety screws, which are currently the standard of care in adults, according to new notions of fixation under compression. For children, smooth pins (Moore or Knowles pins) are still the preferred option.

The management issues are vary depending on the age of the presentation. Fixation failure in aged osteopenic bones, substantial fragment displacement, posterior comminution, and disruption of blood supply are all concerns.

In young people, there is a greater risk of nonunion and avascular necrosis (AVN).

The anatomical and biomechanical considerations of a femoral neck fracture make it unique. The medial femoral circumflex artery, lateral femoral circumflex artery, and obturator artery all send blood to the femoral head through intracapsular terminal branches that run parallel to the neck. Any femoral neck fracture damages the AVN-producing terminal blood arteries. As a result, it's known as femoral head vascular injury. Because the fracture is intra-articular, the fracture surfaces are exposed to synovial fluid and its enzymes. The hip is subjected to a significant degree of shearing strain depending on the fracture structure and the activity of numerous groups of muscles acting on it. As a result, precise reduction and internal fixation are required to expect fracture healing.

Anatomical reduction, early and stable fracture repair with 6.5mm AO cannulated cancellous screws was reported to offer a high proportion of excellent and satisfactory results in the treatment of intracapsular fracture necks of the femur [1, 2, 3]. This research backs up these assertions.

In this study, 13 young individuals with intracapsular fractures of the neck of the femur were operated on. All of the patients were followed for 4 to 1 year.

In younger and more active patients with a femoral neck fracture, internal fixation of the femoral head is preferred. The functional prognosis of a repaired femoral neck fracture without the development of osteonecrosis is satisfactory [1, 2, 3].

Initial fracture displacement and femoral head blood flow disruption are important factors beyond the surgeon's control. The surgeon's ability to reduce fixation failure and nonunion depends on various aspects that he or she may manage, including the timing of surgery, the quality of reduction, and attaining a stable fixation [3, 4].

Early and delayed repair of subcapital hip fractures in individuals under sixty years of age were compared by Jain *et al*. [5] They found no significant difference in functional results between the early and delayed-fixation groups after a minimum of two years of follow-up. Our research corroborated this, as there was no significant difference in the outcomes of patients who were operated on early (within 1-3 days) versus late (4-7 days). Both groups have similar functional outcomes [10].

It's also crucial to get the screws in the right place. The inverted triangle with the apex inferior is favoured because it reduces the stress riser effect and hence the risk of sub-trochanteric fractures. Close to the cortical bone of the femoral neck, the screws should be put as far apart as feasible. Screws should be parallel, with a maximum angulation of 100 degrees between them. The screw tips should be no more than 5mm away from the subchondral bone.

We allowed mobilizing by 6 weeks and early non-weight bearing ambulation with a walker for three months in our series. This period is followed based on clinical and radiological symptoms of

Full weight bearing was approved unassisted by the union. In virtually all cases, the hip range of motion was restored to near pre-trauma levels.

The high incidence of fracture healing in these individuals was most likely related to the healing ability and strong bone quality of most young patients' femoral head and neck.

The current study has some limitations, including a small study group and a short follow-up period to remark on AVN incidence. To remark on the occurrence of AVN, the study has to be followed up on.

Treatment of intracapsular femur neck fractures in young adults with anatomical closure reduction and stable internal fixation with AO Cannulated Cancellous screws yielded a high percentage of excellent and good outcomes [1, 2, 12, 9]. This study backed up these findings and found them to be equivalent to those found in earlier investigations.

Conclusion

In this study, 13 young people with intracapsular fractures of the neck of the femur were treated surgically with closed reduction and 6.5 mm AO cannulated cancellous screw fixation.

The following are the findings of our research:

Road traffic accidents are causing an increase in intracapsular fractures of the neck of the femur in young adults, and these injuries are particularly common in middle-aged men.

The most prevalent age groups to be wounded were those between the ages of 31 and 40. The average age of the participants in this study was 35.5 years. The most prevalent and difficult consequences are femoral head osteonecrosis and nonunion. Initial fracture displacement and femoral head blood flow disruption are important factors beyond the surgeon's control. However, there are a number of other factors that the surgeon can control to reduce or prevent these problems. Early diagnosis, early surgery, anatomic reduction, capsular decompression, and stable internal fixation should all be considered when treating femoral neck fractures.

In our study, early diagnosis, early fixation (within 7 days) with anatomical reduction and internal fixation with Cancellous screws yielded encouraging results.

The role of capsulotomy is still debatable.

We had gone for open reduction in none of the situations in our series.

The study found that three screws and four screws both produced good results.
For three months, early non-weight bearing ambulation using a walker was strictly permitted. Following this period, unassisted full weight bearing was allowed based on clinical and radiographic evidence of union.
The functional outcome by Modified Harris Hip score was satisfactory in 96.67 percent of cases, with Excellent in 75 percent of cases and good in 21 percent.
There was one case of complication in our study, and one case of non-union.
As a result, we find that 96.67 percent of young people with intracapsular femur fracture necks treated surgically with closed reduction and internal fixation with 6.5 mm AO cannulated cancellous screw fixation had excellent to good functional outcomes. As a result, this is the best surgery for intracapsular fracture neck of the femur, and it will continue to be used in orthopaedic practise for a long time.

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None

Conflict of interest
None declared

Ethical approval
Considered and taken

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