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COMPARING THE RADIOLOGICAL AND FUNCTIONAL RESULTS OF PATIENTS WHO HAD NUMEROUS CANNULATED SCREWS VERSUS DYNAMIC HIP SCREWS FOR FEMUR NECK FRACTURES: A RANDOMIZED CLINICAL TRIAL.

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Abstract

Introduction
Orthopedic surgeons have struggled with intracapsular neck femur fractures for years, and their outcome and treatment remain uncertain, especially in younger patients. In an orthopedic emergency, an intracapsular femur fracture neck must be minimized with firm internal fixation to improve femoral head circulation and prevent nonunion and avascular necrosis. In India, sliding hip screws are used less for intracapsular neck femur fracture repair than cannulated screws. The purpose of this comparative study is to evaluate the outcomes of both fixation modalities as well as the factors influencing these fixations in the population.

Materials and Methods
This study, which was carried out in a tertiary care hospital in the orthopedics department, is prospective and randomized. It involved 60 patients who were randomly assigned to two groups. Thirty patients in Group A underwent surgery using three cannulated cancellous screws, while thirty patients in Group B underwent surgery using dynamic hip screws.

Results
It was discovered that DHS is not only more stable but also permits improved compression across the fracture, enabling early union and mobilization. In patients treated with DHS, non-union was not a problem; in contrast, four patients treated with CC screws developed non-union. In the study, patients managed with DHS had an average union time of 13 weeks, whereas patients managed with CC screws had an average union time of 17 weeks.

Conclusion
For the management of all patients with fractured neck femur i/v/o, early mobilization, early union, and a decreased risk of non-union are advised. DHS with a derotation screw is one recommended method.

Recommendation
Based on the comparative study, dynamic hip screws with derotation screws are preferred over cannulated cancellous screws for intracapsular neck femur fractures due to their stability, early union, and reduced risk of non-union. Better patient outcomes require early mobilization.

Keywords: *Young Patients, Fracture Neck Femur, Cc Screw, DHS.*
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INTRODUCTION
In orthopedics, there is a notable problem presented by intracapsular femoral neck fractures, particularly in young people. This challenge is further compounded by the rising incidence of such fractures, which is mostly driven by high-energy trauma. These fractures are primarily observed in the geriatric population and carry significant societal and healthcare ramifications. The prevalence of femoral neck fractures worldwide is projected to increase, with estimates suggesting a rise to 2.5 million cases by 2025 and 4.5 million cases by 2050 [1].

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The technique of operative care, which encompasses fracture reduction and stabilization, has emerged as the favored method as compared to conservative treatment. Extended periods of immobility during conservative treatment might result in several problems, including respiratory infections, pressure ulcers, and muscular wasting. The existing surgical interventions for the stabilization of femoral neck fractures encompass the utilization of cannulated cancellous screws and sliding hip screws. The utilization of just nails and Knowles pins has been discontinued in light of their elevated rates of failure and limited efficacy [2].

Non-union and avascular necrosis are the main consequences observed in cases of intracapsular femoral neck fractures. Among these problems, avascular necrosis has a greater influence on functional outcomes, particularly in younger patients [3]. Fractures of this nature are regarded as vascular injuries that affect the blood supply to the bone. The degree of vascular compromise is closely associated with the displacement of the fracture and the resulting consequences [4]. Hence, it is imperative to promptly employ stiff internal fixation to enhance blood circulation within the femoral head and mitigate the risks of non-union and avascular necrosis.

The method of employing numerous cannulated screws positioned in parallel was first established in 1980 to improve fixation precision and minimize the occurrence of complications [5]. The utilization of cannulated cancellous screws for internal fixation, in conjunction with meticulous anatomical reduction, presents several notable benefits, including diminished blood loss, decreased duration of surgery, reduced need for transfusions, and shorter hospitalization periods. In addition to the utilization of numerous cancellous screws, sliding hip screws are employed in clinical practice due to their enhanced strength and ability to mitigate the occurrence of recurrent subtrochanteric fractures [6]. Nevertheless, these procedures necessitate a more extensive surgical approach and have the potential to result in rotational misalignment of the femoral head while inserting screws.

In the context of India, the utilization of sliding hip screws for the treatment of intracapsular femoral neck fractures is comparatively less prevalent when contrasted with the use of cannulated screws. The objective of this study is to evaluate the outcomes of different fixation procedures and determine the elements that influence these outcomes within our specific demographic.

MATERIAL AND METHODS

Study design

Nested Prospective study

Participants

A total of 60 cases were examined in this study. The entire patient population was separated into two distinct categories: a) According to a study conducted by researchers, 30 patients who underwent treatment involving the use of numerous cancellous screws exhibited positive outcomes, and b) 30 Patients who underwent treatment with a dynamic hip screw and derotation screw were included in the study.

The objective of this study was to examine the functional and anatomical outcomes in patients who underwent osteosynthesis for fracture neck femur using either a Dynamic Hip Screw and derotation screw or Multiple Cancellous Screws.

Period of study

May 2020 – June 2022.

Inclusion Criterion

The age group of interest for this study encompasses individuals from the time following the fusion of the epiphysis until they reach the age of 60 years. The study examines fractures of the neck of the femur, specifically transcervical and subcapital fractures, with consideration for both sexes.

Exclusion criterion

Age group: Individuals who have not yet experienced the fusion of epiphysis and those aged beyond 60 years. The presence of any pathological lesions, such as osteomalacia, aneurysmal bone cyst, or a basic cervical fracture of the neck of the femur, was seen.

Before their inclusion in the study, all patients were provided with a comprehensive explanation of the objectives of the research, and the methodologies employed, and subsequently gave written consent after being adequately informed. Upon admission, patients' medical history was documented and a comprehensive clinical examination was performed. In the course of the investigation, spinal anesthesia was administered to all participants. The patient was relocated to a radiolucent fracture table. The pelvis was positioned on the perineal supports, and the foot was secured to the footrest to ease the C-arm examination, specifically for obtaining a lateral view using a fluoroscopic image intensifier. The technique of closed reduction was primarily employed with Swiontkowski's method. The individuals who were not subjected to reduction underwent reduction through the implementation of the Lead Better technique/Flynn method. The confirmation of reduction was achieved through the utilization of AP and lateral views, with exposure under 'C-

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arm' technology, and the subsequent display of the images on a television screen. Additional corrections or reductions were made as needed to achieve precise reduction. The Pauwels classification is applied based on the visualization of the fracture line observed on a C-arm picture. The assessment of the necessity for a Pauwels valgus osteotomy is being conducted. The clinical evaluation of reduction adequacy was conducted using the heel palm test, whereas the radiological assessment was performed using Garden's alignment index. The heel palm test involves the placement of the heel within the palm of an extended hand. In the event of total reduction, spontaneous external rotation of the leg will not occur. The leg that was impacted underwent a thorough cleansing using Betascrub solution, starting from the belly and extending to the knee joint. Subsequently, a betadine solution was given to the limb, followed by the placement of a drape that exposed the anterior superior iliac spine (ASIS) and the proximal end of the lateral section of the thigh. This preparation was done to facilitate the desired surgery.

PROCEDURE

Dynamic Hip Screw Fixation

The patient is positioned appropriately, and the fracture reduction is carried out, followed by draping of the surgical site. To access the femur laterally, a distal skin incision is made, the length of which depends on the chosen implant. The vastus lateralis muscle is elevated, and the perforating branches of the profunda femoris artery are ligated. A guide pin is inserted into the subchondral zone of the femoral head, with the entry point determined based on the planned osteotomy. Typically, a 135-degree plate is utilized, positioned parallel to the lateral cortex to ensure the correct angle. Two pins are temporarily used for fixation and to prevent rotational misalignment. The length of the lag screw, usually 5 mm less than the measured length, is determined, and a bore is created using a step drill. Tapping is performed as necessary to avoid excessive torque, particularly in cases involving young or highly sclerotic bone. The lag screw is then inserted to achieve compression at the fracture site, and its position and depth are confirmed using fluoroscopic guidance.

Multiple Cannulated Screw Fixation

A lateral longitudinal incision of approximately 6 cm is created along the greater trochanter. The superficial fascia, Tensor fascia latae, and vastus lateralis are divided. The origin of the vastus lateralis muscle is lifted subperiosteally at the base of the trochanter. A guide wire is placed through a drill hole in the lateral cortex, positioned midway between the anterior and posterior cortices. This guide wire serves to stabilize the femoral head, preventing any displacement or rotation during insertion. Additional guide wires are placed in parallel to enhance stability. Screws are carefully inserted near the cortical bone, utilizing washers to prevent over-penetration. Cannulated drill bits are then used to follow the guide wire, with precautions taken to avoid breakage. A cannulated tap is employed to tap the near cortex. Screws are subsequently inserted over the guide wires, leaving 5-10 mm of the screw exposed outside the lateral cortex. Simultaneous tightening of all screws ensures efficient torque transfer into the femoral head. The position of the screws is confirmed using fluoroscopic guidance.

Post-Operative Management

Intravenous fluids, antibiotics, and analgesics are delivered as necessary. The removal of suction drains, evaluation of the wound, washing, and application of dressings typically occur 48 hours post-procedure. The removal of sutures often occurs on or around the tenth day. Before being discharged, the patient is instructed to engage in mobilization using a walker, practice toe-touch weight-bearing, and perform quadriceps exercises. Patients are advised to refrain from placing any weight on the injured limb until additional instructions are provided. Subsequent appointments are arranged at intervals of 4 weeks, 2, 3, 4, 6 months, and 1 year. Clinical evaluations evaluate many factors including symptoms, hip range of motion, pain levels, and limb length. Radiographs are utilized to assess the process of bone union and identify any potential problems. Partial weight-bearing may be permitted in the presence of trabecular continuity, with full weight-bearing being authorized if the union has been proven.

RESULTS AND OBSERVATIONS

The research encompassed a cohort of 60 individuals diagnosed with recent femoral neck fractures. The majority of instances, accounting for 50% of the total, were observed within the age range of 30-41 years, with a calculated mean age of 34.5 years. The prevalence of males affected by the condition was 66%, whereas females accounted for 34% of the affected population. The study revealed that there was a presence of right-side involvement in 55.45% of patients, whereas left-side involvement was seen in 42.54% of instances. Fractures were predominantly attributed to road traffic accidents. The prevalence of Pauwels Type II fractures was found to be the highest at 63.5%, followed by Type I fractures at 21.5%, and Type III fractures at 12%. The majority of cases (60%) underwent surgical intervention within a 24-hour timeframe following the occurrence of the injury, whereas 20% of patients underwent surgery after 72 hours due to delayed presentation or the presence of accompanying injuries.

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Table 1:

Mode Of Injury	No. of cases	Percentage
Road traffic accident	30	51
Fall	24	40
Sports Injury	6	9
Total	60	100

A total of 14 patients who underwent CC screw fixation underwent prophylactic capsulotomy, but such intervention was not deemed necessary in cases involving DHS with derotation screws. The prevailing screw lengths employed were 85mm for the Dynamic Hip Screw (DHS) and 75mm for the Cannulated Cancellous (CC) screws. The mean intraoperative blood loss was 150 cc in the DHS group and 50 cc in the CC screw group. A total of seven patients necessitated postoperative blood transfusion, primarily attributed to pre-operative hemoglobin levels that were below the acceptable threshold. There were variations in the mobilization and weight-bearing methods employed by the two fixing groups. The occurrence of wound complications encompassed six instances of superficial infections, which were successfully resolved with the administration of intravenous antibiotics. Reoperation was necessary for screw removal in three cases involving CC screws, however, no cases involving DHS required reoperation. The mean duration of hospitalization ranged from 10 to 14 days for both fixing techniques. The average duration for union formation was found to be 13 weeks in the DHS group and 17 weeks in the CC screw group. Based on the revised Harris hip score, it was observed that 42.5% of patients yielded outstanding outcomes, 37.7% were classified as good, 12% were deemed fair, and 3.8% were categorized as bad. All participants successfully resumed their pre-injury levels of activity without necessitating any occupational modifications.

DISCUSSION

In the current investigation, no evidence has been discovered to suggest that the impact of age, sex, and laterality of fracture have any influence on the outcome of fracture therapy. The assessment of these factors on the result of a fractured neck femur is challenging due to the presence of various factors linked with this outcome. No studies have been identified that indicate the influence of these variables on the outcome of fracture treatment.

Modality of Treatment

The study revealed a statistically significant disparity in outcomes that favored the use of DHS. Patients who underwent DHS management exhibited a significantly greater percentage of excellent outcomes (60.3%) compared to those treated with CC screws (24.8%). Furthermore, no poor outcomes were observed among patients managed with DHS, but a subset of patients treated with CC screws experienced unfavorable effects. This implies that the use of DHS not only provides enhanced stability but also facilitates improved compression at the fracture site, hence promoting early mobility and union. Furthermore, among the DHS group, no instances of non-union were observed, whereas three patients who underwent CC screw treatment experienced non-union. The duration of union was shown to be significantly shorter in the DHS group, with an average time of 13 weeks, in comparison to the CC screw group, which exhibited an average length of 17 weeks. The preferred approach for managing femoral neck fractures is to utilize the DHS with a derotation screw. This suggestion is based on the several advantages associated with this technique, including the ability to facilitate early mobilization, expedite the healing process, and decrease the likelihood of non-union. The selection between DHS and CC screw fixation for femoral neck fractures has been a topic of contention within scholarly discourse [7]. Numerous studies have indicated the absence of statistically significant disparities in results across various methods, however other research posits that DHS procedures offer enhanced stability and facilitate expedited mobilization [8].

Fracture Type

In the present investigation, the management of Pauwel's Type III fractures involved the utilization of both DHS and CC screws. However, it was observed that the CC screw group exhibited a higher incidence of problems such as delayed union and varus. It is worth noting that non-union did not occur in any of the Type III fractures. From a biomechanical standpoint, it has been observed that sliding hip screw devices exhibit a higher level of effectiveness compared to cannulated screws when addressing fractures classified as Pauwels Type III. The utilization of DHS with a derotation screw is advised for Pauwel's Type III fractures due to its capacity to provide appropriate compression and stability. However, it is advisable to use caution in cases of high subcapital fractures, as the threads of the DHS may have limited ability to securely hold the fracture fragments

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in place. Fractures were categorized according to anatomical, Garden's, and Pauwel's classifications, with Pauwel's classification being of special significance about outcomes. Pauwel's Type III femoral neck fractures pose a considerable challenge due to their elevated propensity for non-union, as evidenced by previous research [9].

Time Interval Between Injury and Surgery

The study primarily focused on surgical procedures that were conducted within a 24-hour timeframe following the occurrence of the accident. The occurrence of non-union in patients treated with CC screws was shown to be greater when surgery was postponed, particularly if the delay exceeded 72 hours. The postponement of surgical intervention has the potential to induce fracture end resorption, so compromising the effectiveness of compression, particularly in the context of CC screw fixation. The optimal timing for surgical intervention in cases of femoral neck fractures continues to be a subject of ongoing discussion and disagreement among the medical community. The early implementation of surgical intervention is recommended to reinstate adequate blood circulation to the femoral head, hence mitigating the potential occurrence of osteonecrosis [10].

Method of Reduction (Open vs. Closed)

In the present investigation, it was found that a minority of patients necessitated open reduction, and there was no substantial escalation in the risk of AVN. The majority of cases successfully underwent closed reduction with Swiontkowski's operation, which, although being an extension-type maneuver, did not result in an elevated risk of avascular necrosis (AVN). Research findings indicate that there is no statistically significant disparity in the occurrence of AVN rates when comparing closed versus open reduction techniques [11].

Role of Capsulotomy

The current study's findings were inconclusive in determining the efficacy of capsulotomy, mostly due to the limited size of the sample population. The performance of capsulotomy was not undertaken in patients who were handled with DHS treatment, as it was determined that reaming for the installation of lag screws was adequate for decompressing the femoral head. The controversy about the utilization of capsulotomy in the treatment of femoral neck fractures persists. According to a study by [12], capsulotomy has the potential to decrease intracapsular pressure and enhance blood circulation to the femoral head.

Post-Operative Radiological Reduction

The attainment of anatomical or valgus-impacted reduction is necessary to achieve favorable outcomes. The presence of malalignment following a surgical reduction procedure is associated with an elevated likelihood of experiencing sequelae, including non-union, AVN, shortening, and suboptimal functional results [13]. Hence, it is advisable to consider anatomical or valgus-impacted reduction.

Positioning of Lag Screw and Type of Barrel

The measurement of tip-apex distance (TAD) was not conducted in our study due to the inconsistent magnification of X-rays. However, our findings indicate that positioning the DHS lag screw in the lower quadrant along the calcar and utilizing a long barrel plate were linked to enhanced stability and compression [14]. The DHS utilizing derotation screws exhibited superior compression capabilities in comparison to CC screws. Additional research in the field of biomechanics is required to validate the aforementioned conclusions.

Duration of Surgery and Blood Loss

The group of patients who received the CC screw demonstrated reduced surgery length and blood loss, which can be related to the utilization of smaller incisions. There were no apparent problems linked to anesthesia or blood loss in either of the groups.

Complications

The influence on non-union risk was observed to be associated with many parameters, including displaced fractures, poor reduction, and screw location. The variables of age and sex were found to have no statistically significant effect on the rates of non-union. AVN was observed in a minority of cases, and none of the patients necessitated hip replacement surgery. The use of bisphosphonate therapy effectively averted more deterioration. Manageable minor problems, such as superficial infection and bursitis, did not have a significant impact on the overall functional outcomes.

In brief, the research provides evidence in favor of utilizing DHS with derotation screws for the treatment of femoral neck fractures. This preference is justified by the enhanced stability, compression capabilities, and reduced risk of non-union associated with DHS as compared to CC screws. The attainment of anatomical or valgus-impacted reduction is of utmost importance to achieve the best outcomes. Therefore, it is necessary to do further inquiry into the role of capsulotomy. It is advisable to promptly perform surgical intervention within a 72-hour timeframe following an injury to minimize the likelihood of non-union complications, particularly in cases using CC screw fixation. Further

research in the field of biomechanics is necessary to validate the optimal placement of lag screws for the treatment of intracapsular femoral neck fractures.

CONCLUSION

Femoral neck fractures in young people are infrequent occurrences that often arise from high-impact trauma, frequently concomitant with further injuries. The fractures in question are accompanied by challenging sequelae, namely osteonecrosis of the femoral head and non-union. In the conducted investigation, a union rate of 100% was seen with the use of the DHS, while a rate of 90% was attained with the utilization of the CC screw. The elevated level of union observed within the DHS group can be due to the efficient process of compression and impaction occurring at the site of fracture. The surgeon does not have control over factors such as interruption and displacement of femoral head blood flow. Nevertheless, there are other elements under the control of surgeons that can help alleviate and prevent these issues. The key components of managing femoral neck fractures encompass timely diagnosis, expeditious surgical intervention, accurate alignment, decompression of the joint capsule, and secure repair of the fracture.

Limitations

The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

Recommendations

Based on the comparative study, it is recommended that in cases of intracapsular neck femur fractures, the use of dynamic hip screws (DHS) with derotation screws should be preferred over cannulated cancellous screws (CC) to achieve greater stability, facilitate early union, and reduce the risk of non-union. Early mobilization is crucial for better patient outcomes.

Source of funding

No funding was received.

Conflict of interest

No conflict of interest declared.

List of abbreviations

DHS- Dynamic Hip Screw
CC- Cannulated Cancellous
ASIS- Anterior Superior Iliac Spine
AVN- Avascular Necrosis
TAD- Tip-Apex Distance

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