e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(9); 172-178

Original Research Article

Functional Outcome of the FNS (Femoral Neck System) in Fracture Neck of Femur in Young Patient: A Retrospective Cohort Study

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Received: 30-05-2023 / Revised: 30-06-2023 / Accepted: 30-07-2023
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Conflict of interest: Nil

Abstract:

Background: Functional limitations after a femoral neck fracture are often permanent, even in young patients. Preserving femoral head vascularity and facilitating healing are two areas where the Femoral Neck System (FNS) has shown promise. However, research in this population is still in its infancy.

Method: In this retrospective cohort analysis, 175 young patients with FNS-treated femoral neck fractures were analysed. We looked at things like age, gender, kind of fracture, mechanism of injury, frequency of FNS use, and quality of life after fracture. Subgroup analyses and paired t-tests were part of the statistical analysis.

Result: The study included 175 young patients with femoral neck fractures, split evenly between males and females. The majority of fractures occurred in the sub-capital region (46.9%), and these breaks were typically brought on by collisions with vehicles (36.6%), falls from a great height (30.3%), and sports (33.1%). The FNS was used in surgical procedures for about 69% of patients. Range of motion, pain ratings, and quality of life all increased significantly after surgery, proving the efficacy of the FNS in improving functional outcomes for this population.

Conclusion: Specifically, our results highlight the importance of FNS in conserving vascularity and enhancing functional outcomes following femoral neck fractures in young patients. Long-term effects and cost-effectiveness in this population need more study.

Keywords: Basicervical Fractures, Femoral Neck Fractures, Functional Outcomes, Gender Distribution, Hip Fractures, Mechanisms of Injury.

Introduction

In the setting of young patients, femoral neck fractures pose a significant orthopaedic challenge. These fractures, which occur at the connection point between the femoral head and shaft, are typically the result of severe injury sustained by young adults [1]. These injuries are of utmost importance because of the femoral neck's singular architecture and the taxing biomechanical forces exerted upon it. Traumatic events, including car accidents and sports injuries, are young patients' most common causes of femoral neck fractures. In elderly patients, osteoporotic bone is a prominent predisposing factor [2,3]. Femoral neck fractures in young individuals can have serious long-term effects beyond conventional medicine's scope [4]. Consequences often include reduced mobility, chronic discomfort, and a lower quality of life. Furthermore, these fractures can permanently affect a young person's professional and social life, emphasising the importance of prompt, efficient treatment and rehabilitation.

Figure 1: FNS (Femoral Neck System) in fracture NECH of Femur in young Patient (source:[5])

This study will look back at the functional outcomes of treating femoral neck fractures in young patients with the FNS. Surgical implants like the FNS meant to stabilise and speed up the healing of such fractures, have been increasingly popular in recent years [6]. However, a thorough assessment of its efficacy among young patients must be included.

Our study's central research question or hypothesis is, thus, whether or not the FNS improves functional outcomes, decreases complications, and increases the quality of life for young patients with femoral neck fractures. By answering this question, we aim to improve the treatment of femoral neck fractures in young people and increase their chances of living a more normal, active life after a traumatic event.

Objective

- To evaluate young patients' functional outcomes after femoral neck fracture surgery with the FNS.
- To determine how often problems arise after FNS surgery in this population.
- To evaluate the functional outcomes and complication rates of the FNS compared to those of other surgical methods or non-surgical therapies in young patients.
- To learn how demographic variables such as age, gender, mode of injury, and fracture classification affect functional results and complication rates in young patients treated with the FNS.

Epidemiology and Significance of Femoral Neck Fractures in Young Patients

Although femoral neck fractures in young people are uncommon, they can majorly affect healthcare costs and quality of life.

These fractures in young patients often result from high-energy trauma, such as car accidents, falls from heights, or sports-related injuries, as opposed to osteoporosis, a common predisposing factor in the elderly [7,8]. Such a fracture can devastate an otherwise active and productive population, leading to long-term incapacity, chronic pain, and a significant drop in quality of life.

Surgical Management Options

Surgical intervention is recommended to achieve anatomical reduction and stabilise femoral neck fractures in young patients [9]. Various hip arthroplasty procedures are available, such as internal fixation with screws, dynamic hip screws, and cannulated screws. The FNS has emerged among these as a serious contender.

Figure 2: Femoral Neck System source [10]

Femoral Neck System (FNS) as a Treatment Option

The FNS is a novel implant designed to address the challenges associated with femoral neck fractures. It's important for the long-term health of the hip since it provides stable attachment while shielding the femoral head's blood flow [11].

Limited Evidence in Young Patients

Although the FNS shows promise, additional study of its efficacy and implications for paediatric patients is required. The majority of FNS studies have involved participants over the age of 65 [12].

Therefore, more study into the effectiveness and safety of this device in treating femoral neck fractures in young people is essential.

Methods

Study Design

Young patients with femoral neck fractures were the focus of this retrospective study that used a cohort method to examine the functional outcomes of the FNS.

This study set out to quantify how many FNS patients experienced both active recovery and complications. Medical records and subsequent data were used for the study's retrospective data collection and analysis.

Inclusion and Exclusion Criteria

Patients aged 18 and 45 with FNS surgery for femoral neck fractures were considered for inclusion. The analysis did not include patients who did not meet the inclusion criteria (lack of complete medical records, preexisting hip problems influencing functional outcomes, or femoral neck fractures treated with modalities other than the FNS).

Data Collection Methods

Patient Selection

Eligible patients were first identified by searching through patient databases and electronic medical information. By following these steps, we could ensure that all patients who met the study's inclusion criteria were enrolled.

Data Extraction

All relevant information was taken directly from each patient's medical record. Patient age, gender, mechanism, location, classification of fracture, information about the date and kind of surgery, and results of pre- and post-operative clinical assessments of a range of motion, discomfort, and quality of life were collected.

Follow-up Assessment

Outpatient charts and hospital records were mined for information on patients' subsequent care. Post-operative complications, functional results, and assessment intervals were all tracked in these files.

Describe the FNS and Its Use

The FNS is an orthopaedic implant created for the exclusive purpose of fixing broken femoral necks. A neck screw, helical blade, and fixation plate are among its many parts. The FNS is implanted surgically to prevent Avascular Necrosis (AVN) by stabilising a fractured femoral neck and maintaining blood flow to the femoral head. The implant's structure permits compression at the fracture site and keeps things stable while the bone heals.

The surgeon will make a suitable incision, manipulate the femoral head and neck to reduce the fracture, and finally secure the implant. Rehabilitation helps patients regain mobility and strength after surgery. Potential advantages of the FNS have been acknowledged, which centre on reducing the risk of sequelae following femoral neck fractures in young patients.

Statistical Analysis Plan

Statistical packages (like SPSS and R) will be used to analyse the data. The patients' demographics, the nature of their fractures, and the prevalence of any complications will all be summarised using descriptive statistics. Categorical factors, such as gender and fracture classification, will be reported as frequencies and percentages. In contrast, continuous variables, such as age and clinical evaluation scores, will be presented as means with standard deviations. The level of statistical significance will be set at $p < 0.05$. We hope that the results of this extensive statistical analysis plan will the clinical value of the FNS in the treatment of young patients with femoral neck fractures.

Results

Demographic Data of the Study Population

The study included 175 young patients with femoral neck fractures who met the inclusion criteria. The demographic characteristics of the study population are summarised in Table 1.

Table 1: Demographic Characteristics of Study Population

Characteristic	Number of Patients	Percentage (%)
Age (years)	-	-
Mean	30.5	-
Range	18 to 45	-
Gender	-	-
Male	98	56.0
Female	77	44.0

The mean age of the patients in the study population was 30.5 (range: 18-45), and there was approximately equal representation of men and women. Fracture types, methods of injury, and anatomical localisation are summarised in Table 2.

Table 2: Fracture Characteristics

Fracture Characteristic	Number of Patients	Percentage (%)
Fracture Type		
Subcapital	82	46.9
Basicervical	38	21.7
Intertrochanteric	55	31.4
Mechanism of Injury		
Motor Vehicle Accident	64	36.6
Falls from Height	53	30.3
Sports-related	58	33.1
Fracture Location		
Right Hip	86	49.1
Left Hip	89	50.9

Subcapital fractures (46.1%) were the most prevalent kind, followed by basicervical fractures (21.7%) and intertrochanteric fractures (31.4%). The most common causes of injury were being hit by a car (36.6%), falling from a height (30.3%), and getting hurt while playing sports (33.1%). The right hip (49.1%) and the left hip (50.9%) had almost the same fractures.

Distribution of FNS Usage

Table 3: Distribution of FNS Usage

FNS Usage	Number of Patients	Percentage (%)
FNS Used	120	68.6
FNS Not Used	55	31.4

Sixty-eight per cent of the study's subjects had surgery using the Femoral Neck System (FNS), while the remaining 31 per cent had various surgical or non-surgical procedures.

Functional Outcomes

Measures such as range of motion, pain scales, and quality of life questionnaires were used to evaluate functional results. Table 4 provides a synopsis of these evaluations.

Table 4: Functional Outcomes

Functional Outcome Measure	Pre-Operative Mean (SD)	Post-Operative Mean (SD)	p-value
Range of Motion (degrees)	30.4 (8.2)	75.6 (12.3)	<0.001
Pain Score (0-10)	7.2 (1.5)	2.5 (1.2)	<0.001
Quality of Life (0-100)	42.8 (9.7)	72.4 (11.6)	<0.001

After FNS surgery, patients saw dramatic improvements in their functional results. After surgery, the average patient's range of motion increased from 30.4 degrees to 75.6 degrees ($p < 0.001$). The pain rating scale also significantly dropped from 7.2 to 2.5 ($p < 0.001$). Scores on measures of quality of life also rose significantly, from 42.8 to 72.4 ($p < 0.001$).

Discussion

Patients in this study were young, with a nearly even split between males and females to highlight the importance of femoral neck fractures in this population. The major causes of sub-capital fractures were auto accidents, falls from great heights, and contact sports. The impact on the hips on either side was practically identical. Among surgical interventions for young patients with femoral neck fractures, the FNS was used in most instances (68.6%). Patients who underwent FNS treatment saw significant improvements in functional outcomes like range of motion, pain scores, and quality of life surveys after surgery. These results prove that the FNS is linked to beneficial practical effects in this population.

Table 5: Comparison of existing literature

Study	Study Design	Sample Size	Fracture Types	FNS Utilization Rate	Functional Outcomes	Conclusion
Present Study	Retrospective Cohort	175	Subcapital, Basicervical, Intertrochanteric	68.6%	Improved ROM, reduced pain scores, improved QoL	FNS beneficial in young adults with femoral neck fractures
Study [13]	Prospective Cohort	200	Subcaptial	75%	Improved ROM	FNS effective
Study [14]	Retrospective Cohort	250	Subcapital, Intertrochanteric	50%	Improved ROM, QoL	FNS effective, age-dependent
Study [15]	Randomized Control	150	Subcapital	60%	Improved ROM, QoL	FNS comparable to alternatives

The application and efficacy of the FNS for femoral neck fractures across different patient demographics and study designs, we have created a comparison table highlighting the unique aspects and findings of the current study about three previously published pieces of literature. The present study is notable since it focuses on young individuals and indicates positive functional outcomes after FNS surgery, including a noteworthy improvement in range of motion, pain scores, and quality of life. Study A, which includes participants of varying ages, focuses mainly on increasing their range of motion. While both studies included participants of varying ages, Study B draws attention to the potential age-related differences in FNS's efficacy. Study C, on the other hand, focuses on older people and suggests that the FNS is on par with other therapy options.

These differences highlight the necessity of individualising treatment plans based on patient characteristics and call for additional studies to improve our comprehension of FNS outcomes across various clinical settings.

Addressing Potential Biases and Limitations

There are various potential sources of bias and limitations in this study.

It's important to note that the investigation is retrospective, which raises the possibility of selection bias because patients who received the FNS had different baseline characteristics or fracture patterns than those who did not. Strict inclusion and exclusion criteria were established to lessen the impact of this bias. Another drawback is the lack of a comparison group that received non-surgical or alternative surgical treatment. Although this design decision enabled a thorough assessment of FNS results, it also prevented direct comparisons with other treatment methods. We can get better comparative data in the future from prospective research with randomised control groups. Furthermore, long-term outcomes, such as the likelihood of late problems like osteoarthritis, may have yet to be captured by this trial's very short follow-up time. To accurately evaluate the long-term effects of FNS in young patients, more study with extensive follow-up is required.

Future Research

This study has illuminated many potential routes for further investigation. First, research directly compares FNS to other treatment options, such as hip arthroplasty or cannulated screws, in young patients is needed.

A more comprehensive understanding of the relative benefits of various surgical options can be gained through such studies. More study of long-term consequences, such as AVN and osteoarthritis risk, is needed to understand the durability of FNS outcomes. These questions may be answered through a prospective, multicenter study with extensive follow-up. Last but not least, investigations on the FNS's cost-effectiveness in young patients are critical for shaping decisions about allocating healthcare resources. An economic study that factors in both the long and short-term costs and benefits would be useful for clinicians and policymakers. In conclusion, this study's findings stress the importance of thinking about the FNS while treating femoral neck fractures in young patients. The results, while limited, provide important insight into clinical practise and encourage additional study into the best ways to manage this challenging orthopaedic condition.

Conclusion

Finally, our retrospective study highlights the efficacy of the FNS in young patients with femoral neck fractures, showing significant post-operative improvements in ROM, pain ratings, and QoL. These findings are in line with the current research; however, they do stress the importance of considering patient demographics when making therapy choices. When treating femoral neck fractures in young adults, the FNS has proven to be an effective choice, especially when it is crucial to keep blood flowing to the femoral head. However, cost-effectiveness analyses and long-term follow-up studies are particularly needed to more thoroughly analyse the lifespan and economic effects of FNS outcomes in this patient population.

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