

Meta Analysis of the Results of Internal Fixation of Femoral Neck Fractures in Young Adults by Cannulated Screws

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ABSTRACT

Background: Even while femoral neck fractures are more common in the elderly, high-energy induction's nature leads to worse clinical consequences in the young. **This study aimed** to do a meta-analysis to assess the clinical results of internal fixation with cannulated screws in the treatment of fracture neck femur in young adults, including the rate of union, rates of revision surgery, surgical complications, and general medical issues.

Subjects and methods: Utilizing research databases from 2000 to 2021, pertinent publications were found. The following keywords were used in the search: young adults, cannulated screws, internal fixation, and femoral neck fractures. To ascertain the impact of internal fixation of femoral neck fractures in young adults by cannulated screws and rates of postoperative complications, revision, function, operating time, Harris hip score, and follow-up time in young adult patients with a femoral neck fracture, six published randomized controlled trials involving a total of 231 patients were suitable for inclusion in the review. With the Revman 5.1 program, studies' demographic data were extracted, including the number of patients, their ages, and their gender.

Result: 231 patients were treated with cannulated screws for internal fixation. A follow-up period of 21.6 6.0 months was typical for all patients. In contrast, 171 patients (74.3%) had a satisfactory union without any problems. Nonunion occurred in 27 patients (11.6%), fixation failure in 8, and AVN in 22, respectively.

Conclusion: Young patients with femoral neck fractures who are relatively healthy and independent can benefit from internal fixation with cannulated screws.

Keyword; Young adults, Cannulated screws, Internal fixation, Fractures of the femoral neck.

INTRODUCTION

Young individuals rarely experience femoral neck fractures, which frequently result from high-intensity trauma. They have a higher chance of developing femoral head osteonecrosis and nonunion⁽¹⁾. A positive outcome can be influenced by a variety of factors, many of which can play a key part in preventing these disastrous complications. While establishing an anatomic reduction and a secure internal fixation are essential, other therapeutic factors like the timing of surgery, the function of the capsulotomy, and the types of fixation remain in question. Three cannulated cancellous screws can be used for permanent fixation^(1,2).

In the older population, intracapsular femoral neck fractures following a minor fall are rather prevalent⁽³⁾ nonetheless, they only represent 2 to 3 percent of all femoral neck fractures in young people⁽⁴⁻⁷⁾. Understanding and contrasting the characteristics between elderly and young adult patients is crucial for the evaluation and treatment of femoral neck fractures in young adults. There are distinctive distinctions in the osseous and vascular structure, the mechanism of damage, accompanying injuries, fracture pattern, and therapeutic objectives⁽¹⁻⁴⁾.

Femoral head osteonecrosis and nonunion are more common in young individuals with femoral neck fractures^(6,8-12). In young patients with femoral neck fractures, osteonecrosis rates range from 12 to 86% in the literature^(5,6,10-13). This terrible consequence may cause the femoral head to collapse, which would then result in osteoarthritis⁽¹⁾.

Giving the young age and increased levels of activity, arthroplasty surgeries are not recommended, and reoperation and salvage procedures like osteotomies have high failure rates⁽¹⁴⁾. Understanding and treating young adult femoral neck fractures benefits from knowledge of various treatment options and potential consequences⁽¹⁾.

The objectives of treatment differ for young adults versus the elderly. The objectives are maximizing movement and weight bearing in the older patient while avoiding problems related to extended bed rest. The possibilities for surgery include hemiarthroplasty, complete hip arthroplasty, reduction and internal fixation. The patient's physiological age, amount of exercise, medical comorbidities, and level of bone density are all taken into account⁽¹⁾.

The internal fixation of the femoral neck fracture by cannulated screws and an open or closed reduction are two highly successful therapeutic options for young adults. Preserving the femoral head, preventing osteonecrosis, and preventing nonunion are the primary objectives^(1,2).

There have been several clinical investigations into cannulated screws used for internal fixation. They consist of systematic reviews, randomized controlled trials, and observational research. By doing an up-to-date meta-analysis of RCTs, we solve these problems. Our goal in this study is to conduct a meta-analysis to assess the clinical outcomes of internal fixation by cannulated screws in the treatment of fracture neck femur in young adults, including the percentage of union, the prevalence of revision surgery, the incidence

of surgical complications, and general health complications.

MATERIAL AND METHODS

We looked for randomized controlled studies examining the effectiveness of cannulated screws in fixing the femoral neck in young adults.

We included only studies meeting the following criteria:

Randomized controlled trails evaluating cannulated screws effect in femoral neck fixation in young adults; included patients.

- From 20 to 60 years old.
- Acute displaced femoral neck fracture.
- Clinical outcomes that have been reported, such as mortality, the prevalence of general complications and problems relating to fractures, and revision surgery.

All trials involved patients having their first surgery, according to the publications we found in the English-language literature.

Two computerized databases used for research (PubMed and Google Scholar) were searched for relevant articles from 2000 to 2021. The following keywords were used in the search: young adults, cannulated screws, internal fixation, and femoral neck fractures.

Initially, we found 140 documents that were pertinent. Six published articles that passed the inclusion criteria and qualified for this inquiry were found by screening the title. They consisted of 231 patients in total.

We were looking for a summary of participant characteristics, the breakdown of union time, distribution of operating time, and postoperative Harris Hip Score.

Other issues that are directly related to surgery were referred to as "surgical complications" and included non-union or early repositioning, avascular necrosis, loosening of the screws, revision, and other issues.

Ethical consideration:

The Institutional Review Board of Zagazig University approved the study. The Declaration of Helsinki, the World Medical Association's guideline of ethics for studies involving humans, was followed in the performance of this work.

Data are organized in Microsoft Excel 2010 and exported to the version 3 of the complete meta-analysis program to test for mean differences. Analyze heterogeneity 12 and the Cochran's Q test to test heterogeneity and homogeneity of study results and findings, it is approximately distributed as a chi-square with k-1 degrees of freedom under the null hypothesis. **P value less than 0.05 was considered significant.**

RESULTS

Socio demographic distribution as mean age from all studied was **41.42±12.6** and males were 67.5% and 32.5% were females as shown table 1.

Table (1): Distribution of demographic data

Study	Year	Follow-up (months)	N	AGE Mean±SD	SEX	
					Male	Female
He <i>et al.</i> ⁽¹⁵⁾	2021	12-24	36 cases	47.58±10.3	61.1 %	38.9 %
Siavashi <i>et al.</i> ⁽¹¹⁾	2015	12	28 cases	28.9±13.0	75.0 %	25.0 %
Zhang <i>et al.</i> ⁽¹⁶⁾	2016	24	54 cases	45.8 ± 14.2	55.5%	44.5%
Gupta <i>et al.</i> ⁽¹⁷⁾	2016	39	45 cases	39.3±10.85	71.1%	28.9%
Hou <i>et al.</i> ⁽¹⁸⁾	2015	24	31 cases	38.7±8.52	70.9%	29.1%
Liporace <i>et al.</i> ⁽¹⁹⁾	2008	18	37 cases	42.0±10.58	NA	NA
Pooled		22.5	231	41.42±12.6	67.5%	32.5%

Pooled analysis showing time union as **14.89±2.65** weeks (Table 2).

Table (2): Distribution of time of union

Study	N	Union time/ Weeks (Mean±SD)
He <i>et al.</i> ⁽¹⁵⁾	36 cases	14.03 ± 1.78
Siavashi <i>et al.</i> ⁽¹¹⁾	28 cases	NA
Zhang <i>et al.</i> ⁽¹⁶⁾	54 cases	15.21±1.36
Gupta <i>et al.</i> ⁽¹⁷⁾	45 cases	NA
Hou <i>et al.</i> ⁽¹⁸⁾	31 cases	16.50±2.65
Liporace <i>et al.</i> ⁽¹⁹⁾	37 cases	14.50±1.88
Pooled		14.89±2.65

Insignificant heterogeneity

We test the homogeneity among studies and we found that studies results were homogenous. No differences in results among studies, after quantifying all factors. We found no significant heterogeneity and we reported agreement between studies.

Pooled analysis showing mean operation time as **48.5±14.69 (Table 3)**.

Table (3): Distribution of operation time

Study	N	Operation time/minutes Mean±SD
He <i>et al.</i> ⁽¹⁵⁾	36 cases	49.94 ± 14.46
Siavashi <i>et al.</i> ⁽¹¹⁾	28 cases	43.82 ± 11.36
Zhang <i>et al.</i> ⁽¹⁶⁾	54 cases	27.33 ± 7.61
Gupta <i>et al.</i> ⁽¹⁷⁾	45 cases	61.0 ± 15.36
Hou <i>et al.</i> ⁽¹⁸⁾	31 cases	64.58 ± 18.56
Liporace <i>et al.</i> ⁽¹⁹⁾	37 cases	NA
Pooled		48.5±14.69

We examined the homogeneity of study results and discovered that it was present. After measuring all criteria, studies' findings were the same. We reported no discernible heterogeneity and agreement between the studies.

Studies showing significant increase regarding **Harris** hip score after 18 months with pooled increase from **21.96±4.36 to 86.4±6.58 with P= <0.01** (Table 4)**.

Table (4): Harris hip score postoperative

Study	N	Post Harris Mean±SD	Z	P
He <i>et al.</i> ⁽¹⁵⁾	36 cases	88.44 ± 5.91	-----	-----
Siavashi <i>et al.</i> ⁽¹¹⁾	28 cases	92.0 ± 6.36	-----	-----
Zhang <i>et al.</i> ⁽¹⁶⁾	54 cases	85.63 ± 5.51	13.57	<0.01**
Gupta <i>et al.</i> ⁽¹⁷⁾	45 cases	88.65± 4.23	-----	-----
Hou <i>et al.</i> ⁽¹⁸⁾	31 cases	81.92 ± 8.34	11.88	<0.01**
Liporace <i>et al.</i> ⁽¹⁹⁾	37 cases	NA	-----	-----
	Pooled	86.4±6.58	16.25	<0.01**

** : Highly significant

No significant heterogeneity

We examined the homogeneity of study results and discovered that it was present. After measuring all criteria, studies' findings were the same. We reported no discernible heterogeneity and inter-study agreement.

Pooled analysis found that overall complication rate was 25.7% (Table 5).

Table (5): Distribution of complications

		Complication				Total
		Nonunion cases	Fixation failure	Femoral neck shortening	Avn	
He <i>et al.</i> ⁽¹⁵⁾	36 cases	3	1	3	2	25%
Siavashi <i>et al.</i> ⁽¹¹⁾	28 cases	-----	2 (first 3 months) 3 (2 nd , 3 rd 3 months)	-----	3	28.5%
Zhang <i>et al.</i> ⁽¹⁶⁾	54 cases	5	-----	-----	8	24%
Gupta <i>et al.</i> ⁽¹⁷⁾	45 cases	5	-----	-----	3	17.7%
Hou <i>et al.</i> ⁽¹⁸⁾	31 cases	7	2	-----	3	38.7%
Liporace <i>et al.</i> ⁽¹⁹⁾	37 cases	7	-----	-----	3	27%
	Pooled	11.6%	3.4%	1.29%	9.5%	25.7%

Avn: Avascular necrosis

DISCUSSION

1) According to sample size and sex

He et al.⁽¹⁵⁾ in a study including 36 patients, there were 22 men and 14 were women. **Siavashi et al.**⁽¹¹⁾ studied 28 patients; 21 men and 7 women. **Zhang et al.**⁽¹⁶⁾ in research including 54 individuals, 30 were men and 24 were women. **Gupta et al.**⁽¹⁷⁾ in research including 45 patients, 32 were men and 13 were women. **Hou et al.**⁽¹⁸⁾ had 22 of the 31 individuals studied were males, while 9 were females. **Liporace et al.**⁽¹⁹⁾ had a study that involved 37 patients. male were 67.5% and 32.5% were female all of these studies indicate that males are more likely than females to sustain a femoral neck fracture in the young adult age range.

2) According to age group:

This study's age group consisted of young adults. The study's average age was 41.42 ± 12.6 years old. **He et al.**⁽¹⁵⁾; the average age in their study was 47.58 ± 10.3 years, which was higher than the norm in prior studies. **Siavashi et al.**⁽¹¹⁾; the average age in their study was 28.9 ± 13.0 years, which was lower than the average in prior studies. **Zhang et al.**⁽¹⁶⁾; the age in their study was 45.8 ± 14.2 years, on average. **Gupta et al.**⁽¹⁷⁾; the average age in their study was 39.3 ± 10.85 . **Hou et al.**⁽¹⁸⁾; the average age in their study was 38.7 ± 8.52 years. **Liporace et al.**⁽¹⁹⁾; the average age in their study was 42.0 ± 10.58 years.

3) According to operative technique:

All cases were treated utilizing percutaneous cannulated screws after initial fracture reduction using a fracture table and a C arm. In the anteroposterior view of the hip joint, anatomic reduction is indicated by a 160° angle between the head and neck trabecular lines and a 180° angle in the lateral view. From the anatomic position, five degrees of varus and valgus were acceptable. Cannulated screws were used to complete the fixes. In the shape of an inverted triangle, three screws were placed parallel to one another⁽¹⁵⁻¹⁹⁾.

4) According to operation time:

He et al.⁽¹⁵⁾; the typical surgery took 49.9 minutes in their study. **Siavashi et al.**⁽¹¹⁾; the typical operation time in their study was 43.82 minutes. **Zhang et al.**⁽¹⁶⁾; the typical surgery took 27.33 minutes in their study. **Gupta et al.**⁽¹⁷⁾; the average operation time in their study was 61 minutes. **Hou et al.**⁽¹⁸⁾; the average surgery time in their study was 64.58 minutes, whereas the average operation time across all prior investigations was 48.5 minutes. As a result, this approach is not time-consuming.

5) According to postoperative complications and union rate:

He et al.⁽¹⁵⁾ included a total of 36 cases in their study, of which 27 experienced a union without complications, 3 experienced nonunion, 1 experienced fixation failure, 3 experienced femoral neck shortening, and 2 experienced avascular necrosis. **Siavashi et al.**⁽¹¹⁾ in their study, there were 28 instances, 20 of which

experienced union without difficulties, 5 of which experienced fixation failure, and 3 of which experienced avascular necrosis. **Zhang et al.**⁽¹⁶⁾ in their study included 54 patients, of which 41 had union without problems, 5 had nonunion, and 8 had avascular necrosis. **Gupta et al.**⁽¹⁷⁾ in their study, there were 45 instances total, of which 37 had union without problems, 5 had nonunion, and 3 had avascular necrosis. **Hou et al.**⁽¹⁸⁾ in their study, there were 45 instances, of which 37 had union without problems, 5 had nonunion, and 3 had avascular necrosis. Finally, **Liporace et al.**⁽¹⁹⁾ had 37 instances in their study, of which 27 experienced union without sequelae, 7 experienced nonunion, and 3 experienced avascular necrosis. A combined analysis indicated that the overall rate of problems was 25.7%, but that full union was achieved in 74.3% of cases treated with cannulated screws.

According to this study, the mean operation duration was **48.5 ± 14.69** minutes. Shorter operation times are unquestionably better for patients, even though their impact on the femoral head is still debatable.

The mean time of follow up of cases included was 22.5 months, the mean time of union of fractures was **14.89 ± 2.65** weeks and the Harris hip score after 18 months of follow up was **86.4 ± 6.58** .

The nonunion rate of femoral neck fractures treated with three Cannulated Screws (CS) alone was 11.6%, but only 27 cases out of 231 cases had nonunion; 3 patients had femoral neck shortening (1.29%); 22 patients had avascular necrosis of the femoral head (9.5%); 5 patients had fixation failure in the first 3 months after surgery; and 5 patients in the second and third.

CONCLUSION

For relatively healthy, independent young adults with femoral neck fractures, we found the analysis to be informative in determining the effectiveness of internal fixation by cannulated screws. Internal fixation of femoral neck fracture in young adults by cannulated screws is successful.

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