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ORIGINAL ARTICLE

Medial Buttress Plate Augmentation To Cannulated Screws In Vertical Unstable Fracture Neck Femur

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Abstract

Background: ***A sizeable shear load at the fracture site, as may occur with a vertical fracture pattern in these situations, has been correlated with a greater likelihood of internal fixation failure. Nonunion rates range from 16% to 59% for Pauwels type 3 femoral neck fractures, while osteonecrosis rates range from 11% to 86% because of the significant shear pressures involved in fixing these fractures. Any attempt to treat a femoral neck fracture that does not include anatomic reduction & stable internal fixation is destined for failure.***

Aims and objectives: ***The focus of this research was to contrast the radiographic and functional consequences of repairing unstable femoral neck fractures with a medial buttress plate (MBP) and a cannulated screw (CS).***

Patients and methods: Patients were recruited from the orthopedic surgery department of the Damietta Faculty of Medicine, Al-Azhar University.

Results: ***Of the examined cases, 17 were males (85%) and 3 were females (15%). The mean operative time was 90.71 ± 11.43 minutes, and the mean hospital stay was 4.16 ± 1.54 days. 10% of the patients suffered from nonunion, 5% from pain, and 5% from infection.Meanwhile, two patients reported femoral neck shorting. 12 (60%) cases were excellent, and 5 (25%) were good. Although only two cases were fair and one case was poor.***

Conclusion: ***MBP augmentation to CSs as a means of stabilizing fractures of the femoral neck showed excellent outcomes with minimal postoperative complications and high union rates.***

Keywords: Medial buttress plate; Neck femur; Vertical unstable fracture

1. Introduction

High-energy trauma is frequently the reason for femoral neck fractures in young people. [1] A significant shear load at the fracture location, as shown in a vertical fracture pattern, may cause internal fixation failure in these injuries. [2] Pauwels type 3 femoral neck fractures are mainly vertical and are correlated with substantial shear stresses after fixation, which can cause nonunion rates between 16 and 59 percent and osteonecrosis rates between 11 and 86 percent. [3] Successful treatment of femoral neck fractures requires anatomic reduction &stable internal fixation. [4]

CSs, a sliding hip screw with or without a supplementary derotation screw, cephalomedullary nails & proximal femoral locking plates are possible methods of fixation. Orthopedic trauma specialists disagree on a single fixation method as the best way to treat these injuries. [5]

In a recent meta-analysis of femoral neck fractures in young people, the total reoperation rate was found to be eighteen percent, the rate of nonunion was found to be nine percent, the rate of avascular necrosis was found to be fourteen percent, and the incidence of implant failure was approximately 10 percent. [6]

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Researchers looked at the outcomes of 62 Pauwels type 3 femoral neck fracture cases for the study. Of these cases, 37 were treated by CSs, and 25 were treated with a fixed-angle device. They discovered that nonunion happened in sixteen percent of cases and avascular necrosis occurred in eleven percent of cases. [2]

For fractures of the femoral neck that occur vertically, a buttress plate inserted in the antero-inferior direction can help prevent further shearing of the fractured bone. This method employs a modified Smith-Peterson technique that allows for direct fracture site visibility during anatomical reduction & makes it easier to insert an MBP. [7]

Our study set intended to assess the radiographic and functional outcomes of CSs augmented with MBP to treat unstable femoral neck fractures.

2. Patients and methods

This was prospective case-series research done on 20 cases at the orthopedic surgery departments of Al-Azhar University in Damietta.

Inclusion criteria: age above 18 years and a vertically unstable fracture of the femur neck

Exclusion criteria: severe blood & immune system diseases, Pathological fractures, UN-controlled diabetic patients, Severe multiple traumas or background with ipsilateral hip or femur surgery & conditions, for example, post-dysplastic deformities and osteoarthritis

2.1.Method:

All patients were subjected to a complete history (personal history, complaint & its duration, present, past medical, past surgical, and clinical history), physical examinations (general, local, and neurological examinations), and investigational studies (routine laboratory investigations and radiological investigations).

2.2.Surgical technique: Operative Assessment

Patients were given general anesthesia and positioned supine on the surgical table with the injured hip raised at an angle of 10-15 degrees; fixations were performed using CSs while being monitored by C-arm fluoroscopy.

The greater trochanter has a hole bored into its distal cortex next to the calcar femoral. This was used to insert a guide wire. Two more guide wires were parallel to the first guide wire, running along the anteroposterior and lateral cortexes. Biplane fluoroscopy was used to confirm the reduction.

Next, a hole is made in the femoral head, 5 mm below the cartilage, using a guide wire and a CS of the correct length.

With an inverted triangle, partially threaded 7.3 mm CSs were inserted.

After inserting three parallel CSs into the femoral neck, the MBP was formed, put on the femoral neck's anterior medial surface, and secured with three screws.

Postoperative evaluation: The radiological findings were utilized to provide postoperative mobility instructions, which included weight bearing as tolerated, and frequent follow-ups were done one month, three months, six months, a year & two years following surgery. These checkups were conducted for one month, three months, six months, a year, and two years following surgery. The degree of union, implant position & fracture misalignment were all assessed at each follow-up. Also, the degree of shortening of the femoral neck was determined utilizing both anteroposterior & lateral views of the patient's skeleton.

2.3.Ethical Consideration The cases were informed and given the specifics of the procedure before it was performed. Before beginning this investigation, written consent was obtained, approval was received from the Institutional Review Board committee at the Damietta Faculty of Medicine at AL-Azhar University, approval was received from the managers of the hospital in which the research was carried out, and all participants' right to confidentiality was upheld throughout this research. The collected information was not going to be utilized for any other reason.

2.4.Statistical Analysis

Data collection Serial clinical examination and radiological assessment Computer software IBM SPSS (V.23; Chicago, IL, USA) Statistical tests An ANOVA and T-tests were used for the outcome measures. The data were reported as numbers & percentages for qualitative variables, whereas for quantitative ones, they were expressed as means and standard deviations (SD).

The mean of the arithmetic values () and the standard deviation (SD) were utilized to summarize the data.

The comparison utilized methods such as the student t-test, the Mann-Whitney test, the Chi-square test (X2), the Z-test for percentage, and the odds ratio (OR).

In terms of its level of significance, a significance level (P-value) of 5% was chosen as the cutoff for all of the statistical tests described in the previous paragraph. A P value of > 0.05 shows that the findings are insignificant, while a P value of 0.05 reveals that the findings are significant.

The results are considered to have more significance than the P value that was achieved.

3. Results

Table 1. Demographic and clinical data of the examined cases

Variables		*Patients (n=20)*	
		Mean ± SD	Min – Max
Age (years)		42.65 ± 8.73	27 - 58
BMI (kg/m²)		26.54 ± 2.61	22.4 – 30.2
Sex		N	%
	Male	17	85
	Female	3	15

Of the examined cases, 17 were males (85%) and 3 were females (15%), with a mean age of 42.65 ± 8.73 years and a range of 27–58 years & a mean BMI of 26.54 ± 2.61 kg/m2 .Table 1

Table 2. Mode of injury among the examined cases

	Patients (n=20)	
	N	%
RTA	11	55
Fall	6	30
Sport injury	3	15

Table 2 showed that according to mode of injury, 11 (55%) of cases were because of RTA, 6 (30%) of cases were due to falls and 3 (15%) of cases were because of sports injuries.

Table 3. Different classification among the examined cases

Garden classification	*Patients (n=20)*	
	N	%
Type III	12	60
Type IV	8	40
Pauwels classification	Patients (n=20)	
	N	%
Type I	6	30%
Type II	10	50%
Type III	4	20%
ASA classification	Patients (n=20)	
	N	%
Grade I	14	70%
Grade II	6	30%

Table 3 showed that according to Garden classification 12(60%) of cases were type III and 8(40%) were type IV, according to Pauwels classification 6(30%) of cases were type I ,10(50%) were type II and 4(20%) were type III and according to ASA classification 14(70%) of cases were grade I and 6(30%) were grade II.

Table 4. Hospital stays and postoperative complications among the examined cases

Variables	*Patients (n=20)*	
	Mean ± SD	Min – Max
Operative time (min) Mean ± SD	72.25 ± 12.34	64 – 112
Blood loss (ml) Mean ± SD	296.48 ± 91.27	200 - 400
Hospital stays (days) Mean ± SD	4.16 ± 1.54	2 – 6
Postoperative complications	N	%
Non-union	2	(10%)
Wound infection	1	(5%)
Pain	1(5%)	(5%)
Femoral neck shorting	2	(10%)

Table 4 showed that the mean operative time was 72.25 ± 12.34 and the mean hospital stays was 4.16 ± 1.54. It also showed that 10% of the patients suffered from non-union, 5% from pain, and 5% from infection. Meanwhile, two patients reported femoral neck shorting.

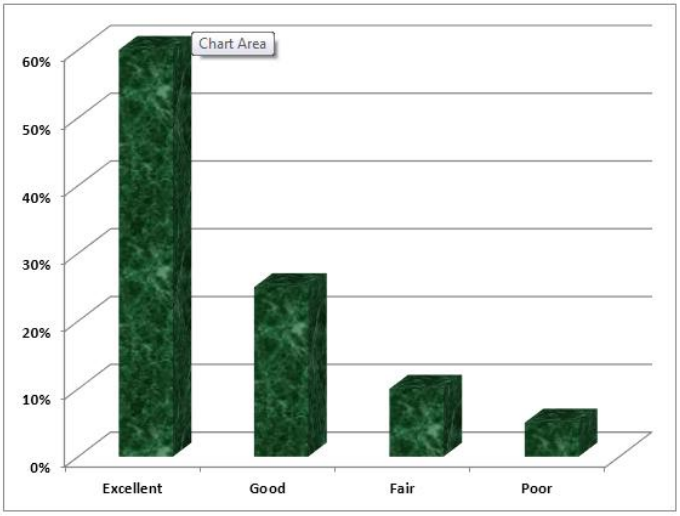

Figure 1. Outcome distribution among the examined cases

12 (60%) of cases were excellent, and 5 (25%) of cases were good. While only two cases were fair and one case was poor.

CASE PRESENTATION

Female patient 48 years old admitted with neck femur fracture, due to falling from height, it was treated with medial buttress plate augmentation to cannulated screws

Figure 2. Plain x-ray preoperative AP & lat

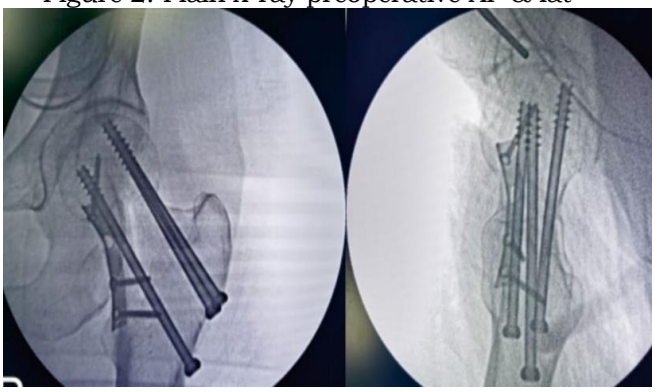

Figure 3. Intraoperative

Figure 4. Postoperative AP & lat

Figure 5. After 6 months

4. Discussion

Low-energy trauma, which can be the result of direct or indirect processes, has a disproportionately negative impact on older patients. When you violently rotate your lower limb outward or fall on your greater trochanter, the femoral neck can hit the back lip of the acetabulum. This is a direct mechanism that can cause an injury. When a muscle's force is greater than the femoral neck's strength, an indirect mechanism occurs. [8]

Most femoral neck fractures in younger people are caused by high-energy trauma, for example, an automobile accident or a fall from an elevated position. Stress fractures, a consequence of repeated bending and twisting, are common in sports, military recruits, and ballet dancers. Patients with osteoporosis and osteopenia are more likely to suffer from insufficiency fractures. [9]

These days, CS and sliding hip screw designs are typically employed to treat intracapsular femoral neck fractures in young cases. Both approaches have been extensively discussed and aim to apply compression to the fracture site. [10]

The main results were as follows:

In our study regarding demographic and clinical data of the studied patients, we found that of the examined cases, 17 were males (85%) and 3 were females (15%), with a mean age of 42.65 ± 8.73 years and a range of 27–58 years & a mean BMI of 26.54 ± 2.61 kg/m2.

Xiong et al., who sought to investigate the inferior calcar buttress reduction pattern in young adults with dislocated femoral neck fractures, can support our study. The research reported that the mean age was 52.4 ± 5.9 years while BMI was 23.5 ± 1.2 as the two inferior cortices group in buttress cortical apposition. Shortening (> 5 mm) occurred only in one patient. However, there were nine females and seven males in the same group.[11]

Concerning the mode of injury among the studied patients, we found that 11 (55%) of cases were caused by RTA, 6 (30%) of cases were caused by a fall, and 3 (15%) of patients were caused by sports injuries. 75% of the cases had fractures on the right side, and 25% were on the left.

Our results line up with those of Ma et al., who aimed to assess the function of the MBP in the treatment of Pauwels Type II & III Femoral Neck Fracture. The research reported that 14 patients had fractured the right limb, while eight patients had fractured the left limb. The mechanism of injuries was that 14 patients had a traffic accident, six patients fell, and two patients had a sports injury. [12]

Our findings revealed that 12 (60%) cases were type III, and 8 (40%) were type IV, by the Garden classification. In our current study, 10 (50%) of the studied patients were type II, 6 (30%) were

type I, and 4 (20%) were type III, along with the Pauwels classification. Regarding ASA classification among the studied patients, we found that 14 (70%) of patients were ASA I, and 6 (30%) of patients were ASA II.

Ma et al., who sought to assess the efficacy of treating unstable femoral neck fractures in young adults using either an MBP alone or a combination of several CSs, can support our study. The research stated that the prevalence of Garden classification type III was 14 and 8 in type IV, while the prevalence of Grade 1 ASA was 16 and 6 in grade 2. However, the majority of patients in the multiple CSs combined with the MBP group were 14 in the type III Pauwels classification and 8 in the type II. [12]

Concerning operative time and hospital stay among the studied patients, we found that the mean operative time was 90.71 ± 11.43 minutes, and the mean hospital stay was 4.16 ± 1.54 days.

Consistent with our findings, Huang et al. aimed to examine the efficacy of open reduction and internal fixation (ORIF) with MBP & allograft bone-assisted CS fixation for cases with unstable femoral neck fractures with comminuted posteromedial cortex. Patient age was found to be 48.73±6.38 years old among the group that received the MBP and allograft bone-assisted CS (48 cases, 20 females). The average operation time (min) was 75.35±27.67, while the average hospital stay (d) was 6.23±2.38. However, the average blood loss (ml) was 153.45±64.27. [13]

Our findings revealed that 12 (60%) of cases had excellent outcomes, 5 (25%) had good outcomes, only two patients had fair outcomes, and one case had poor outcomes.

In line with the work of Giordano et al., the goal was to find out what the medial plate means in the case of Pauwels type III femoral neck fractures. Two parallel CSs placed at the bottom of the femoral neck, along with a Pauwels screw and a medial plate at the fracture's tip, kept the bone from failing in varus or shear forces, which are common issues that can happen with this type of fracture. The findings of their study demonstrated that the utilization of a MBP yields a structurally better configuration for Pauwels type III fractures that are stabilized by utilizing numerous CSs. [14]

Collinge et al. also researched the possible benefits of adding a femoral neck buttress plate (FNBP) to the usual way of fixing high-energy displaced femoral neck fractures in young adults. Their research findings indicate that utilizing FNBP as an adjunct to traditional fixation techniques leads to enhanced clinical outcomes. These outcomes include reduced occurrences of failed fixation, osteonecrosis, nonunion, and the necessity for subsequent reconstructive surgical interventions. Utilizing a small fragment (3.5 mm) plate immediately attached to the medial region of the femoral neck, which avoids placement in a more anterior position, maximizes the benefits of this method. [15]

Furthermore, Li et al. looked into the use of a medial anatomical buttress plate (MABP) to treat a fractured and dislocated femoral neck. They discovered that the femur was more stable when fixed with an MABP when looking at its stress peaks, stress distributions, and Z-axis dislocations compared to the other two methods. [16]

5. *Conclusion*

MBP augmentation to CSs as a means of stabilizing fractures of the femoral neck showed excellent outcomes with minimal postoperative complications and high union rates.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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