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A study was conducted on subtrochanteric hip fractures that were treated using cerclage wires and long cephalomedullary nails.

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Abstract

Background: Orthopaedic traumatologists continue to face the difficult problem of subtrochanteric fractures. Potential concerns like as delayed union, nonunion, malunion, and implant failure make it challenging to obtain satisfactory outcomes in complex fractures, even with recent technical breakthroughs and better implants. These challenges arise due to specific anatomical and mechano-biological characteristics of this region. The subtrochanteric portion of the human skeleton is exposed to the most significant compressive and tensile loads, which pose a danger to stability and increase the likelihood of implant failure.

The motivation behind this review research was to perceive how subtrochanteric hip breaks treated with cephalomedullary nails fared as far as mending and intricacies after open decrease with cerclage wire. This region is particularly challenging due to reduced contact area, decreased blood supply to the cortical bone, and the presence of strong deforming muscular forces.

Materials and Methods: Between January 2022 and December 2022, we analyzed every single patient who had surgery at Vinayaka Mission Medical College and Hospital's Department of Orthopaedic Surgery in Karaikal, Puducherry. The two groups were compared using a comparative analysis. Group A had cerclage wire therapy, whereas Group B did not. Type of fracture, amount of time in the hospital, time spent operation, blood transfusions, alignment, bone union, and consequences including infection rates, non-union, and the necessity for more procedures were among the several aspects that were investigated.

Result: The research included a total of 58 individuals. Twenty patients made up Group A, while thirty-eight patients made up Group B. With a p-value of 0.0004, 3A fractures were the most prevalent kind of break. The average length of stay in the hospital for the two groups was the same (9 vs. 10.6 days, p=0.81). Despite the fact that group A required more time for surgery and received more blood transfusions than group B, the differences were not statistically significant (p=0.58). Both groups were somewhat more likely to have unionized than the other

(90% vs. 92.1%; p=0.09). Exclusively in group B was malalignment seen, with a frequency of 5% to 13.5% ($p < 0.01$). A comparable number of issues happened (15% versus 18.4%) and reoperations were essential (15% versus 15.8%) (p=0.99). All in all, subtrochanteric hip cracks treated with cephalomedullary nails and cerclage wire altogether protracted the careful cycle and diminished misalignment rates. Although not statistically significant, it resulted in a decreased re-operation rate.

Keywords: Subtrochanteric fracture; cerclage wire; union; cephalomedullary nails; hip fracture

Introduction

It is difficult to attain anatomical alignment when treating a fracture in the subtrochanteric area because of the high concentration of stress and the many factors that produce deformation at that location. Your short external hip rotators and powerful hip abductors (gluteus medius and minimus) connect to the greater trochanter. On the other hand, the iliacus and psoas hip flexors connect to the lesser trochanter, a bony protrusion at the base of the intertrochanteric ridge [3]. The proximal portion of a subtrochanteric femur fracture is in external rotation, flexion, and abduction as a result of the aforementioned muscles [1,2]. The hamstrings and hip adductors shorten and adduct the distal portion of the fracture, which causes a general deformity of the varus and anterior apex at the location of the fracture. Young patients typically suffer subtrochanteric fractures as a result of high-energy trauma, which is frequently brought on by car accidents [4]. In senior individuals, these fractures are commonly connected with falls, and sometimes occur owing to pathological fractures. Bone fragility is primarily brought on by osteoporosis, high homocysteine levels (a dangerous "natural" amino acid linked to cardiovascular disease), Paget's disease, osteomalacia, osteopetrosis, and osteogenesis imperfecta. Metabolic bone disease can lead to the development of stress fractures in the hip area. Subtrochanteric fractures account for around 4% to 19% of fractures in the upper part of the thigh bone. These fractures are characterized by abnormalities in flexion, external rotation, and abduction due to the muscle attachments in this area. For the proximal femur's compression and tension stresses to be somewhat stable and solidified, proper osteosynthesis is essential [6]. The treatment of choice is cephalomedullary nailing, which has a high success rate of up to 95%. A traction table and occasionally instruments like pins, levers, and reduction forceps are utilized in order to align these fractures [5]. But in certain types of fractures, manipulation and closed reduction don't work to get the bone in the right place, thus 7–40% of the time, doctors have to open the focus and use cerclage wire. Because it might cause damage to the periosteal vascularization and drain the fracture hematoma, several authors try to avoid using it. Open reductions or cerclage wire should not damage the periosteal vascularization, Perren asserts that biological fixation is the most effective treatment for these fractures [8].

Materials and Techniques

From January 2022 through December 2022, we analyzed every patient who had surgery at the Orthopaedic Surgery Department of Vinayaka Mission Medical College and Hospital in Karaikal, Puducherry. We compared two groups: one that had cerclage wire therapy and another that did not. Type of fracture, amount of time in the hospital, time spent operation, blood transfusions, alignment, bone union, and consequences including infection rates, non-union, and the necessity for more procedures were among the several aspects that were taken into consideration. In order for a patient to be included in the study, they needed to meet the following requirements: They were required to be at least 18 years old, have a subtrochanteric fracture, receive treatment with a cephalomedullary nail, have a minimum of a 12-month follow-up, and use or not use a cerclage wire. The following types of fractures were not eligible for inclusion: those caused by tumor processes, those linked to bisphosphonates, and those that had already been treated at another institution. The same

surgical team performed the procedure on a traction table with fluoroscopy monitoring on all patients at the same medical facility. It was common practice to repeatedly attempt closed reduction of the fracture in the beginning. When that wasn't an option, the focus shifted to carefully manipulating soft tissues to get access, then realigning the fracture directly, and finally placing cerclage wire. The wires used were always 1.5 mm in diameter. The postoperative rehabilitation program began on the second day after surgery and included progressively raising the weight on the operated leg using a walker or Canadian crutches. Based on the development of each individual case, follow-up exams were undertaken at 3, 6, and 12 months, as well as 3 and 6 weeks. The following factors were taken into consideration: sex, age, injury mechanism (high or low energy), type of Seinsheimer fracture, length of surgery, quality of reduction, tip-apex distance, hospital stay, need for blood transfusions, healing rate and duration, complications, and reoperation. Radiographs collected immediately after surgery allowed for evaluation of reduction quality and tip-apex distance. By comparing the surgically reduced femur's cervico-diaphyseal angle to that of the non-operated femur, we were able to determine the efficacy of the reduction. The angulations in the lateral and anteroposterior radiographs were also checked. The reduction was deemed adequate when the measurement revealed an anteroposterior and lateral misalignment of less than 10o in comparison to the non-operated limb. If the misalignment was detected in only one of the two projections, it was considered acceptable; if it was detected in both, it was considered unsatisfactory. Indicative of less-than-ideal reduction was a rotational misalignment more than 4 degrees. A precision level of less than 25mm was used to measure the tip-apex distance according to the approach described by Baumgaertner. By examining the subsequent radiographs, we were able to determine the consolidation rate and time, in addition to the incidence of any problems. We looked for signs of healing as part of the clinical-radiographic evaluation, like the absence of pain when applying weight to the fracture and the presence of a bone callus in three of the four femoral layers in the anteroposterior and lateral projections. Pseudarthrosis occurs when there has been no healing progress in the three months after surgery and there has been no consolidation nine months later. For the objective evaluation of function, the Harris hip score from the most recent office follow-up was used. The patients were divided into two groups after each variable's data were examined: Group A had access to cerclage wire, while Group B did not (Figure 1, 2).

Figure 1: Proximal Femoral Nail Screw

Figure 2: Proximal Femoral Nail System

Statistical analysis

In order to summarize the categorical variables, percentages and frequencies were used. The chi-square or Fisher test was used to examine the relationship between the categorical variables when the assumptions were not met. The mean and standard deviation were used to summarize the continuous variables unless there were unusual values. Based on the distribution, the median and range or interquartile range were used in these instances. The groups were compared using the Wilcoxon test for these factors. Based on a p-value less than 0.05, which indicates statistical significance, the findings were drawn from the study that was done using the R software.

Results

Out of the 75 patients evaluated, 17 were excluded for various reasons. Nine patients were excluded because they had received treatment at a different medical center when they were referred. The following reasons were given for the exclusion of three individuals: fractures induced by tumor processes, three patients whose bisphosphonate usage resulted in fractures, and two patients who failed to complete the minimum follow-up criteria. 60.3% of the 58 patients with subtrochanteric fractures were female, with only 35 being female. At 68.34 ± 22.06 years, the average age was recorded. In 39 instances (67.2%), the damage was caused by insufficient energy, while in 19 cases (32.8%), it was caused by high energy. After subtype 2A (3% of instances), subtype 3B (7% of cases), type 4 (9% of cases), subtype 2C (7% of cases), and subtype 3A (36% of cases), the most prevalent fracture pattern according to the Seinsheimer classification was subtype 3A. Closed fracture reduction was performed on 65.5% of the patients, whereas open reduction was done on 34.5%. In every instance, wiring was used; eight patients got one loop and twelve got two. The fracture subtype that had the highest utilization of wiring was 3A, accounting for 52.38% of cases ($p = 0.004$) (Table 1).

Table 1. Group A & B – Pre-Op Characteristics

	Group A	**Group B**
	With cerclage wire	**No cerclage wire**
No. of patients	**24**	**36**

Male sex (%)	60	55.5
Female sex (%)	40	44.5
Age	65.3 ± 17.3	64.7 ± 23.5
Type of fracture		

The duration of the surgery was 69.19 ± 8.34 minutes. A blood transfusion was necessary for 43.1% of the patients. The patients' hospital stays ranged from 6 to 50 days, with a median of 9 days. In comparison to the group that did not get cerclage wire therapy, the one that did had shorter hospital stays, longer surgeries, and more transfusions of red blood cells after surgery (Table 2).

Table 2. The Outcomes From the Groups Using and Not Using Cerclage Wire Compared.

	Group A (with cerclage wire)	Group B (no cerclage wire)	p
No. of patients	24	36	
Hospital stay (days) (median IQR)	8 (3-18)	11 (3-22)	0.81
Surgical time (min) (mean SD)	77.4 ± 7.5	63.2 ± 4.6	<0.0001
Transfusions (n %)	15- 62.5	9 – 23	0.58
Reduction (n %) Good Acceptable Fair	 24 -100 0 0	 33 - 86.8 3 - 7.8 2 - 5.3	0.46
TAD (mm) (mean SD)	14.3 ±3.2	15.3 ± 3.9	0.23
Misalignment (n %)	---	6– 16.66	0.01
Consolidation (n %)	23 – 95.8	34 – 94.44	0.9
Consolidation time (weeks)	14.5	14.3	0.21
HHS (mean SD)	89.7 ± 2.65	86.4 ± 3.9	0.11

The abbreviations IQR, SD, HHS, and TAD stand for interquartile range, standard deviation, Hip Harris Score, and tip-apex distance, respectively.

Out of the patients who were not treated with wire, five individuals (8.6%) experienced misalignment. One patient had misalignment only in the anteroposterior view, measuring 12 degrees. A other patient had a 12 degree anteroposterior misalignment and a 10 degree lateral misalignment. Just in the lateral view did two patients exhibit misalignment ranging from ten to fifteen degrees. A rotational variation of 15° was observed in the remaining part. The series' tip-apex distance was measured at 15.41 3.74 mm. According to Table 2, consolidation occurred in 91.4% of cases (n = 53) and lasted an average of 15.9 weeks (range 8-32). At the conclusion of the follow-up period, the Harris hip score, which ranged from 80 to 94, was 88.60 3.47. From fifteen to forty months, researchers followed up with study participants. The average length was thirty months. Table 2 provides a comprehensive comparison of the outcomes of the groups with and without the cerclage wire (Table 3).

Table 3. Discussion of Complications in the Two Settings, Comparatively.

	Group A (with cerclage wire) (n = 20)	**Group B (no cerclage wire) (n = 38)**	**p**
Complications (n%)	3 - 15	6 – 18.4	0.99
Aseptic pseudarthrosis (n %)	1 – 5	1 – 2.6	0.99
Infected pseudarthrosis (n%)	1 - 5	2 – 5.7	0.99
Infection (n%)	1 - 5	-	0.34
Rotation defect	-	1 – 2.6	0.78
Cephalic screw removal (n %)	-	2 – 5.3	0.54
Reoperations (n %)	3 - 15	6 – 15.8	0.99

Reoperations were necessary for nine cases, which accounted for 15.5% of the total difficulties. Five patients developed pseudarthrosis, which accounted for 8.6% of the total cases. Three individuals were infected and underwent a two-stage prosthetic revision procedure, which resulted in a positive outcome. The incidence of aseptic pseudarthrosis was 3.4%, or two instances. It was necessary to replace a nail in one instance due to a fracture. In the second instance, a bone transplant was necessary in addition to nail replacement. After 22 weeks, the fracture began to mend, and after 26 weeks, it cemented. A surgical debridement was performed 20 days after the operation to treat an acute infection, and the patient was then prescribed antibiotics. An additional patient needed a second operation 48 hours later due to a 15º internal rotation defect in the treated limb. Two of the five patients who had pain on the outside of their thighs reported that the cephalic screw had protruded. After the fractures had healed completely, the screws were later taken out. The prevalence of postoperative misalignment varied significantly between the groups, despite the fact that there were no significant differences in morbidity or reoperation rates (Figure 3).

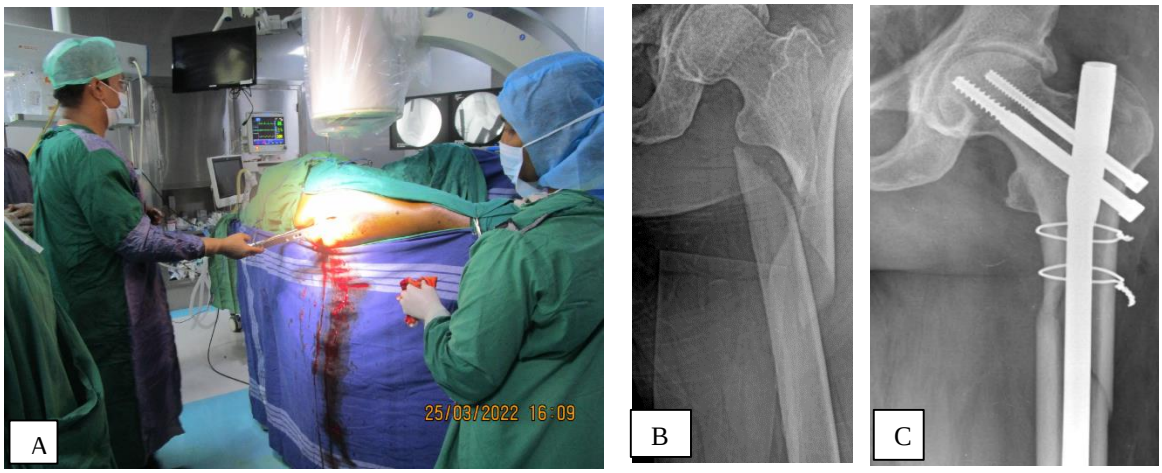

Figure 3: A)Showing intra operative image during the procedure, B) Showing preoperative radiography of the same patient, C) Showing post operative radiology where cephalomedullary nailing with cerclage wiring was done

Discussion

The research found that using cerclage wire drastically reduced the frequency of misalignment and increased the reduction quality. The introduction of cerclage wire did, however, lengthen the surgical procedure. In this study, 60% of patients who experienced misalignment had to undergo a second operation, emphasizing the importance of achieving proper alignment [9]. The large discrepancy in misalignment can be attributed to two specific factors. Loops aid in achieving and maintaining proper reduction, making it easier to position the implant correctly at the desired entry point. In addition to assisting with fracture reduction, Finsen found that cerclage wire increased the construct's overall stability and strength, which decreased the likelihood of implant fatigue. We used the maximum number of loops for the 3A fracture subtype according to the Seinsheimer classification [10]. After the fracture has been reduced on the traction table, it may seem straight when looked at from the front, but when seen from the side, there could be a big misalignment. Sometimes, even with the nail itself, you can't get the displacement down to a manageable level. It calls for lowering the emphasis and opening it up using wire loops. The insertion of wire loops into the skin has recently gained a lot of popularity due to the excellent outcomes it has produced [11]. On the other hand, you may not always have access to the exact tools needed for this technique. There was no discernible uptick in problems when the wire loops in this trial were implanted using conventional techniques, taking special care around delicate tissues. Results were similar to those seen with percutaneous insertion [7]. Nevertheless, it should be mentioned that this research does have some limitations. It is retrospective in nature and had a small patient population, which limited the statistical analysis that could be performed [12]. A type 2 error may also have occurred because several of the examined factors were not statistically significant due to the small number of reported problems. Although there were different numbers of patients in each group, we were able to compare them thoroughly since their preoperative features were similarly distributed [13]. Some of the study's merits include thorough postoperative assessments and the fact that all treatments took place at the same facility with the same surgical team using the same procedure. Proper follow-up was also an important component [14,15].

Conclusions

When cephalomedullary nails and cerclage wire were used to treat subtrochanteric fractures, the procedure took longer but resulted in better reduction quality and much less displacement. The utilization of it was more prevalent in fractures of typology 3A. The utilization of this technique did not have a substantial impact on the rates of complications, at least based on the data from this study. We require meticulously planned research with a greater degree of evidence and a larger sample size in order to ascertain the external validity of our findings.

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