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RESULTS OF MINI OPEN INTRAMEDULLAR NAILING IN LATERAL POSITION FOR ACUTE FEMUR SHAFT FRACTURE: REDUCTION WITHOUT FRACTURE TABLE THROUGH A SMALL INCISION

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ABSTRACT

Background: Intramedullary nailing is the most popular procedure for treating femur shaft fractures while the patient is supine on a fracture table. This procedure carries a risk of compartment syndrome and pudendal nerve palsy. In this work, we describe a modified surgical procedure for this kind of fracture in the lateral decubitus position that involves reduction through a tiny incision at fracture site.

Methods: from June 2019 to June 2021, 25 patients with acute femoral shaft fractures who were treated using this technique and had at least one year of postoperative follow-up and were included in the study. An incision is made at the fracture site using a minimally invasive surgical method, and the fracture is reduced in absence of fracture table with one finger or a bone hook in the lateral decubitus position.

Results: all twenty-five fractures healed in an average of 20 weeks (range, 16–24 weeks). For this treatment, the average operating duration was 73 minutes, average c-arm shoot was 32 shoots,

Conclusion: This technique has the benefits of being quicker to perform, not requiring a traction table, having minimal blood loss, and being particularly effective for patients who have suffered multiple traumas.

Key words: femur shaft fracture, mini-open, lateral decubitus position, interlocking nail.

INTRODUCTION

Adults with femur shaft fractures are best treated with closed intramedullary nailing[1-12,24]. The femur was biologically fixed by keeping the fracture hematoma and surrounding soft tissue, both of which are essential for proper fracture healing, which is the key factor contributing to these remarkable results.[13,14]

In fracture reduction using closed femoral nailing, a fracture table with continuing traction are frequently necessary. When using a fracture table, this approach is frequently linked to a number of problems, including compartment syndrome in the healthy limb[15] and peroneal nerve palsy[9,16]. The surgery was successfully carried out by Karpos et al.[20], Sirkin et al.[21], and Wolinsky et al[12,]. without the use of a fracture table or distractors. Eliminating the fracture table can lessen the requirement for intraoperative patient transport and manipulation in polytrauma patients. This may shorten the overall length of the procedure and make the patients safer[17,18].

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With the patient on a radiolucent table, closed reduction of the fractured femur can be accomplished either manually or with the aid of an external distracter[17,19]. These techniques have a steep learning curve and are technically challenging. Inexperienced surgeons run the risk of making the procedure take longer than necessary. The open intramedullary approach has advantages over the closed nailing technique, including excellent reduction, quick operating periods, and ease of learning[22,23], However, it can also lead to cosmetic problems and is linked to complications like a high chance of infection and a higher incidence of union delay.[8,13,14]

We discuss our experience with a mini-open intramedullary nailing approach to easily reduce and treat acute femoral shaft fractures. Our theory was that a limited amount of soft tissue dissection in a femur shaft fracture treated using a mini open approach at the fracture site would not have an impact on the clinical outcome and would shorten the surgical procedure.

METHODS

From June 2019 to June 2021, we conducted 25 patients who had acute shaft of femur fractures underwent mini-open intramedullary nailing procedures. In this study, patients who had been followed up on for more than a year were included.

Inclusion criteria:

patients with acute femoral shaft fractures who are older than 18 years.

Exclusion criteria: The following fracture types were excluded: pathological fractures, open fractures (Gustilo type 2 and 3), extremely unstable fracture comminutions (Winquist grade IV), old fracture non-union, as well as delayed union., as were pre-existing stiffness, deformity, and congenital malformations of the afflicted limb.

Each fracture in this study group was stabilized within 24 hours when it was medically possible. Preoperative skeletal traction was carried out for surgeries that were postponed for longer than this time frame.

The mechanism of the injury, any accompanying injuries, any procedures carried out under the same anesthesia, the length of the operation, the anticipated amount of blood loss, and the functional outcomes were all obtained by reviewing the medical records.

Preoperative radiographs were evaluated to determine the fracture position, patterns, and amount of comminution.

To assess the effectiveness of reduction and the progression of fracture healing, the preoperative x-rays were analyzed.

An angular deformity of exceeding 5 degrees or a difference in leg length of more than 2 cm were both considered malunions.

Surgical techniques

The patient is positioned on the operating table in the lateral decubitus position while under general or spinal anesthesia (Fig. 1). A 7-8 cm skin incision is made along the femoral shaft starting at the proximal end of the greater trochanter. In accordance with its fibers, the gluteus maximus fascia was cut. Piriformis fossa was felt. The tip of the guide wire is introduced into the proximal canal till it is directly over the fracture. The proximal canal was widened with a 9-mm reamer to make space for the guide rod.

To make room for the insertion of a finger or two, a 2.5 cm long lateral, longitudinally skin incision is made. The ideal location for the incision is determined by bending the broken femur or by utilizing an image intensifier. After the incision has been expanded further into fascia, the opening allows for easy palpation of the proximal fragment's distal end. (Fig. 2). The fracture location is reached using these techniques without the need to extensively dissect soft tissue.

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Fig 1: patient positioned in lateral decubitus position.

Fig 2: skin incision made at fracture site

Approximately one cm before the distal tip of the proximal canal, the guide rod's tip is placed. The fracture is reduced with the finger of one hand, and the guide wire is inserted into the principal distal fragment with the other hand. In the majority of oblique fractures, this is typically simple and can be finished in a few minutes. Use a bone hook to help with reduction if the bone overrides in a transverse fracture.

Once the proper diameter and consistent reductions are attained, the entire femur is then reamed through the guide wire in 1 mm increments. It is crucial to maintain manual traction on the distal femur while reaming to enable better alignment. This action serves in deterring larger reamers from further comminution. As the femur is being reamed, palpate at fracture location to evaluate the reduction. This approach also results in the preservation of reaming material near the fracture site.

Preoperatively, measure the opposite femur to determine the nail's length. During surgery, measure the guiding rod to determine the nail's length. Manually insert the chosen nail into the canal while applying traction to the distal femur. By palpating the fracture site while rotating the limb both internally and externally, the proximal screw's stability can be evaluated. Distal locking is frequently not required for a fracture above the isthmus since stable fixation is typically attained at this point.

If stability is not adequate, distal locking must be performed. When a C-arm fluoroscope is available, bending the hip and bringing the leg off the table in a lateral position should be used to get a clear view of the distal femur. Using the image identifier as a guide, distal locking is done. If a fluoroscope is not accessible, the open approach is used to lock the distal end. Use a nail of the same length to determine where one of the distal screws is located. Make a hole in the lateral cortex along the same sagittal axis as the proximal screw using a big drill bit. Enlarge the hole until you can see the screw hole on the nail. After that, use a normal drill bit to drill through the screw hole to the far cortex. It is simple to insert the other locking screw in a similar fashion after one of the distal locking screws has been secured.

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Post-operative care

On the second postoperative day, patients were instructed to undertake CPM-assisted passive functional exercises of the injured limb. Patients who could participate in activities outside of bed were urged to do so.

one week after surgery, to gradually begin weight-bearing exercises while using a support device.

On lateral and anterior plain radiographs taken both immediately following surgery and at the most recent follow-up appointments, frontal and sagittal plane alignments were assessed.

As signs of fracture union, 3/4 cortices producing callus and receding fracture lines on radiographs were considered.

RESULTS

The current study involved 25 adults and evaluated femur shaft fractures managed with lateral mini open intramedullary nailing. All operations were completed without difficulty. There were 19 men and 6 women. The average age was 42.08 (range 22-61) years. Nine type A, 15 type B and 1 type C fractures according to AO classification.

In all 25 individuals, distal locking was successfully accomplished. The average number of c-arm shoot was 32(range 18-55) shoots. For verification of successful guide wire insertion and distal locking, radiation exposures were required. Due to the ease of inserting a guide wire with a finger through a small incision at the fracture site, there were fewer radiation exposures. Mean operation time was 73 min (range,40–120 min). In comminuted fractures, the average operating time was longer.

At the site of the incision, two patients had acquired a superficial infection that was treated with antibiotics and a regular dressing. For a period of 12 months, all patients were followed up. All fractures healed in an average of 20 weeks (range, 16–24 weeks). A reduction in limb length of 1.5 cm was detected in 1 patient. Non- weight bearing ambulation was started on 2^{nd} or 3^{rd} post operative for 21 patients and for four patients it was started within 4-10 days postoperatively.

TABLE 1: CLASSIFICATION OF FEMUR SHAFT FRACTURE

AO TYPE	No. OF PATIENTS	PERCENTAGE
TYPE A	9	36
TYPE B	15	60
TYPE C	1	4
TOTAL	25	

TABLE 2 : TIMING OF SURGICAL STABILIZATION

TIME AFTER INJURY	No. OF PATIENTS	PERCENTAGE
<12 Hr	6	24
12-24 Hr	10	40
Within 5 days	8	32
Within 8 days	1	4

TABLE 3: MECHANISM OF INJURY

MECHANISM OF INJURY	No. OF PATIENTS	PERCENTAGE
MOTOR CYCLE ACCIDENT	18	72
PEDESTRIAN STRUCK BY A	3	12

VEHICLE		
FALL FROM HEIGHT	3	12
OTHERS	1	4

TABLE 4: OPERATIVE TIME

OPERATIVE TIME(MIN)	NO. OF PATIENTS	PERCENTAGE
40-69	12	48
70-99	11	44
100-130	2	8
TOTAL	25	

TABLE 5: COMPLICATIONS

COMPLICATION	NO. OF PATIENTS	PERCENTAGE
SUPERFICIAL INFECTION	2	8
MALUNION	-	-
NON-UNION	-	-
LIMB SHORTENING	1	4

DISCUSSION

It is possible to keep the original hematoma by using closed nails. A critical point to emphasize is the insertion of bone graft material at the fracture site following closed reaming of the intramedullary canal[3,14]. On the other hand, removing the periosteum and gradually decreasing the blood supply to the fracture site are necessary for open reduction and internal fixation of a broken femur. This typically leads to extensive soft tissue damage, substantial blood loss, and concerns about infection or fracture non-union. Use of the open approach as a routine procedure is therefore generally not encouraged. However, other writers advise open nailing for polytrauma patients because it requires no specific tools and achieves fast stabilisation[8,22,23]. The main benefit of closed fixation over open fixation is that the soft tissue envelope can remain intact while the bone structure is restored.

Numerous studies that have been published have shown that closed femoral nailing produces improved outcomes, including consistent fracture healing and a reduced infection rate. Fracture tables are currently employed to achieve a closed reduction, despite the possibility of complications, and the necessity of transferring patients usually severely restricts the management of polytrauma patients. There are now methods for closed femoral nailing that do not require a fracture table.

Sirkin et al. reported a technique of manual traction with the patient on a radiolucent table[21], whereas McFerran and Johnson described the use of a femoral distracter[21]. Although the approaches were successful in producing a closed reduction, they appeared to be laborious and were not well known to most orthopaedic surgeons. These procedures may lengthen the operation and increase the patient's risk when dealing with polytrauma patients when quick fixation is necessary. The early repair of lengthy bone fractures boosted a patient with multiple injuries' likelihood of surviving, according to several studies conducted in the 1980s[25].

Knowing the advantages, drawbacks, and potential risks of various femoral nailing techniques, we choose to employ the one described in this article, particularly for seriously injured patients with numerous injuries. Our main finding is that the mini-open approach did not impair fracture healing. We showed a

similar union rate (100%) to that of closed procedures. Wolinsky et al. reported a union rate of 93.6% after first nailing and an overall union rate of 98.9% following an additional procedure in their most recent and largest research of closed, reamed femoral nailing[12]. Additionally, just two superficial infections were found in our investigation, and the minimal blood loss connected with this method was well tolerated.

The usage of our novel method reduces the drawbacks of open reduction. It's crucial to reduce the fracture with just 1 or 2 fingers using a tiny incision. In our experience, an incision as small as 2.5 cm is frequently sufficient for this purpose because an exact reduction is not necessary for the passage of the guide rod into the distal canal. With a larger reamer, an acceptable reduction is typically attained later. In this approach, the soft tissues around the fracture site are preserved, and the reamed bone pieces collected in the reamers' flutes also remain there to serve as bone graft material.

In multiple trauma patients, early surgical fixation might potentially save lives and shorten intensive care unit stays by reducing pulmonary complications, death, and multiple organ failure[26,27]. Acute nailing, which is more critical with this method, also aids in preventing soft tissue stiffness that makes reduction by fingers challenging. The majority of our patients had surgery within 24 hours after being admitted. While they awaited fracture repair, the other patients were all placed in skeletal traction. Despite successfully treating 1 patient 8 days after the accident without the need for an extended approach, we do not advise using our procedure in fractures with a significant amount of time before fixation.

The technique has the significant benefit of requiring short time to finish the entire procedure, which is essential for emergency surgery. Our method takes an hour to complete in skilled hands. In a biomechanical and clinical investigation, Hajek et al. examined the use of 1 or 2 distal screws in the treatment of femoral shaft fractures. The authors came to the conclusion that one distal screw was sufficient for distal fixation[28]. In our analysis, we did not find any distal screw fractures or nail fractures through screw holes.

The mini-open intramedullary nailing approach also has the benefit of requiring a C-arm fluoroscope much less frequently. Contrarily, practically all of the current closed femoral nailing instrumentation solutions demand the utilisation of intraoperative radiography. The rising use of fluoroscopy has sparked worries about the radiation dosage and potential negative consequences on both surgeons and patients, even if the exact danger is yet unknown[29-31].

The degree of comminution is a significant drawback of our method. Since there is no abutment of cortices at the fracture level in highly comminuted fractures (Winquist type IV), it may be challenging to manage rotational alignment and length stability. The employment of our approach is not advised in such circumstances.

Conclusion

The access to the proximal femur was improved in the lateral decubitus position, making it simple to create an entrance point for an intramedullary device and greatly reducing the problems brought on by other commonly employed methods. Normal nailing procedures involve flexing the hip, which enables the nail to be positioned posterior to the gluteus medius and minimus abductor damage. Our mini-open intramedullary nailing procedure can be just as secure and efficient as the closed technique with careful patient selection and the right surgical approach. There are many unions while there are few complications. The process is rapid, doesn't need moving the patient, and doesn't require for any specialist

equipment. Patients who need quick surgery for many injuries and whose transfer to a fracture table is inappropriate are the best candidates for this type of surgery. Patient will require only shorter hospital stay when surgery is performed in the lateral decubitus position because it reduces operative time, fluoroscopy time, and blood loss significantly. Additionally, this promotes early mobilization and weight bearing. Additionally, it enables the early resumption of activities to improve knee range of motion.

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