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Treatment of Tibial Fractures by Locked Intramedullary Nail at Al-Nasiryah Teaching Hospital

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Abstract

Background: Intramedullary nailing is an efficacious method for the treatment of diaphyseal tibial fractures. Nonetheless, infrapatellar intramedullary nailing may readily induce angulation and rotational displacement at the fracture termini, hence elevating the risk of postoperative infection. We were shown successful reduction and stabilization with intramedullary nailing. We employed locked intramedullary nailing for the management of tibial fractures.

Aim of Study: We aim to evaluate the outcome of our strategy for managing tibial fractures through the use of a locked intramedullary nail. We also aim to assess the effectiveness of this device, making it a viable treatment option for such damage.

Methods and Result: Between January 2022 and March 2023, 50 patients were enrolled for tibial fracture fixation with locked intramedullary nailing. There were 40 males and ten females. The average age was 35 years (range: 20 to 60). The average follow-up duration was (8). We collected age, gender, fracture type, fracture features, union rate, healing duration, and complications where, in form of time from injury to surgery days, there was no appreciable statistical variation depending on gender categories.

Conclusion: The application of intramedullary nail fixation has proven to be an effective technique and is considered a viable treatment option for tibial fractures in our country. This method is associated with a high rate of union and favorable functional outcomes, with no observed functional impairments.

Keywords: Treatment of tibial fracture by locked intramedullary nail, Thi Qar

Introduction : Tibial fractures can occur in individuals of all ages, ranging from young toddlers who fall, middle-aged adults who twist their legs while skiing, individuals who sustain injuries in car accidents or falls from ladders, to elderly osteoporotic individuals who miscalculate a forceful step off the pavement or are struck by vehicles at pedestrian crossings. The severity of injuries ranges from non-displaced fractures which can be treated conservatively to complicated fractures with severe soft-tissue injuries that is treated with external fixation with plastic surgery or even amputation. (1,2).

Different trauma mechanisms can cause different types of fractures. Adopting sterile surgical procedures and antimicrobial prophylaxis allowed the advancement of surgical intervention for tibial fractures. (3)

Proximal tibial fractures are less complicated fractures that happen when the knee is hit with low-energy valgus or varus force. This causes tibial plateau fractures with joint surface depression. High-energy trauma, like a traffic accident, can also cause a proximal tibial fracture, leading to a complicated intra-articular fracture.

Low-energy rotational forces can generate tibial shaft fractures, which result in a two-part spiral fracture, also high energy direct blow to the lower leg, such as those experienced in motorcycle or vehicular collisions, can also result in tibial shaft fractures.

The typical pilon fracture in distal tibial fractures is induced by an axial stress on the foot and leg, causing the talus to blast into the tibia's distal articular surface. These fractures are commonly found following falls from heights or traffic accidents (2).

When treating tibial fractures with intramedullary nailing, the infrapatellar technique is often used with the knee flexed or hyperflexed (120–130°), and it has been shown to be effective.

However, regarding specific types of tibial fractures, such as metaphyseal fractures. The using of intraoperative closed reduction and fluoroscopic imaging, along with inadequate soft tissue conditions at the location of intramedullary nail implantation, hyperflexion may cause complications. This increases infection risk postoperatively (6).

The proximal and distal tibias mostly have cancellous bone, in which medullary cavity is large and the cortical bone is not thick. Angulation and rotational displacement at the fracture sites can result after infrapatellar intramedullary nailing, primarily due to the insufficient stability provided by the implanted intramedullary nail (4).

Materials and Methods :Between January 2022 and March 2023, 50 patients were enrolled whose locked intramedullary nailing via a suprapatellar technique used for fixation of tibial fracture. The criteria which were included: Recent tibial fractures without involvement of the articular surface; patients aged 20 to 60 years. Patients exhibiting pathological fractures, neurovascular injuries, severe Gustilo III open fractures, or any other conditions that hinder the functionality of the lower limbs were not included in the study (6).

This research has received ethical clearance from the hospital's ethics committee. The demographic information, including age, sex, and clinical information such as fracture etiology, affected sides are recorded for each patient. In summary, there were 40 males and 10 females. The mean age was 35 years (6).

All surgical procedures were performed using standardized general anesthesia. Patients with closed fractures were positioned supine on a radiolucent operating table, with the affected hip flexed at 45° and the affected knee flexed at 15°. A tourniquet was not employed in this procedure. Instead, we marked the anterior border of the tibial tubercle and the patella on the skin. We made a 3 cm midline skin incision at the superior pole of the patella, then carefully dissected the patellar tendon and suprapatellar bursa (7).

We used skin markers to determine the entry location for nail insertion, with the surgeon's index finger made contact with the anterior edge of the tibial tubercle, situated along the intercondylar fossa of the femur, as well as the joint space located posterior to the patella. Subsequently, the surgeon positioned a protective sleeve (with an inner diameter of 13.5 mm and an outer diameter of 14.5 mm) along the designated pathway, orienting its conical tip towards the anterior margin of the tibia. Following this, a 2.5 mm non-threaded guiding pin was inserted through the sleeve.

The entry point for the insertion of the guide pin was determined under C-arm fluoroscopic guidance. The identified site was located slightly medial to the lateral tibial spine, as evidenced by the anteroposterior radiograph. This position corresponded to the junction of the anterior border and the ventral cortex of the tibial plateau, as illustrated in the lateral radiograph. The guide pin was advanced roughly 5 to 6 centimeters without penetrating the posterior marginal cortex of the tibia, after which a long ball guide pin with a diameter of 3 millimeters was inserted.

We conducted a closed reduction procedure, gradually inserting a long ball guide pin through the fracture to position the distal guide pin located at the distal metaphysis of the tibia. When the pin significantly deviated from the center of the medullary cavity, as visualized under C-arm fluoroscopy, we adjusted it using a skilled manual technique. We used an entry reamer to enlarge the medullary cavity after confirming the guide pin's appropriate placement (5,7).

We measured the length of the nails using a specially developed ruler. We then performed intramedullary reaming to a depth of 1.5 mm beyond the selected diameter of the nail, followed by the implantation of the corresponding intramedullary nail. It is essential to position the proximal end of the intramedullary nail is located 1 cm inferior to the aperture on the anterior margin of the tibia, ensuring that the distal end aligns with the metaphyseal lines.

If inserting the nail by hand is hard, especially when fixing fractures in the distal tibia, hitting the nail tail may help it move to the articular surface of the distal tibia. C-arm fluoroscopy verified the positioning of the intramedullary nail and the reduction of the fracture. We employed a blocking screw to aid in reduction and correction. Finally, we detached the external connector bar and affixed the tail cap (5,7).

Results :We treated 50 cases of tibial fractures with locked intramedullary nailing, which included 40 males and 10 females with an average age of 35 years. There was no statistically significant difference between sexes regarding the duration from injury to surgery, consolidation period in weeks, removal of the locked intramedullary nail in weeks, and follow-up duration in months.

Table (1): Group of some parameters according to age

Age	Male	Female	Total	Percentage
20-30	13	2	15	30
31-40	12	3	15	30
41-50	10	3	13	26
51-60	5	2	7	14
Total	40	10	50	

Table (2): characteristics of tibial fracture

Fracture Characters		Frequency	Percentage %
Mechanism Of Injury	Motor Cycle Accident	14	28
	Falling From Height	10	20
	Sport Accident	6	12
	Passenge In Vehicles Accident	12	24
	Vehicles Hit	8	16
Site Of Injury	Left	16	32
	Right	34	68
Fracture Configuration	Oblique	16	32
	Comminuted	6	12
	Spiral	8	16
	Transverse	20	40
Total	50		

Most of the cases were due to motor cycle accident (28%), right sided injury (68%), oblique and transverse (32%), (40%), fracture disfiguration, as shown in table II.

Table (3) : Union Rate in Weeks

		Percentage %
10-12 Week	**25**	**50**
13-15 Week	**8**	**16**
16-18 Week	**5**	**10**
19-21 Week	**4**	**8**
22-24 Week	**5**	**10**
Total	**47**	**94**

Rate of union and other complications related to the bone.

		Percentage %
Union	**42**	**84**
Delayed Union	**5**	**10**
Malunion	**Shortening 1**	**2**
	Rotation Deformity 1	**2**
Nonunion	**1**	**2**

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Table (4): distribution according to complications

Complications		Frequency	Percentage %
1. Quadriceps Atrophy	Yes	18	36
	No	32	64
2. Knee Joint Pain	Yes	16	32
	No	34	68
3. Knee Range Movement	Yes	44	88
	No	6	12
4.Asymmetrical Swelling Of TheInjured	Yes	5	10
	No	45	90
5. Delayed Union	Yes	5	10
	No	45	90
6. Nonunion	Yes	1	2
	No	49	98
7. Malunion	Yes	3	6
	No	47	94
8. Infection			
Superficial	Yes	2	4
	No	1	2
Deep	Yes	1	2
	No	48	96

Discussion : Intermedullary nailing is treatment of choice for fracture of tibia, our study's participants ranged in age from 20 to 60 years. The mean age of our patients was between 30 ± 10 years. Male patients were represented in the majority of our cases (40 out of 50 patients). Our result was comparable to the study published by (Ali A Alwan AlTamimi,

Basra 2016), (Al-algawy Alaa A.H.Babylon 2010) (8,9). Our study does not exhibit any notable variations from other studies as all show that young age men had a higher prevalent fracture shaft of tibia.

Mechanism of injury: In our research , the predominant mechanism was motorcycle accidents, observed in 14 individuals 28%, followed by passengers' accident was recorded in 12 patients (24%), fall from height was recorded in 10 patients (20%) vehicles hit was recorded in 8 patients (16%) and sport accident was recorded in 6 patients (12%) this is analogous to the epidemiology research conducted by (Ali A Alwan Al-Tamimi, Basra 2016) in which the main mechanism of injury is RTA was recorded in 48 patients (64%) and (Al-algawy Alaa A.H. babylon,2010) in which the main mechanism of injury is also RTA in 32 patients (57%) .(9)

Side of fractures: Our study indicates that right-side fractures are more common in 34 patients (68%), while 16 patients (32%) experienced left-side fractures, which is comparable with the study done by (Ali A Alwan Al-Tamimi, Basra 2016) that shows that right side fracture is also the commonest in 42 patients (56%).

Fracture configuration: In our research , the majority of fractures were transverse, occurring in 20 patients (40%). Comminuted fractures were observed in 6 patients (12%), while spiral fractures were noted in 8 patients (16%). This distribution is attributable to the mechanism of injury, as most incidents resulted from motorcycle accidents. this is agreed to the research conducted by (Ali A Alwan Al-Tamimi ,Basra 2016) in which they recorded high percentage of oblique and comminuted fracture (40.5%) and (Al-algawy Alaa A.H.babylon,2010) which recorded high percentage of comminuted fracture recorded in 40 patients (71%) .

Time to union : In our research, the duration until the occurrence of union or the radiological confirmation of union was recorded as follows: 10-12 weeks in 25 patients (50%), 13-15 weeks in 8 patients (16%), 16-18 weeks in 5 patients (10%), 19-21 weeks in 4 patients (8%), and 22-24 weeks in 5 patients (10%) out of a total of 47 patients. This result is comparable to studies conducted by others (Ali A Alwan Al-Tamimi ,Basra 2016) in which TTU was 17.2 +_ 3.2 and(Al-algawy Alaa A.H.babylon,2010) in which shows percentage of (63.5%) union time among LIMN group.

Delay union: In our research , delayed union was observed in 5 patients, constituting 10% of the LIMN group. This outcome is comparable with the studies done by (Ali A Alwan Al-Tamimi, Basra 2016) in which they recorded lower percentage (5%) *9. union was recorded in 42patients (84%). malunion: in our study, shortening was recorded in 1 patient 2% while rotation was recorded in 1 patient 2%. nonunion was recorded in 1 patient 2%, there is no result about it in other study (8).

Complication: In our study, Knee range movement is complication found in LIMN group which is represented in 88% of 44 patient and this is comparable with the studies published by (Al-algawy Alaa A.H., Babylon 2010) in which the recorded knee range movement 11% of total 52 patient (*9). While (Ali A Alwan Al-Tamimi, Basra 2016) recorded in 2 patient 5% of LIMN (8). In our study Quadriceps atrophy was recorded 36% in 18 patients. There is no result about it in other studies (10).
Our study shows knee joint pain in LIMN about 32% in 16 patient and study done by (Ali A Alwan Al-Tamimi, Basra 2016) recorded knee joint pain in 16 patients of total 74 represented 40% (*8). While (Al-algawy Alaa A.H., Babylon 2010) recorded 26.7% in 15 patient post operatively (9).
In our study we have 5 person (10%) of delayed union. In two studies, we have same result with (Al-algawy Alaa A.H., Babylon 2010) and reported all of them get united at within 29 weeks (9).

Delayed union was reported 5% in 2 patients among LIMN. Application of intramedullary nail fixation was effective apparatus and this method considered as reasonable procedure of treatment in tibial fracture in our country with high rate of union, good functional outcome and there was no functional impairment. Asymmetrical swelling of the injured found only in our study recorded 5 patients represented 10%in LIMN group (10).

There is also malunion 6% in 3 patients in our study, Infection in our analysis indicates no significant difference in infection rates, with superficial infections identified in 2 patients (4%) of the LIMN group and deep infections documented in other cases 1 patient 2% of LIMN group and this comparable with other studies (Ali A Alwan Al-Tamimi, Basra 2016) recorded 2.5% in 1 patient of LIMN (8) and study done by (Al-algawy Alaa A.H., Babylon 2010) recorded 7%in 4 patients of LIMN group (9).

Conclusion : Application of intramedullary nail fixation was effective apparatus and this method considered as reasonable procedure of treatment in tibial fracture in our country with high rate of union, good functional outcome and there was no functional impairment.

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