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The Analysis of the Unstable Tibia Fracture Treatment Applying Internal Stabilization Method

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A B S T R A C T

The study included 51 patients with tibia fractures, who underwent percutaneous bone reposition and stabilization with unrimed tibial locking nail. The results obtained using this method were compared with those obtained by standard fracture treatment where flat and anatomic plates were applied (n=64). In patients who had osteosynthetic material implanted percutaneously (using unrimed tibial locking nail) there was no incidence of post surgical osteitis or any pseudarthrosis. The healing callus of the fracture was of lesser quality and spindle shaped, suggesting that fracture stabilization using this method was less efficient. In patients with fractures stabilized by the open method using flat and anatomic plates (n=64), we noticed 3.1% (n=2) cases of osteitis and 4.7% (n=3) cases of pseudarthrosis. Due to lesser incidence of postoperative osteitis, our method of choice in tibia fractures would be percutaneous stabilization with unrimed tibial locking nail. However, this treatment method has its disadvantages, too. Fracture callus is of lesser quality and it is spindle shaped. Furthermore, there are problems with adequate percutaneous reposition in some cases, as well as necessity for radiological checking.

***Key words**: fractures tibiae, tibial nail, plate, osteitis*

Introduction

The inner stabilization is most frequently used in treatment of unstable closed and open lower-extremity long bone fractures[1]. In order to stabilize these fractures well, most frequently flat and round anatomic plates are used, as well as Kuntscher nails. The principal condition in successful inner stabilization of the fracture is the absence of injured limb infection. The incidence of osteitis and pseudarthrosis seems to be higher in tibia fractures than in thigh or upper extremity fractures. These complications represent a big medical and economical problem and affect the functional status of the extremities.

The treatment of unstable fractures of hand and foot short bones with the low-profile mini-plating system can cause the formation of scars and contractions of the functionally important joints[2]. The minimum osteosynthesis of the short bones with Kirschner wires is accompanied by a minor surgical trauma and satisfactory functional results[3,4].

The external fixation is a method of choice in stabilization of unstable long bone fractures of the second and third degree[5], often with massive joint and soft tissue injuries[6,7]. The incidence of postoperative complications in long bone fractures of the lower extremities sustained in the war is higher than in peacetime fractures[5,8].

In recent years we have stabilized closed or open tibia fractures of the first degree in our patients by intramedullary unrimed tibia-locking nail. The osteosynthetic material has been implanted percutaneously and intramedullary using the appropriate technological equipment and then radiologically checked.

The study describes our clinical experiences and observations regarding the treatment of war and peacetime fractures of the same localization by external fixation and internal stabilization.

Furthermore, both advantages and disatvantages are presented, including some less popular factors in treat-

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ment of tibia fractures using percutaneous intemedullar stabilization method with unrimed tibial locking nail.

Patients and Methods

Two groups of patients with unstable tibia fractures were compared. In the first group, the fracture stabilization was performed by a standard open method using flat and anatomical plates. In the second group, the fractures of the same localization were stabilized percutaneously and intramedullary with unrimed tibial locking nail and then radiologically checked.

The first group consisted of patients with unstable closed and open tibia fractures of the first degree that were treated by customary techniques and methods in the last two years. The fracture stabilization was preformed after standard surgical incision in the fracture area and open reposition.

The surgery was performed immediately after hospitalization and preoperative and anaesthesiological preparations. In preoperative treatment some patients received antibiotics (Vancomycin, Ceftazidin or Meropenem). The indications and the antibiotic choice were determined by the surgical team.

In the choice of antibiotics, we followed our department's clinical experience regarding the most pathogenic microbial flora: Staphylococcus aureus and epidermis, Pseudomonas aeruginosa, Serratia, Klebsiella and Proteus mirabilis.

Osteosynthesis material was chosen according to fracture site. Anatomical plates were used in tibia fractures in the upper or lower third, whereas in other fracture sites flat plates were used. The patients with the fracture within the joint (knee or ankle) were not included in the study. We tried to form groups of patients with the same or similar fractures and then apply different method in their treatment. The group treated by internal osteosynthesis of tibia (with flat and anatomic plates) consisted of 64 patients. All patients were postoperatively treated by anti thrombus medications and walking therapy using a stick or walker. Majority of patients with only tibia fractures could walk on their own very soon.

After patients' release from hospital, follow up included regular radiological checking to monitor the recovery and to advise patients on how to proceed with the tibial loading. There was no significant difference between these two patient groups in the recovery speed. The patients were followed for one more year and there were no significant differences in the functional status of lower leg fractures treated either with unrimed tibial interlocking nail or with plates.

The incidence of complications, including pseudarthrosis and osteitis is described in the results.

The second group consisted of 51 patients with unstable closed and open tibia fractures of the first degree. The fracture stabilization in this group was performed using percutaneous unrimed tibial locking nail (Figure 2). In first degree open fractures the wound was surgically treated, followed by reposition and radiological checking. If the percutaneous reposition failed and there was inadmissibly large space between the bone fragments we changed the treatment method. These patients underwent a small incision of soft tissue in the fracture area and visually controlled reposition. The bone stabilization was performed using a plate or unrimed tibial locking nail. These patients were not included in the group 2. The site where the nail was inserted was typical, just above the tuberositas tibiae[9]. In order to find the exact site for bone trepanation we used radiography, whereas the length and the size of the tibial nail were determined according to standard procedure[10,11].

The fracture reposition, the insertion of the tibial nail and its fixation required appropriate equipment, traumatological experience and radiological checking.

Patients treated in this way were allowed to load the operated tibia freely very soon after the surgery. This was of great importance and benefit to the elderly patients who find it hard to use their orthopedic aids. The follow up period for our patients was one year. During this period we could observe bigger (spindle shaped) callus at the site of the bone fracture, suggesting that the fracture stabilization with unrimed tibial locking nail was not the best method of choice. Yet, in these patients there was no pseudarthrosis or osteitis.

Results

In table 1 it is evident that 95.31% (n=61) of the group 1 patients had closed tibia fractures, while 4.69% (n=3) had open fracture of the first degree. No injuries to important blood vessels were detected.

TABLE 1
NUMBER OF CLOSED AND OPEN TIBIA FRACTURES OF THE FIRST DEGREE TREATED WITH FLAT AND ANATOMICAL PLATES (GROUP 1) OR UNRIMED TIBIAL LOCKING NAIL (GROUP 2) AND COMPLICATION INCIDENCE

	Surgical method (stabilization)	Fracture type			Complications		
		Closed N (%)	Open 1st degree N (%)	Total N (%)	Injury to big blood vessels N (%)	Osteitis N (%)	Pseudarthrosis N (%)
Group 1	Internal	61 (95.31%)	3 (4.69%)	64 (100.00%)	0 (0%)	2 (3.13%)	3 (4.69%)
Group 2	Intramedullar	34 (66.67%)	17 (33.33%)	51 (100.00%)	0 (0%)	0 (0%)	0 (0%)

TABLE 2
TIBIA FRACTURE SITE IN PATIENTS TREATED WITH THE FLAT AND ANATOMICAL PLATES (GROUP1) AND IN PATIENTS WITH THE SAME FRACTURE TYPE TREATED WITH INTRAMEDULLAR STABILIZATION (GROUP 2)

	Surgical method (stabilization)	Fracture site			Total N (%)
		Upper third N (%)	Medium third N (%)	Lower third N (%)	
Group 1	Internal	9 (14.06%)	23 (35.94%)	32 (50.00%)	64 (100.00%)
Group 2	Intramedullar	6 (11.76%)	26 (50.98%)	19 (37.25%)	51 (100.00%)

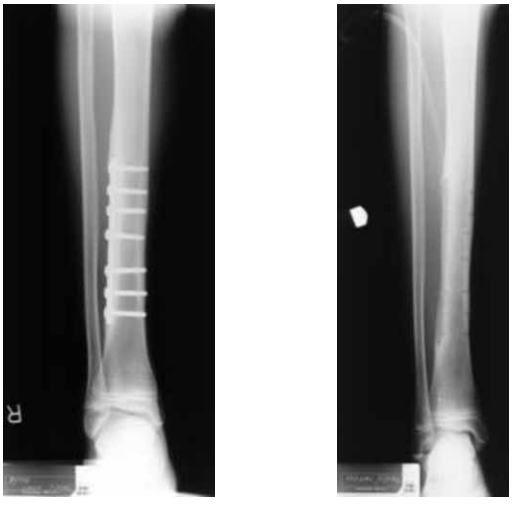

Fig 1. a) stabilization of the tibia fracture with anatomical plate, b) callus shape after the fracture treatment and removal of alenthesis.

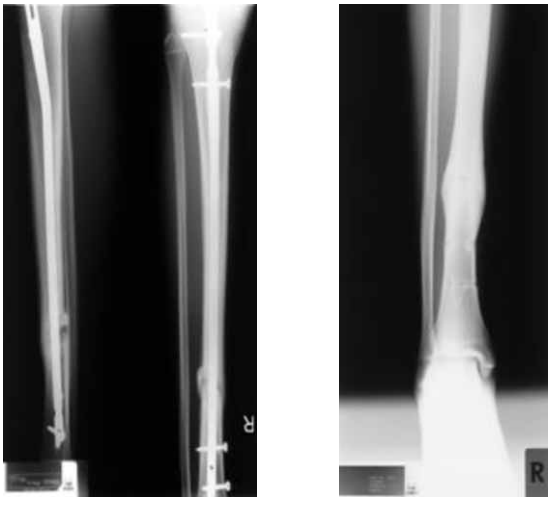

Fig 2. a) stabilization of tibia fracture with the unrimed tibial locking nail, b) spindle shaped callus after the fracture treatment and removal of osteosynthesis material.

Two patients (3.13%) had osteitis and in 3 patients (4.69%) the fracture did not heal due to pseudarthrosis. In group 2, 66.67% (n=34) of patients had closed fractures and 33.33% (n=17) had open fractures of the first degree. There were no injuries to important blood vessels and no cases of osteitis or pseudarthrosis.

Table 2 shows indication for the fracture stabilization in group 1. Anatomical plates were mostly indicated in tibia fracture of the lower third part (n=32, 50.00%). Majority of these fractures were diagonal and spiral.

In group 2 indication for unrimed tibial locking nail was the tibia fracture of the medium part (n=26, 50.98%). The fractures were mostly vertical or crenated, and rarely diagonal or spiral.

Discussion

Tibia fractures occur rather frequently in traumatological surgery, especially unstable tibia fractures. Most frequent treatment method in unstable tibia fractures of the first degree is surgical stabilization with flat and anatomical plates[1]. The method consists of incision of soft tissue in the fracture area, revision and visual fracture reposition and the stabilization with appropriate osteosynthetic material. Possible complications of surgical treatment and wound contamination in open fractures are osteitis and pseudarthrosis. In group 1, where fracture stabilization was performed using flat and anatomical plates there were 3.13% (n=2) cases of osteitis in post surgical period and 4.69% (n=3) cases of pseudarthrosis (Table 1 and 2). The incidence of these complications is significant, but acceptable since similar or even higher incidence is mentioned by some other authors[11–13]. Tibia fracture stabilization with anatomical plates was performed mostly in spiral and diagonal fractures of the lower third (Table 2, n=32,50%). The outgrowing quality of the fracture and the shape of callus are shown in Figure 1a and b.

In the last two years, besides the mentioned method of internal stabilization with the plates, we have started with the tibial fracture stabilization using unrimed tibial locking nail. In group 2 we had no cases of osteitis and pseudarthrosis in the follow up period (Table 1 and 2) and the fracture healed creating spindle shaped callus (Figure 2a and b). Most fractures treated with this method occurred on the medium part of tibia (Table 2, n=26,51%).

The spindle shaped callus suggests that fracture treatment with unrimed tibial locking nail is of lesser stabilization quality. We prefer percutaneous fracture

stabilization with intramedullar tibial nail due to lesser incidence of postoperative osteitis in comparison to the standard open method and visual fracture reposition. This method is extremely efficient in vertical and crenated fractures of the medium third part of the tibia, since the percutaneous fracture reposition with radiological checking is done routinely.

We would like to point out that there are some difficulties in percutaneous fracture reposition, especially in preserving continuity of calf bone and in spiral fractures or if there are small fragments in the fracture hole. In the absence of anatomical fracture repositioning and less adequate positioning of unrimed tibial locking nail, the fracture would be less stable and spindle shaped callus would be of lesser quality. The treatment method by unrimed tibial locking nail is not very popular among surgeons because the reposition is not always successful, lasts long because of radiological checking and it requires good training. Therefore we have used unrimed tibial locking nail in patients in group 2 only where percutaneous fracture reposition was successful.

The problem with long lasting radiological checking and difficult repositioning could be partially solved by smaller incision and minor injury to the soft tissue at the fracture site and visually controlled repositioning.

Our clinical experience from the war period shows that the incidence of complications in treatment of long extremity bones, such as osteitis and pseudarthrosis (8.3% and 3.7% respectively) is much higher. We can conclude that the incidence of complications after surgery depends on wound contamination in open fractures as well as on trauma severity[5,14,15]. The results of this study show that postoperative complications, like osteitis, also depend on selection of surgical treatment method.

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ANALIZA NESTABILNIH LOMOVA GOLJENIČNE KOSTI METODOM UNUTARNJE STABILIZACIJE

SAŽETAK

Analizirali smo 51 bolesnika s lomom goljenične kosti, koji su bili podvrgnuti perkutanoj repoziciji i stabilizaciji neborajućim tibijalnim čavlom. Rezultate liječenja usporedili smo s ishodom standardnog liječenja lomova korištenjem ravnih i anatomskih ploča na uzorku 64 bolesnika. U bolesnika liječenih perkutanom metodom osteosinteze nisu zabilježeni slučajevi osteitisa i pseudartroze. S druge strane, u bolesnika koji su liječeni otvorenom metodom, uz korištenje ravnih i anatomskih ploča (n=64), u 3.1% (n=2) bolesnika javio se osteitis i u 4,7% (n=3) pseudartroza. Zbog manje incidencije osteitisa, naša je metoda izbora u liječenju lomova goljenične kosti perkutana stabilizacija neborajućim tibijalnim čavlom. S druge strane, navedena metoda ima i nedostataka. Koštani kalus je slabije kvalitete i cilindričnog je oblika. Također, ponekad nije moguća egzaktna repozicija i nužno je intraoperacijsko radiološko praćenje.