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Conventional Surgery or Minimally Invasive Osteosynthesis for the Diaphyseal Fractures of the Tibia

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Abstract

Introduction. Tibial fractures are common injuries. Minimally invasive osteosynthesis, with conventional percutaneous plate, has been described as a technique that seeks to preserve soft tissue viability as much as possible. Method. A prospective, longitudinal, coasi-experimental study is carried out on surgical treatment of tibial fractures, using theoretical and empirical research methods. Results. The largest number of patients belong to the male sex (n=89), adults between 40 and 59 years old, with fractures of the middle third of the tibia, mainly short oblique line and with average times for the intervention in the conventional approach group is of 2.89 days, average surgical time of 73.8 minutes and 8.89 days of stay, with significant differences compared to the MIPO group where the average time for the intervention is 3.10 days, average surgical time of 38.2 minutes and 3.36 days of stay. The group treated with MIPO shows earlier consolidation (1.5 weeks) Conclusions. Minimally invasive osteosynthesis has advantages regarding the reduction of surgical times, complications and consolidation.

Keywords: Tibial fractures; minimally invasive osteosynthesis; MIPO

Introduction

Tibial fractures are common injuries affecting all age groups. In the treatment of these, open reduction and rigid osteosynthesis with conventional AO blades have been used for a long time with good results [1]. Open reduction and traditional osteosynthesis with AO blade and screws for diaphyseal fractures of the tibia can cause additional damage to the soft tissues, with complications such as suture dehiscence, material exposure, infection and non-union. External fixation of the tibia is used in the initial management when there is severe soft tissue damage, massive edema, or if the general condition of the patient is compromised; when external fixation is used as a definitive method of treatment, it can present complications such as infection in the nail tract, angular deformities and problems in consolidation [2].

Minimally invasive osteosynthesis, with conventional percutaneous plate, has been described as a technique that seeks to preserve soft tissue viability to the maximum, while simultaneously offering the advantages of stable fixation. The percutaneous insertion of the implant preserves the periosteum and vascular integrity, reducing the incidence of complications [2,3]. The advantages of the technique are well known, including preservation of the osteogenic potential of the fracture hematoma, being biologically friendly, and the least surgical trauma to the surrounding soft tissues, which is why it is recommended for fractures and should be recommended among orthopedic surgeons [4]. The study aims to provide partial results on the study of our service on treatment variants for tibial fractures.

Method

A prospective, longitudinal, co-experimental study is carried out on surgical treatment of tibial fractures, in general hospitals in the province of Villa Clara, in the period between January 2018 and December 2021.

Theoretical and empirical research methods are used. The sample was taken at random, from a universe made up of all the tibial fractures operated on in the general hospitals of the province, two groups were formed, one where the traditional diaphyseal surgery techniques of the tibia are used and another group where minimal surgery is used. invasive with AO plate. To avoid bias in the investigation, all cases were treated by groups of selected surgeons, made up of professors from the group of each service, with specific guidelines. A survey model was made where the study variables are poured.

Inclusion criteria

- Diaphyseal fractures of the tibia.

- Fractures treated with AO plates and screws.

- Grade 1 open fractures of Gustillo- Anderson.

Exclusion criteria

- Patients who abandon follow-up in our consultations.

For the processing and analysis of the information, descriptive statistics with absolute and relative frequency distribution and measures of central tendency such as mean, standard deviation, mode, ratio and percentage analysis were used, supported by the Excel computer program of the Office 2010 package. for Windows.

Results

The majority of patients treated with osteosynthesis for tibial fractures belong to the male sex (n=89), according to age, patients between 40 and 59 years old predominate, with a greater number between 50 and 59 years old, however adults older than 60 years are less affected in the series (Table 1).

Table 1: Distribution of patients treated with osteosynthesis for tibial fractures according to age and sex.

Age (year)	Sex				Total
	Male		Female		
	Group 1	Group 2	Group 1	Group 2	
18-29	10	6	1	-	17
30-39	9	7	3	2	21
40-49	12	5	2	3	22
50-59	24	4	4	3	35
60-69	4	2	1	1	8
Over 70	3	3	1	1	8
Total	62	27	12	10	111

Source: Database.

Table 2 shows the distribution of patients with tibial fractures treated by osteosynthesis according to their location and the type of osteosynthesis performed. It is observed that there is a significant number of patients who suffer fractures of the middle third of the tibia n=59, which represents 53.1%. Conduct by conventional osteosynthesis predominates. As can be seen in Table 3, the average times to perform the surgical intervention are very similar even if different types of osteosynthesis are used, however, the surgical time decreases by almost half when minimally invasive surgery is used, the same thing happens in the average length of hospital stay.

Table 2: Distribution of patients with tibial fractures treated by osteosynthesis according to their location and the type of osteosynthesis performed.

Fracture's location	Type of osteosynthesis		Total n (%)
	Group 1 Conventional surgery	Group 2 Minimally invasive osteosynthesis MIPO	
Proximal part	14	9	23 (20,7)
Midway part	42	17	59 (53,1)
Distal part	18	11	29 (26,2)
Total	74	37	111 (100)

Source: Database.

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The fundamental complications are observed in Table 4, where the relationship between the type of fracture according to its communication with the outside and the type of osteosynthesis can be seen, it can be seen that 12.2% of the patients operated on conventionally suffer some type of of complication, pseudoarthrosis (n=5) is the most common, in patients operated by minimally invasive only 2.7% of complications were presented, expressed as local sepsis. It is important to say that in the entire sample no complications were found related to the implant - such as loosening or breakage - or to the surgical technique. The average of consolidation in weeks is 17.1 weeks in group 1 and 15.6 weeks in group 2, it is significant as there is a decrease of 1.5 weeks compared to the conventional surgery group.

Table 3: Relationship between the type of fracture and the average times in osteosynthesis.

Type of fracture	Group 1 Conventional surgery			Group 2 Minimally invasive osteosynthesis (MIPO)		
	Days to operate	Surgical time in minutes	Hospital stay	Days to operate	Surgical time in minutes	Hospital stay
Short oblique fracture corta	3,23	71	6,92	3,19	35	3,02
Long oblique fracture	3,25	74	7,87	3,28	37	3,21
Cross fracture	1,42	68	7,50	2,36	33	3,15
Comminuted fracture	3,28	79	15,02	3,35	42	3,72
Butterfly wing spiral fracture	4,31	77	7,16	3,34	44	3,68
Total	2,89	73,8	8,89	3,10	38,2	3,36

Source: Database

Table 4: Relationship between the type of fracture according to its communication with the outside and the type of osteosynthesis.

Type of fracture	Complications					
	Group 1 Conventional surgery			Group 2 Minimally invasive osteosynthesis (MIPO)		
	Sepsis	Retardo consolidación	Pseudoartrosis	Sepsis	Retardo consolidación	Pseudoartrosis
Closed fracture	2	1	3	1	-	-
Open fracture	2	1	2	-	-	-
Total	4	2	5	1	-	-

Consolidation average in weeks Group 1- 17.1 weeks.

Average consolidation in weeks Group 2. 15.6 weeks.

Source: Database.

Discussion

The tibia is a bone that has a precarious vascularity, mainly in the middle third of its diaphysis and towards the distal area. These conditions are the main cause of a high rate of pseudoarthrosis, therefore, the research and development of an osteosynthesis system that preserves vascularity has been one of the objectives of orthopedic science. In fractures of the tibia, this type of implant is indicated in injuries that occur in any area of the bone that ranges from the proximal end, diaphysis and distal end. The indications are the same as for traditional osteosynthesis with open reduction and wide approaches [3,5]. However, one of the important differences is that minimally invasive plate osteosynthesis (MIPO) does not have as its primary objective the anatomical or exact reduction, but only the correct alignment of the fragments in the longitudinal axis, avoiding the varus, valgus, ante or recurvatum [6]. Akram et al. [7] present 60 patients, 80% of them men (n=48) with a mean age of 43 years. The results of this study are similar.

In a review of 148 tibial shaft fractures, closed (94 cases) and open (54 cases). A predominance of spiral fractures (26%) was confirmed, followed by transverse (22%) and short oblique (22%), being the most frequent location at the level of the distal third of the diaphysis (48%) [8]. Fractures of the proximal tibia are serious injuries and present a challenge for treatment, because they result in high-energy injuries, commonly associated with other injuries and frequent complications [9].

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Currently, the surgical treatment of diaphyseal fractures of the distal tibia is controversial due to the multiple osteosynthesistechniques and materials. The minimally invasive percutaneous techniques (MIPO) allow us to preserve the periosteal circulation, a crucial point in the natural processes of patient convalescence [3,5,10,11]. The correct indication and application of the technique has significantly reduced the complication rate of traditional open plate surgery [12]. Hernández Olivera estimated an average surgical time, most frequently between 1 and 2 hours in 109 cases, greater than 2 hours in 56 cases, and less than one hour in only 34 cases [13]. In Argentina, Niño Gómez D et al. [14] analyzed 30 fractures operated on with the MIPPO technique between October 1999 and February 2004 at the Dupuytren Institute. Using various types of implants, the authors compared the type and time of consolidation and the results of studies carried out in the same center on surgically treated tibial fractures. They refer to an average consolidation time of 17.5 weeks. Five fractures healed primary and the rest secondary. Those treated with DCP plate with antero-internal approach consolidated in 18.5 weeks [14].

For Gracia Rodríguez I et al [8] in Spain, using conservative methods, the mean consolidation period was 15 weeks; consolidation was early in 36 cases (24%), normal in 88 (59%) and delayed in 24 (16%), observing the presence of pseudoarthrosis in 10 patients (7%). However, for Akram W, Kumar Mahto A, Alam M [7] using minimal invasion, the consolidation period was an average of 16 weeks (range between 12 and 20 weeks) except for two cases with delayed consolidation. The same as for Quintero Laverde and Delgado Nieto who report that all the patients included in their study consolidated with the intervention described between 10 and 20 weeks, and with an average of 12.2 weeks [11]. In his series Akran had five superficial infections that were treated with oral antibiotics [7]. Hernández Ortega in Mexico reports in his study that out of a total of 40 patients, who were treated surgically with DCP, complications arose in a group of them, delayed consolidation was observed in 8 (20%), septic pseudoarthrosis in 2 (5%), surgical wound infection in 2 (5%). Long bone fractures are common, while tibial fractures have a high incidence. Not only is it common, but it is often difficult to treat. Its subcutaneous location causes complications such as pseudarthrosis, delayed consolidation and defective consolidation [16].

Conclusion

The authors consider that minimally invasive percutaneous conventional AO plate osteosynthesis is an effective technique that minimizes soft tissue damage, preserves cortical vascularization, and allows consolidation with the benefits of stable fixation. The surgical technique requires correct alignment of the axes, in addition to functional postoperative management, which allows prompt recovery of the range of motion and early reintegration of the patient into their usual activities. There is an evident decrease in surgical times and complications.

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