

Characteristics of Plate and Screw Fixation in Tibial Shaft Fracture at Sanjiwani General Hospital Gianyar in 2021: A Retrospective Descriptive Study

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ABSTRACT

Tibial shaft fracture is the most common fracture condition since the position of the tibia bone is close to the subcutaneous tissue. The incidence of tibial shaft fractures is 16.9/100,000 per year, with males between 10-20 years of age having the highest incidence. The operative procedure for it is closed intramedullary nailing as the gold standard in this case, and plate fixation as an alternative procedure. This study aims to determine the characteristics and complications of the ORIF P/S procedure, considering that the gold standard, in this case, is the intramedullary nail. This research is a descriptive-retrospective study. The sample of this study was obtained from secondary data from medical records of patients with tibial shaft fractures in adults at Sanjiwani Gianyar Hospital from January 2021-December 2021. Data collection was taken using the Total Sampling method. The research variables were age, gender, fracture type, fracture location, surgery method, and complications. The results showed 16 patients with tibial shaft fractures in adults. Males were the most common sex, with a percentage of 68%; the highest age was in the 18-59 years old category, with a rate of 69%, and the most common type of fracture was closed fracture, with a percentage of 56%. Most fracture locations are on the right side, with a rate of 62.2%. All surgery used the ORIF P/S method with a percentage of 100%. Complications obtained were infection, with a percentage of 6.2%, and delayed union, with a rate of 6.2%.

Keywords: characteristics; complications; fracture; tibial shaft

INTRODUCTION

Tibial shaft fracture is the most common long bone fracture since the position of the tibia bone is close to the subcutaneous tissue and is more prone to open fractures than other long bones.[1]

The incidence of tibial shaft fractures is 16.9/100,000/year. Men have the highest incidences of 21.5/100,000/year, with the highest frequency between the ages of 10 and 20 years old, while women have a frequency of 12.3/100,000/year and have the highest frequency between the ages of 30 and 40 years old. Most tibial shaft fractures occur during walking, indoor activities, and sports. The distribution among sex shows that males show a higher frequency of fractures when participating in sports activities and walking. Women led the highest frequency of fractures while walking and during indoor activities.[2]

The mechanism of injury from this fracture is low-impact or high-impact trauma. Indirect injuries are usually the result of low-impact means with spiral configurations or oblique fractures, and one of the bone fragments can penetrate the skin from the inside. A direct injury can crush the skin over the fracture site, which is usually the case with high-impact injuries and usually occurs in motorcycle accidents.[3]

Treatment of tibial shaft fractures depends on the soft tissue's state, the bone injury's severity, fracture stability, degree of contamination, and other factors originating from the patient. The purpose of management of this fracture is to reduce soft tissue damage and maintain the skin covering tissue, to prevent at least recognize compartment syndrome, to get and hold re-alignment fracture, to begin weight-bearing earlier, and to start joint motion as soon as possible.[1,4]

Tibial shaft fracture therapy can be done operatively or non-operatively. The non-operative procedure is a cast, especially for displaced fractures or minimum displaced, and as an alternative, it can use a Sarmiento cast. The possible surgical procedures include closed intramedullary nailing, plate fixation, and external fixation. The closed intramedullary nailing method is preferable in most cases of tibial shaft fracture. For diaphyseal fractures, the union can be achieved in nearly 95% of cases. This method is technically quite difficult for metaphyseal fractures close to the ends of the bone, but it has evolved and is the best way to treat tibial shaft fractures. Plate fixation can also be used for metaphyseal fractures but is unsuitable for nailing.

The disadvantage of plate fixation is that it exposes the fracture site and thus strips the soft tissue around the fracture, which can increase the risk of infection, and the *delayed union* is unavoidable.[1] Therefore, researchers are interested in understanding the complications of the ORIF P/S procedure performed at Sanjiwani Hospital, considering that the gold standard for tibial shaft fractures is an intramedullary nail.

METHOD

This study uses a descriptive-retrospective method design by identifying data on complications in patients with open tibial shaft fractures and closed tibial shaft fractures by ORIF P/S during intra and post-operative times at the Sanjiwani Hospital in the period January 2021 – December 2021. The sample was obtained by total sampling from secondary data obtained from medical records. The number of samples in this study was 16 patients. The inclusion criteria were all patients with tibial shaft fractures over 14 years who had performed ORIF P/S surgery. Exclusion criteria were proximal, distal, and tibial shaft fractures under 14 years old.

RESULTS

Sample Characteristic

This study showed 16 samples with a tibial shaft fracture after ORIF P/S surgery at Sanjiwani Hospital Gianyar. Medical records collected a total of 16 samples during this research. The characteristic of the collected sample in this research is age, sex fracture type, and fracture location. Most of them are 18-59 years old (69%), followed by 14-18 years old (19%) and >59 years old (12%). The result is that 11 (68%) samples are male, and 5 (32%) are female. This is also divided by type of fracture, open tibial shaft fracture as 7 (44%), and close tibial shaft fracture as 9 (56%). Fracture location, dextra shaft tibia fracture, there were 10 (63%) samples and left tibia shaft fracture as 6 (37%) samples. Based on research data, the surgical method used in this patient is ORIF P/S as 16 (100%), and Intramedullary Nail did nothing because C Arm Radiography is not working. The characteristic distribution is served in Table 1.

TABLE 1: Characteristic Tibial Fracture.

Characteristic	Frequency (%)
Age	
14-18 Years old	3 (19)
>18-59 Years old	11 (69)
> 59 Years old	2 (12)
Sex	
Male	11 (68)
Female	5 (32)
Type of Fracture	
Open fracture	7 (44%)
Close Fracture	9 (56%)
Fracture location	
Dextra shaft Tibia	10 (63%)
Sinistra shaft Tibia	6 (37%)
Method of Surgery	
ORIF P/S	16 (100%)
Intramedullary Nail	0 (0%)

Complication

There were two complications found in this study that is 1 (6,2%) *delayed union* case and 1 (6,2%) infection case. Complications such as *Non-union*, *Malunion*, *Implant prominence*, and *Knee stiffness* are unfound.

The complication distribution is served in Table 2.

TABLE 2: Complication Tibia Fracture.

Complication	Frequency (%)
<i>Delayed union</i>	1 (6,2)
<i>Non-Union</i>	0 (0)
<i>Malunion</i>	0 (0)
<i>Infection</i>	1 (6,2)
<i>Implant Prominence</i>	0 (0%)
<i>Knee Stiffness</i>	0 (0%)

DISCUSSION

This study found 16 people \in tibial shaft fracture cases who had *ORIF P/S* performed at the Sanjiwani Gianyar Hospital in 2021, with an average of 11 people (68%) being male. This is to the research of Wikananda et al. in 2019 at Sanglah General Hospital, which stated that 68.9% of the patients in the research sample he conducted were male.[5] Paula's results of this study are also by 2016, which also showed 85% for the male gender sample. This could happen since men have more active activities outdoors, where they drive almost daily; this is one of the risks of accidents/trauma. [3]

Based on the sample's age in this study, the most common tibial shaft fracture occurred at the age of 18-59 years, 11 people (69%). This result is similar to other studies from Hariprashad in 2017, which stated that the most age-experienced tibial shaft fractures were 18-49 years, which was as much as 73.4%.[6] These results are also supported by research conducted by Jhonet et al. in 2022 at H. Abdul Moeloek Hospital Bandar Lampung, where the average incidence of fractures in the tibial shaft was found at the age of 19-59 years old, which was 81.7%. It can occur due to the age category 18- 59 years old being the productive age and legally allowed to drive. This is one of the risks of fracture due to driving accidents.[7]

This study found that the most common type of fracture was a closed fracture in 9 people (56%). These results are not by research conducted by Jhonet et al. in 2022, which mentioned that as many as 50.4% had a closed fracture.[7] However, the difference between these two studies is very small due to the mechanism of injury from the fracture.

In this study, the surgery method used was Open Reduction Internal Fixation with Plate and Screw (ORIF P/S) due to an un-functioning C Arm in the Gianyar Sanjiwani Hospital. It is not by the theory stated that the method of Intramedullary nail is the gold standard in tibial shaft fracture cases. It is supported by research conducted by Avilucea et al. in 2015. She mentioned that ORIF P/S has 2.52 times the risk of complications compared to the intramedullary nail. Patients can also do partial weight-bearing after surgery.[8]

This study mentions that one patient (6.2%) experienced *delayed union* complications. Comparison of *delayed-union* complications can be supported by Akanksha et al. research on Delayed Tibial Shaft Fracture Healing Associated with Smoking. This study also explained that nicotine decreases tissue perfusion due to increased platelet aggregation and reduced levels of microvascular prostacyclin as well as its inhibitory effect on the function of fibroblasts, red blood cells, and macrophages. In addition, carbon monoxide has a high binding affinity for hemoglobin, allowing it to decrease tissue oxygenation by displacing oxygen from hemoglobin. It explains the biological possibility of delayed healing of tibial fractures due to smoke.[9]

In addition to this research, It is also supported by research conducted by D. Georgiannos et al. stated that *delayed union* occurred in 22.8% of patients. This is associated with factors of risk of smoking and high-energy trauma.[10]

This study showed no complications in *mal union* and *non-union* after ORIF P/S surgery was performed on a tibial shaft fracture at Sanjiwani Hospital, Gianyar. This is to a study conducted by Vallier et al. which stated that 5.4% of patients experienced complications of *malunion*. [11] It is also supported by Avilucea's study, which said that 2.8% of patients experienced similar complications, and the study also mentioned that the average patient experienced difficulties of *mal union* was 2-3%. This is supported by research by Malik S. et al. in 2022, which said the prevalence of complications of *mal union* in cases of tibial shaft fractures was only 7% in patients younger than 60 years. In contrast, this study found that 78% were under 60 years. The study also said there was no significant difference between the ORIF P/S and IMN measures for *malunion* complications in tibial shaft fractures.[12]

In this study, complications were found in *infection* in 1 person (6.2%). It is also research conducted by Avilucea et al., which stated the level of risk of *infection* in post-ORIF P/S tibial shaft fracture patients was 5.6%. [8] The study also explained that the *infection* rate in post-ORIF P/S tibial shaft fracture patients was higher than in the IMN surgery method. The low *infection* rate in patients undergoing ORIF P/S surgery at Sanjiwani Gianyar Hospital can occur because before the operation, the sterilization process had been carried out properly, and prophylactic antibiotics such as ceftriaxone had been given to all patients in pre-operative and post-operative. According to research by Patzakis in 2015, the most important factor in reducing the infection rate for patients with fracture cases is the early administration of antibiotics.[13] This recommendation is also supported by the latest research from Lack et al. in 2015, who mentioned that in a univariate analysis of 137 patients that the infection rate decreased when antibiotics were administered within 66 minutes.[14]

In this study, there were no complications of implant prominence. This result is similar to other studies by Mukherjee et al., which stated that only two people (9.5%) experienced these complications.[15] These results are also supported by research conducted by Shrestha D et al., which said that less than 30% of patients with tibial shaft fractures have a risk of implant prominence.[16]

In this study, there were no complications of Knee Stiffness (0%). His result is similar to other studies from Mukherjee et al. in 2017, who stated that in his research, there were no patients with complications of knee stiffness.[15] However, in the survey by Sirvent et al., she mentioned that The incidence rate of postoperative knee stiffness reaches 3% -18%, and the need for re-surgical intervention is very low, only 0% -5%.[17]

CONCLUSION

It was concluded that the most common complications of tibial shaft fracture are *infections* and *delayed union*; however, there is only 1 case. Other complications were not found. Due to there are several factors that influence the emergence of these complications, such as age, BMI, fracture location, and type of fracture, but these complications can also be prevented, one of which is by a good sterilization process and also giving prophylactic antibiotics during pre-operative and post-operative. The suggestion is ORIF P/S can still be conducted in cases of tibial shaft fractures in areas with inadequate health facilities while considering risk factors and complications that may occur during pre-operative.

Still, it would be better in a hospital with complete health facilities and infrastructure to perform intramedullary nails as the gold standard operative method in cases of femoral shaft fracture.

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