



FRACTURE OF THE FIFTH METATARSAL. BIBLIOGRAPHIC REVIEW

**Bryam Esteban Coello García¹, Diana Carolina Martínez Pesántez²,
Felipe Ismael Ulloa Gómez³, Michelle Carolina Guerrero Cabrera⁴,
Jordy Fernando Renteria Rengel⁵, Helen Tatiana Guzhñay Rivera⁶,
María Gabriela Montenegro Vásquez⁷**

¹Postgraduate doctor in orthopedics and traumatology at Faculdade de Ciências Médicas Minas Gerais. Belo Horizonte Brasil. ORCID: <https://orcid.org/0000-0003-2497-0274>

²Postgraduate doctor in orthopedics and traumatology at Faculdade de Ciências Médicas Minas Gerais. Belo Horizonte Brasil. ORCID: <https://orcid.org/0000-0002-8622-7016>

³Postgraduate doctor in orthopedics and traumatology at Faculdade de Ciências Médicas Minas Gerais. Belo Horizonte Brasil. ORCID: <https://orcid.org/0000-0003-4122-5778>

⁴General physician graduated in the Medical Sciences Faculty in Universidad de Cuenca. Cuenca – Ecuador

⁵Postgraduate doctor in orthopedics and traumatology at Faculdade de Ciências Médicas Minas Gerais. Belo Horizonte Brasil. ORCID: <https://orcid.org/0000-0002-2788-2619>

⁶General physician graduated in the Medical Sciences Faculty in Universidad de Cuenca. Cuenca - Ecuador. ORCID: <https://orcid.org/0000-0001-5821-638X>

⁷General physician graduated in the Medical Sciences Faculty in Universidad de Cuenca. Cuenca - Ecuador. ORCID: <https://orcid.org/0000-0002-5363-0925>

Corresponding Author: **Bryam Esteban Coello García**, Address: Rua Tiradentes 266. Campo Belo. Minas Gerais. Brasil, Postal Code: 37270-000

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SUMMARY

Introduction: fractures of the fifth metatarsal have various forms of treatment, depending on the type of injury and the person who suffered it. They have great importance and frequency in athletes. They usually occur due to different trauma mechanisms. They were first described in 1902. They are the most prevalent metatarsal fractures and need to be recognized and treated in a timely and appropriate manner.

Objective: to detail the current information related to the fifth metatarsal fracture, classification, description, treatment, recovery time as well as the different surgical techniques.

Methodology: a total of 29 articles were analyzed in this review, including review and original articles, as well as clinical cases, of which 19 bibliographies were used because the other 10 articles were not relevant for this study. The sources of information were PubMed, Google Scholar and Cochrane; the terms used to search for information in Spanish, Portuguese and English were: fractura de pie, 5th metatarsal fracture, Jones fracture. Fracture of the fifth metatarsal, fratura do quinto metatarso.

Results: the anatomical division system of Lawrence and Bottle is still used. CT and MRI could be considered in the case of delayed healing, stress fracture with normal radiographs or in nonunion. Surgical options include intramedullary screw fixation, bone grafting procedures or a combination of both. Surgical treatment of fractures of the base of the fifth metatarsal in professional athletes offers good clinical results.

Conclusions: Regarding the current information related to the fracture of the fifth metatarsal, we note the importance of classification, clinical and social history of the patient, for the appropriate choice of treatment, both conservative and surgical. As for the recovery time in conservative treatment varies depending on the affected area. In delayed union or nonunion, surgical intervention should be performed.

KEY WORDS: metatarsal, fifth, fracture, Jones, treatment.



INTRODUCTION

Fractures of the fifth metatarsal are injuries of the foot that occur due to several varieties of injuries and therefore have several forms of treatment, starting from conservative therapy to surgical treatment depending on the type of injury and the person who has suffered it. These injuries have great importance and frequency in elite athletes and active people. Fractures of the fifth metatarsal usually occur due to different trauma mechanisms, with twisting and inversion injuries being the most common. In the face of a mild injury that produces a fracture of the fifth metatarsal, we must be oriented to a stress fracture(1). Fractures of the fifth metatarsal are among the most common in feet, its anatomy and blood supply makes them at high risk of delayed healing or lack of healing(2-4).

Thanks to Sir Robert Jones, an orthopedic surgeon, fractures of the fifth metatarsal were described for the first time in 1902. Currently, they are the most prevalent metatarsal fractures, being more common between the third decade of life in men and the seventh decade of life in women. There is a strong correlation between female gender, zone 1 fractures and ballerina fractures. These injuries need to be recognized and treated in a timely and appropriate manner in order to avoid inadequate clinical outcomes such as poor bone healing(5).

METHODOLOGY

A total of 29 articles were analyzed in this review, including review and original articles, as well as cases and clinical trials, of which 19 bibliographies were used because the information collected was not important enough to be included in this study. The sources of information were Cochrane, PubMed and Google Scholar; the terms used to search for information in Spanish, Portuguese and English were: fractura pie, 5th metatarsal fracture, Jones fracture, fractura del quinto metatarsiano, fratura do quinto metatarso.

The choice of bibliography exposes elements related to the fifth metatarsal fracture; besides this factor, several other important factors related to its different treatments are also included.

LITERATURE REVIEW

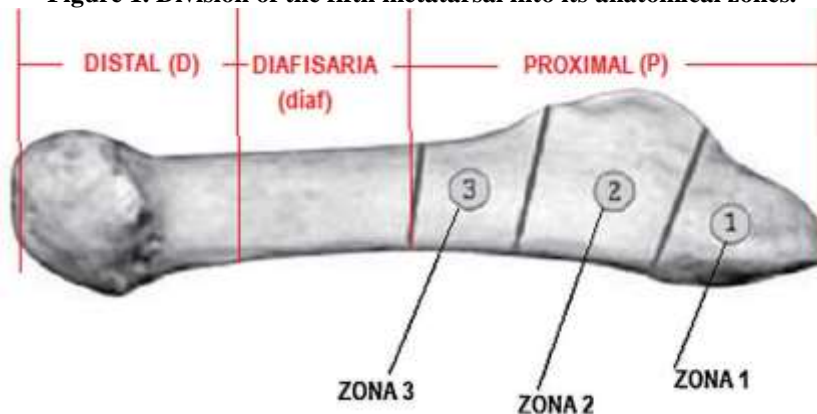
The classification of fractures of the fifth metatarsal is essential for its management, for which we can use the division used by Lawrence and Bottle, which is divided according to the base or proximal part of the fifth metatarsal in 3 zones:

Table 1. Lawrence and Bottle classification for fifth metatarsal fractures.

TYPE	ANATOMICAL ZONE
Zone I	Tuberosity (Pseudo Jones Fractures)
Zone II	Metaphyseal-diaphyseal junction (Jones fractures).
Zone III	Diaphyseal area within 1.5 cm of the tuberosity.

Source: the authors.

Figure 1. Division of the fifth metatarsal into its anatomical zones.



Source: Rev Esp Ortop Traumatol. 2018;62:348-58 (6)

Pseudo Jones or zone 1 fractures are usually due to avulsion of the tuberosity. They occur when the rearfoot is forcibly inverted during plantar flexion, such as after a bad fall following a jump. These are classic of a twisting injury and are the most common fracture of the base of the fifth metatarsal(5).

Jones or zone 2 fractures usually occur from a significant adduction force of the foot with the heel raised or from a sudden

change of direction by an athlete. These fractures affect the fourth and/or fifth metatarsal joints and have pseudarthrosis rates of up to 15-30%(5). An under-diagnosed pathology that can be mistaken for a Jones fracture is Iselin's disease which consists of osteochondrosis of the fifth metatarsal process generated by repeated traction of the lateral peroneus brevis muscle in young athletes between the ages of 9 and 14 years(7).



Zone 3 fractures are usually chronic or stress injuries, caused by repetitive microtrauma, which leads to increased pain with the performed activity for months. We have to suspect a stress fracture when there is previous pain, in addition, pain of quality or duration that worsens with time. Physical examination may reveal tenderness to palpation, swelling and ecchymosis at the site of injury. This type of fracture presents a high risk of pseudarthrosis(5).

There are also shaft fractures, more than 1.5 cm distal to the tuberosity, the so-called dancer's fracture or also known as

long spiral fracture of the distal metatarsal, which is frequent when performing maneuvers by a dancer rolling on his foot while in the midfoot position or held while landing a jump(3,5).

It is usually difficult to differentiate soft tissue injury and fracture of the base of the fifth metatarsal as the swelling and pain of the two injuries lie just below the lateral malleolus. Thus, a thorough examination and proper assessment is needed in cases of metatarsal injuries(4).

Image 1. Radiographs of the right foot with fracture of the fifth metatarsal.



Source: The Authors.

According to the Torg classification, which is a system based on radiographic appearance, stress fractures of the base of the fifth metatarsal are divided into three types:



Table 2. Torg's radiological classification system

TYPE	CHARACTERISTICS
I	<ul style="list-style-type: none"> ● Early ● No intramedullary sclerosis ● Acute fracture line without flaring ● Minimal cortical hypertrophy ● Minimal periosteal reaction
II	<ul style="list-style-type: none"> ● Delayed ● Evidence of intramedullary sclerosis. ● Widened fracture line with involvement of both cortices. ● Periosteal reaction present
III	<ul style="list-style-type: none"> ● No union ● Complete obliteration of the medullary canal by sclerotic bone ● Wide fracture line with new periosteal bone

Source: The Authors.

CT and MRI, could be considered in the case of delayed healing, high index of suspicion of a stress fracture with a normal radiograph or in nonunion, however these are not routine studies(5).

The correct choice of treatment will depend on the anatomical site of injury, as for the clinical and social history of the injured patient, as well as the radiographic signs of recovery(5).

Treatment varies according to the area where the lesion occurs and can be conservative or surgical.

Non-displaced zone 1 injuries tend to use conservative treatment with protected weight bearing in a hard-soled shoe, walking boot or walking cast. Progression to weight bearing, to tolerance, may be initiated depending on the patient's pain and discomfort, this usually disappears within 3 to 6 weeks. However, fractures involving 30% of the articular surface or with an articular step greater than 2mm are treated with open reduction and internal fixation, closed reduction, percutaneous pinning or excision of the fragment(5).

Zone 2 nondisplaced injuries, or also known as Jones fractures, can be treated conservatively with 6 to 8 weeks of non-weight bearing with a short leg cast. Weight-bearing status can advance as signs of bone healing are evident radiologically. Indications for surgical interventions include a high-performance athlete, displaced fractures, or a patient electing to continue surgical treatment, for an early recovery. There are a number of surgical techniques, including tension band and plate construction, intramedullary screw fixation and low-profile screws. Surgical treatment of high-performance athletes minimizes the risk of pseudarthrosis and allows early return to physical activity(5,8,9).

It is recommended to present patients with several treatment alternatives, the patient should be part of the decision of the procedure to be performed since it has a direct impact on the time for recovery and return to activities(10).

There is a large repertoire of surgical methods for the treatment of the proximal fifth metatarsal fracture. For Zone II and Zone III fractures, the percutaneous intramedullary screw is the treatment of choice(2).

There is no agreement as to the ideal screw; however, the literature recommends intramedullary devices with a diameter of at least 4.5mm(11).

Stress fractures of the diaphyseal zone 3 represent a more complicated picture. As a first line of treatment, conservative management without weight bearing in a short leg cast could be initiated, however, before radiological healing is observed, immobilization for up to 20 weeks may be necessary, and even then, it is not uncommon to see the development of pseudarthrosis. High-performance athletes or individuals with Torg type II or III fractures may require surgical interventions. Surgical options include intramedullary screw fixation, bone grafting procedures or a combination of both(5).

A clinical trial conducted in Chile showed that surgical treatment with a 4.0 mm diameter cancellous bone screw with partial thread, solid, stainless steel, and with a head is an effective and safe alternative for synthesizing fractures of the base of the fifth metatarsal in zones 2 and 3, in addition to presenting a low rate of complications(11).

The bone insertion technique requires the removal of a rectangular area of bone measuring 0.7 cm by 2.0 cm at the fracture site and replacing it with an autogenous cortico-cancellous bone graft of the same size taken from the anteromedial distal tibia. The medullary cavity has to be scraped or drilled until all the sclerotic bone has been removed and the medullary canal reestablished before placing the donor graft(5).

Surgical treatment of fractures of the base of the fifth metatarsal in professional athletes offers good clinical results, who return to their sport activities faster compared to other types of fractures. But even with good surgical technique and good postoperative management, delayed healing and refracture can



occur. However, it should be taken into account that an efficient rehabilitation, without compromising the whole process of consolidation and recovery of the patient, reduces the risk of presenting refractures and the presence of pseudarthrosis. Among the studies reviewed, it was evidenced that the following variables were not influential factors for a favorable recovery: surgical time, healing time, Torg classification and if they use a graft during the surgical procedure(12-14).

Conservative treatment is used for dancer's fracture without displacement and other fractures of the diaphysis and neck of the fifth metatarsal, as in zone 1 injuries without displacement. If delayed union or nonunion is evident, surgical

intervention should be performed. In case of displacement greater than 3 mm or an angulation exceeding 10 degrees, the fracture should be reduced and immobilized. If there is no improvement of the fracture reduction or if there is evidence of reduction failure on subsequent radiographs, surgical intervention with percutaneous pinning or plate and screw fixation should be considered(5).

Those who are treated with bone graft inlay technique or intramedullary screw fixation should be kept non-weight bearing with a plaster splint or short leg cast for six weeks in order to gradually return to sport or activity(5).

Image 2. X-Ray of fracture of the Fifth Metatarsal.



Source: The Authors.

Mismanagement of these fractures can lead to poor clinical outcomes and alterations in lifestyle. Urgent referral to orthopedic surgery is necessary for treatment of an open fracture. Traditionally, the use of intramedullary screw fixation has been an option when surgery is warranted, but newer techniques with flat plates have been shown to be successful in elite athletes(9,15-17).

Orthobiologically enhanced surgical fixation of Jones fractures is becoming increasingly common in athletes, regardless of the deficiency of comparative studies corroborating this practice. Biologically enhanced fixation of Jones fractures results in higher fracture healing rates than fixation alone(18).

Other surgical treatment alternatives include tension band wire, percutaneous pinning and external fixation. Avulsion

fractures involving a small part of the tuberosity can also be treated by excision. In situations where fractures evidencing a displacement of more than 2 mm and involving more than 30% of the joint should be corrected by surgical treatment(4).

In patients initially treated conservatively, it was shown that NSAIDs have a negative effect on the healing of the fifth metatarsal fracture. Therefore, NSAIDs are a negative prognostic factor for recovery when treated non-surgically(19).

CONCLUSIONS

Regarding the current information related to the fifth metatarsal fracture, we note the importance of the classification, clinical and social history of the patient, for the appropriate choice of treatment, both conservative and surgical.



The anatomical division system of Lawrence and Bottle is still used. Pseudo Jones or zone 1 fractures are generally due to avulsion of the tuberosity and caused by inversion during plantar flexion, being the most common fracture of the base of the fifth metatarsal. Jones or zone 2 fractures are mostly caused by a force of adduction of the foot with the heel raised or by a sudden change of direction. Zone 3 fractures are usually chronic or stress injuries caused by repetitive microtrauma. In stress fractures of the base of the fifth metatarsal, the Torg classification can be used.

CT and MRI could be considered in the case of delayed healing, stress fracture with normal radiography or in nonunion.

The recovery time in conservative treatment varies depending on the affected zone, being generally from 3 to 6 weeks in zone I, from 6 to 8 weeks in zone II and in zone III diaphyseal stress fractures, immobilization can reach up to 20 weeks, and pseudarthrosis is not infrequent.

Surgical options include intramedullary screw fixation, bone grafting procedures or a combination of both. Zone I fractures involving 30% of the articular surface or with an articular step greater than 2mm are treated surgically. For Zone II and Zone III fractures, the percutaneous intramedullary screw is the treatment of choice. Surgical treatment of fractures of the base of the fifth metatarsal in professional athletes offers good clinical results. In non-displaced dancer's fractures and other fractures of the diaphysis and neck of the fifth metatarsal, conservative treatment is used. If delayed union or nonunion is evident, surgical intervention should be performed. Other surgical treatment alternatives include: tension band wire, percutaneous pinning and external fixation.

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