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MODERN APPROACH TO LOW DIAPHYSEAL FRACTURES OF THE TIBIA (*literature review*)

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Abstract: This literature review includes the literature of the last 10 years devoted to fractures of the distal part of the tibia from the articular surface. In the review of the literature, the concept of the term Pilon, the epidemiology of the disease, the modern and most convenient classification methods, the connection of the injury mechanism with the treatment and the problematic points in the treatment methods and treatment, their relative solutions, and the current problems of the Pilon fractures are highlighted.

Key words: Pilon fracture, distal fracture of tibia, surgical treatment, 3D imaging, fixation.

INTRODUCTION

Pilon fractures are a complex type of fracture that breaks with the articular surface of the distal part of the tibia, this term was first used in science in 1911 by Etienne Destot. His use of the term "pylon" to describe these fractures further revealed its importance in modern orthopaedic medicine and helped form a unified concept among traumatologists [11]. Fractures of the tibia over the articular surface are relatively rare, accounting for the type of fracture, approximately 3-10% of tibia fractures, and in some reports 1-10%, and this figure is less than 1% of leg fractures. [10]. The mechanisms and causes of this type of fracture can mainly be caused by catatrauma or complex car injuries, that is, a large amount of energy is required for the formation of a fracture. [17]. The occurrence of open injuries is strongly related to the mechanism of fracture and can result from high-energy injuries including serious autotraumas and industrial accidents, and these causes account for approximately 50% of pylon injuries. Of course, there are several important aspects of open wounds, and the high susceptibility of open wounds to contamination leads to a longer period of treatment

and difficulties in treatment. [8]. Failure of patients to receive adequate treatment in time can lead to disability.

With this fracture, significant complications such as chronic pain, limitation of range of motion, and complex disability are observed in a large number of patients, so the treatment and rehabilitation of patients are considered important factors [15].

Pylon injuries of the tibia are more common in men than in women and are relatively common among people over the age of 45. It has been said that these demographic trends are related to the fact that men are more exposed to certain risk factors or activities compared to women [1].

Classification. Using of the most convenient classification is of great importance in the treatment of this fracture, we considered it permissible to dwell on a brief classification below. Commonly, pilon fractures of the greater tibia are classified according to the AO/OTA and Ruedi-Algower classifications, however, these systems are based on plain radiography and are not considered useful in terms of preoperative surgical planning or prognostic indicators. Considering these shortcomings, Leonetti and Tigani proposed a new classification system based on the number of articular fragments, the plane of the main fracture line, and computer imaging. This classification was found to provide prognostic correlation in 71 research studies related to pilon fracture [6]. Below is this classification.

Type I: normal metaphysis and with slight displacement of the articular fracture lines
Type II: significant displacement, but with little grinding
Type III: Comminuted fracture with additional displacement.
Of course, this classification is of great importance in the treatment and understanding of the condition of the joint and predicting its remedies. [2].

METHODOLOGY AND LITERATURE REVIEW

There are several methods for treating pilon fractures, depending on several important factors, such as fracture mechanisms, smallness of fragments, open or closed fracture, that is, whether the integrity of the skin is damaged or intact [11].

Conservative treatment. According to scientists, surgical fixation is the most preferred method of treatment and is considered important in reducing complications in patients [9, 18]. However, in elderly patients, it is impossible to ensure the safety of surgical practice in any case. In such cases, the treatment is non-surgical, which involves 6 to 10 weeks of non-weight-bearing immobilization and a firm cast. Today, developing medical technologies, including the practice of external fixation with spinal anesthesia, have been recognized as saving the lives of many patients. [5].

Surgical treatment. In the last 100 years, early surgical treatment has been recommended in low-energy cases of pylon fractures, but in high-energy fractures, it has been confirmed that the general condition of the patient is not suitable for surgery, and in some cases, it ends in death. Complications and difficulties such as high level of contamination, complexity of the injury, long-term functional passivity, require further development of treatment methods in these fractures. [12, 3].

Due to the high prevalence of complications such as contamination and nonunion, the use of a two-stage treatment protocol remains the mainstay of treatment for pilon fractures today. A significant reduction in complications and improvement in

functional outcomes with this two-stage treatment protocol have been reported by many authors. [11].

Temporary fixation. In low-energy trauma fractures without significant comminution or extensive soft-tissue damage, initial treatment for distal tibia fractures with closed reduction and immobilization with a reinforced plaster cast may provide good results in most cases. [7]. In most cases, given the extensive bone fragmentation caused by high-energy trauma, a minimally invasive approach to injury control is the most appropriate initial treatment approach. However, during this external fixation, it is necessary to considering the possible future surgery. [4].

There are several external fixation systems, many of which create an "A-shaped" configuration over the ankle. It is recommended to extend the external fixator to the forefoot to prevent contracture of the ankle and ankle joint (stretching the ankle in a downward position). This stretching ensures stable reduction and minimal movement of bone fragments, creating an optimal environment for soft tissue regeneration. [14]. During temporary external fixation, the timing of CT scan should be carefully planned. In cases of fractures with large fragments and displaced fractures of the large tibia, performing a CT scan before final reduction or temporary external fixation may provide valuable information about the location of the fragments and the necessary surgical approaches. After the scientists reviewed the CT scans, it was found that the surgical plan changed in 64% of cases. Therefore, to obtain complete information about the primary fracture line, fracture pattern, and number of fragments, the "intermediate CT scan and planning" approach is considered the most convenient method [16].

RESULTS

Contemporary approaches today. Studies show that the use of 3D printers in pilon fractures is more effective compared to traditional methods, resulting in reduced surgical time, less blood loss, reduced fluoroscopy time, and improved anatomical alignment. However, several similar reasons, such as the financial cost of this method and the need for high technology, make the implementation of this method not equally possible for everyone. Treatment of distal tibial fractures requires careful consideration of fracture patterns and fragments.

DISCUSSION

In order to choose the most convenient surgical method, it is important to plan thoroughly before surgery. This planning is often done based on advanced imaging techniques such as computed tomography and 3D imaging. Fractured bone tomography provides detailed information on the analysis and 3D imaging of the fracture shape, comminution, and comminution. This information is very important to determine the most suitable surgical approach.

CONCLUSION

In conclusion, injuries to the articular surface of the distal part of the greater tibia are complex injuries that usually occur as a result high-energy trauma and can seriously damage the distal articular surface.

Careful preoperative planning, including computed tomography 3D imaging and soft tissue evaluation, is essential for successful treatment.

These fractures often require a two-stage approach that includes external fixation as a temporary measure, followed by open reduction and internal fixation (ORIF) procedures to achieve anatomic reduction and restore the articular surface. important methods are considered.

Despite the use of advanced technologies in the field of surgery and medicine, this type of injury still has a high complication rate and is often characterized by moderate functional recovery. Pilon fractures continue to present significant challenges to orthopedic surgeons, highlighting the importance of continued research and innovation in their treatment.

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