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Comparison of Operative and Conservative Treatment of Supination-External Rotation Ankle Fracture

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Abstract

Objective: To analyze the effects of surgical and conservative treatments in supination-external rotation ankle fracture (abbreviated as SERAF).

Method: Sixty-eight subjects with SERAF were divided into a reference group and an exploration group, with 34 cases in each. Conservative treatment was applied in the members of reference group with manual reduction and stone paste fixation, while open reduction and internal fixation were applied in those belonging to the exploratory group. The joint function recovery time and treatment effect between the two groups were carefully compared.

Result: The recovery time of joint function in the exploration group was 65.4 ± 12.1 weeks, which was shorter than the reference group (71.6 ± 11.9 weeks), suggesting a distinct difference ($P < 0.05$). Besides, the difference between both groups in the excellent rate of type II injury ($\chi 2 = 1.233$, $P > 0.05$) was not significant. In the exploration group, the excellent rates for type III injury (92.31%) and type IV injury (87.50%) were significantly higher than 57.14% and 33.33% in the reference group, respectively, ($\chi 2 = 4.340, 5.130$, $P < 0.05$).

Conclusion: The difference between surgical and conservative treatment in the curative effect of patients with type II SERAF was not significant, but the effect of surgical treatment was more definite on patients with type III and IV SERAFs.

Keywords: Surgical treatment, Conservative treatment, Supination-external rotation ankle fracture (SERAF), Curative effect.

1. Introduction

Ankle joint is one of the major load-bearing joints, which is formed by tibia, fibula, and talus. The main function of the ankle joint is to perform plantarflexion and dorsiflexion (Henari S. et al., 2011). However, if joint instability occurs during plantar flexion exercises (Tang W-H. et al., 2015), it is easy to cause adverse reactions such as sprains and fractures. Clinically, ankle fracture is a common type of fracture, and SERAF is one of the types (DeAngelis N.A. et al., 2007). Ankle fractures can not only affect the ankle function of patients but also easily cause traumatic arthritis (Shibuya N. et al., 2014; Li M. et al., 2017). Ankle joint injury is not only a disorder of bone structure but also a compound injury of ligaments and soft tissues. Under normal circumstances, the ankle joint maintains the balance of biomechanics under the joint action of surrounding muscles and ligaments. Once one ligament and soft tissue are injured, the balance will be lost. Even if the fracture is reduced by internal fixation, the normal physiological and anatomical relationship of the ankle joint may not be completely restored. Particularly, in patients with SERAF, the foot is in the supination position when injured. Because the talus is subjected to external rotation force or internal rotation of the

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leg, it is subjected to the relative external rotation force, resulting in that the talus rotates against the lateral structure in the medial aspect of the ankle point in an axial-lateral and posterior direction (Pakarinen H.J. et al., 2011)(Weber M. et al., 2010)(Gill J.B. et al., 2007).

The treatment of SERAFs is mainly divided into surgical and conservative treatment. Advantages of conservative treatment are: (1) the traditional closed reduction (if necessary, under fluoroscopy) can reach the anatomical reduction of x-rays or near anatomical reduction; (2) firm plaster or splint external fixation is conducive to prevent fracture re-displacement; (3) it can protect the periosteal blood supply and ligaments at the fracture site, which is conducive to early fracture healing; (4) there is no obvious contraindications; (5) the economic burden is light which can save social medical resources (Phillips W.A. et al., 1985)(Jenkinson R.J. et al., 2005). The advantages of surgical treatment are: (1) it can achieve anatomical reduction, is conducive to ankle function rehabilitation; (2) it can reduce the plaster fixation range and time, if the internal fixation is very strong, it can also omit external fixation, in order to facilitate early functional exercise, shorten the rehabilitation time, prevent joint stiffness, osteoporosis, and muscle atrophy; (3) it can effectively maintain the position after reduction, avoid the repeated closed reduction of unstable fractures and replacement of plaster; (4) it can avoid unphysiological position to fix the affected foot; (5) it can simultaneously remove the hematoma and the bone and cartilage fragments in the joint, remove the soft tissue embedded in the fracture and repair the ligament injury and other combined injuries (den Bekerom MPJ. et al., 2009) In early-stage studies, most scholars thought that surgery had obvious advantages over conservative treatment (Markolf K.L. et al., 1989).

The purpose herein was to figure out the effect of surgical and conservative treatment on patients with SERAFs from February 2016 to September 2017.

2 Material and methods

2.1. General Information

Sixty-eight patients with SERAF treated in our hospital were selected and then divided into a reference group and exploration group by random draw method, where 34 cases in each group from February 2016 to September 2017. There were 19 males and 15 females, aged 20−69, with an average age of 39.5 ± 9.9; 11 cases were type II, 14 cases were type III, and 9 cases were type IV in the reference group. While the exploration group contained 20 males and 14 females, aged 20−68, with an average age of 40.3 ± 9.3; 13 cases were type Ⅱ, 13 cases were type Ⅲ and 8 cases were type Ⅳ. The general information of patients was comparable (P > 0.05).

2.2. Inclusion and exclusion criteria

Inclusion Criteria

All cases were diagnosed by magnetic resonance imaging (MRI) and other examinations, and all had a history of trauma. A typical case is shown in Figure 1.

Exclusion Criteria

Patients with neurovascular compromise; pathological fractures; and open fractures (Okike K. & Bhattacharyya T., 2006)(Say F. et al., 2016).

2.3. Methods

Reference Group

Conservative treatment was applied in the patients with manual reduction and cast immobilization, and then taken the lateral decubitus position, straightened the unaffected side, relaxed the affected muscles, and kept the knee flexed on the affected side. The proximal end of the lower leg is fixed by the nursing staff, while the operator stands at the distal end of the patient. The patient's heel and dorsum of the foot are fixed by both hands, then the middle finger and index finger are used to support the lateral malleolus, and the thumb was used to support the medial malleolus of the patient. At the same time, the operator and the nursing staff simultaneously perform antagonistic traction operation. Subsequently, the operator pushed forward the distal fracture site of the medial malleolus with thumb to obtain the reduction effect of the medial and lateral malleoli, which was later used to reduce the posterior malleolus (Dawe EJC. et al., 2015).

Exploration group

The treatment of open reduction and internal fixation was applied, then ~8 centimeters long incision was opened up at the tip of lateral malleolus after successful anesthesia. The skin, subcutaneous tissue, and fascia layers were respectively incised to fully expose the peroneus longus muscle and the lateral malleolus fracture. Blunt dissection of the lateral malleolus was performed, the distal end of the lateral malleolus was turned posterolaterally and the periosteum at the inferior border of the tibia was bluntly dissected to ensure that the distal tibial malleolar fracture block was fully exposed, and then the malleolar

fracture block was reduced. The cancellous bone screw was used to fix the middle and lower parts of the ankle fragment. An arc incision of 3 to 4 cm in length was made in the medial malleolus of the patient. The skin, subcutaneous tissue, and fascia layers were incised in layers, then a cancellous screw was used for compression fixation. The ankle was dorsiflexed and the cortical screw was threaded over the syndesmosis after the medial deltoid ligament was repaired. Finally, the patient's affected limb was cast and elevated above the heart to observe the blood supply at the fracture site (Wang X. et al., 2017; Choi Y. et al., 2014).

2.4. Observation Indicators

The recovery time of joint function and therapeutic effect were compared between the two groups.

2.5. Efficacy judgment criteria

Excellent: Results of X-ray examination showed that the displacement range in anteroposterior direction of medial and lateral malleolus was less than 2 mm without lateral displacement occurred. The medial malleolus maintained normal space with talus, and the space of tibiofibular syndesmosis was the same as the contralateral side or 2.5 - 4.0 mm.

Available:

Results of X-ray examination showed that the anterior and posterior displacement range of the patient's medial and lateral malleoli was less than 2 mm. The displacement range of the posterior malleolus to the proximal side was 2～5 mm. The widening range of space was only about 2 mm. Similarly, the increased range of space between the inferior tibiofibular joint and the contralateral side was also less than 2 mm.

Poor: Results of X-ray examination revealed that the patients had a posterior dislocation of the talus, or a proximal shift of the posterior malleolus was greater than 5 mm and a lateral shift of the medial and lateral malleoli was greater than 2 mm.

3. Results

3.1. Comparison of joint function recovery time between the two groups

The recovery time of joint function in the exploration group was 65.4 ± 12.1 weeks, which was shorter than the 71.6 ± 11.9 weeks in reference group, between those, the difference was significant ($P < 0.05$).

3.2. Comparison of therapeutic effect between the two groups

The excellent rates of type II injury between both groups are comparable ($\chi2 = 1.233$, $P > 0.05$). The excellent rate for type III injury (92.31%) and type IV injury (87.50%) in the exploration group were higher than 57.14% and 33.33% in the reference group accordingly. The differences were significant ($\chi2 = 4.340, 5.130$, $P < 0.05$, Table 1).

Table 1: **Comparison of Treatment Effect Between the Two Groups [N (%)]**

Group	Type	Case	Excellent	Available	Poor
Reference	Ⅱ	11	10(90.91)	1(9.09)	0
	Ⅲ	14	8(57.14)	4(28.57)	2(14.29)
	Ⅳ	9	3(33.33)	4(44.44)	2(22.22)
Analysis	Ⅱ	13	13(100.00)	0	0
	Ⅲ	13	12(92.31) a	1(7.69)	0
	Ⅳ	8	7(87.50) a	1(12.50)	0

Note: Compared with the same typing of reference group, aP < 0.05

Figure 1: **X-Ray Result of a Typical Supination-External Rotation Ankle Fracture**

4. Discussion

Tibia, fibula, and talus are the main components of the ankle joint, which is a weight-bearing joint in the human body. The ankle joint plays an important role in the patient's lower limb movements, such as jumping and walking as a highly fit joint. Once a fracture occurs, it will have a great impact on the normal life of the patient. Although manual reduction has the characteristics of rapid and noninvasive functional recovery, the surgeon cannot perform fine manipulation on the affected bone. Open reduction and internal fixation therapies are helpful for clinicians to closely observe the specific situation of the fracture site, which can achieve the ideal ankle joint recovery effect and significantly reduce the incidence of re-displacement. However, patients have a higher risk of infection, which may have a certain impact on the postoperative rehabilitation process (Miller SD., 2000; Li J. et al., 2017).

In our study, the recovery time of joint function in the exploratory group was significantly shorter compared with that in reference group ($P < 0.05$). The excellent rate of type III injury and type IV injury in the exploration group were significantly higher compared with those in the reference group ($P < 0.05$). If the patient has low acceptance of surgical treatment or cannot tolerate surgical treatment, conservative treatment can be applied due to the high safety of conservative treatment and the desired reduction effect of type II injury. More than 10% of the patients with type III and IV injury fractures suffered the posterior ankle joint fracture will result in a worse weight-bearing articular surface. Conservative treatment exerts a great difficulty in reduction, while surgical treatment can ensure the accuracy of operation and reduce the failure rate of reduction.

There was no significant difference in the efficacies of surgical and conservative treatment between patients with type II SERAF. In addition, the efficacy of surgical treatment was more definite in patients with type III and IV SERAFs compared with conservative treatment.

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