

Experience of ankle arthroscopy in the treatment of Herscovici B.C type medial malleolus fracture

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Research

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Abstract

Background: Ankle fracture is one of the most common intra-articular fractures, which accounts for about 3.9% of adult systemic fractures. For displaced and unstable ankle fractures, the traditional treatment method is open reduction and internal fixation(ORIF).However,the incidence of postoperative complications ORIF is as high as 36%,So.the purpose of this study was to evaluate the safety and efficacy of ankle arthroscopy in the treatment of Herscovici B.C medial malleolus fractures.

Methods: From July 2018 to October 2020, 21 patients with Herscovici B.C type medial malleolus fractures (16 males and 5 females, with an average age of 37.2 years, ranging from 28 to 56 years) underwent closed reduction and internal fixation under ankle arthroscopy. During the follow-up period, the American Orthopaedic Foot and Ankle Society (AOFAS) were used to evaluate the curative effect.

Results: All the 21 patients were followed up for 8 ~ 15months, with an average of 12.5 months. the average VAS scores on the 3rd and 2nd week after surgery were 2.6 (range, 2-3) and 1.5 (range, 1-2), the average AOFAS ankle scores at the 6 months and 1 year were 80.2 (Range, 76-84) and 92.9 (range, 88-98). The wounds of all patients reached stage I healing, and no wound infection was reported. 1 case of superficial peroneal nerve injury was found. Medial malleolus fractures achieved bone union time was 8-12 weeks, with an average of 10.5 weeks.

Conclusion: Closed reduction and internal fixation under ankle arthroscopy for the treatment of Herscovici B.C medial malleolus fractures, with less damage, reducing local blood supply damage to the fracture, and facilitating the healing of the fractured end, as well as the reduction of wound infection rate, and is conducive to the recovery and exercise of early ankle joint function.

Background

Ankle fracture is one of the most common intra-articular fractures, which accounts for about 3.9% of adult systemic fractures[1-2]. For displaced and unstable ankle fractures, the traditional treatment method is open reduction and internal fixation(ORIF). However, If there is no intra-articular fracture, this mechanism is suitable for reduction. But for intra-articular fractures, especially the fractures of the medial malleolus, the traditional treatment is difficult to accurately restore the smooth articular surface [3]. According to the literatures reports[4-5], the incidence of postoperative complications ORIF is as high as 36%, including persistent ankle joint pain (17.3%) and traumatic arthritis (37% to 53%), possibly due to poor fracture reduction and cartilage defects, ligament tears, etc. [6].

In the past decade, many authors recommend the use of ankle arthroscopy as a tool to display and treatment of those using conventional imaging technology does not recognize the ankle joint disease[7-12]. Our hypothesis is whether it is possible to perform closed reduction of medial malleolus fractures under arthroscopic monitoring, accurately restore the flatness of the articular surface. At the same time, it can further explore the damage of articular cartilage and ligament, reduce postoperative pain and

traumatic arthritis. Therefore, the purpose of this study was to evaluate the safety and efficacy of ankle arthroscopy in the treatment of medial malleolus fractures.

Patients, Materials And Methods

1.1 Patients, Materials

There were 21 patients, 15 males and 6 females, aged 28-56 years, with an average age of 37.2 years. The causes of injury included: 10 cases of foot sprain, 5 cases of traffic accident, and 6 cases of hard object injury (Tab.1).

Table 1 Characteristics of the study population

Age ,year, mean (range)	37.2 (28 -56)
Male,n (%male)	16 (76.1)
Smoking,n (%)	10 (47.6)
Laterality,n(%)	
Right	14 (66.7)
Left	7 (33.3)
Diabetes,n (%)	2(9.5)
Herscovici classification,n(%)	
Type B	8(38)
Type C	13(61.9)
Follow-up, months,mean (range)	12.5(8-15)

The inclusion criteria were as follows: (1) Herscovici B.C medial malleolus fracture within one week of injury, (2) The fracture ends have obvious separation and rotational displacement. The exclusion criteria were as follows: (1) Old fracture,(2)Severe cardiovascular and cerebrovascular diseases that cannot tolerate operation, (3) Open wounds or other fractures of the foot and ankle, (4) Herscovici B.C medial malleolar fracture.

The preoperative examination included anteroposterior and lateral position of ankle radiography. Three-dimensional CT scan of ankle must be conducted to further evaluate the diagnosis. The CT evaluation should include the type of fracture, the degree of displacement, and the size of the fracture fragments (Fig 1).

1.2 Surgery

The patient received epidural anesthesia, taken a supine position and routinely applied a tourniquet. Arthroscopic equipment was installed. Generally, the observation portal was the anterolateral portal, and the operation portal was the anteromedial portal or the auxiliary anteromedial portal located 1.5cm was below the anteromedial portal. Skin incision was made. The capsule was separated and penetrated into the joint cavity. A 4.0 mm.30 degree wide-angle lens was connected. The ankle cavity was explored. After systematic 21-point inspection to evaluate joint parts, observe the damage of ligament and cartilage damage.

The fractured fragments of medial malleolus fracture were exposed. The hematoma, fascia and blood clot embedded in the fracture fragments were removed with blue pliers to assure that there was no fascia insertion between the fracture fragments.

The reduction process under ankle arthroscopy monitoring includes the following steps: First, use clamps to axially pull the medial malleolus to the distal end to facilitate observation of the displacement of the fractured end. Then lift the distal fragment from the ventral side to restore the sagittal line. Second, use clamp as a lever to adjust the rotational malformation of the fracture fragments. Finally, push the fracture fragments to the proximal end to promote the connection of the fractured ends of the medial malleolus, and use the joystick clamp to make fine adjustments to accomplish anatomical reduction.

Under fluo-rosopic control, two guide wires pass through the fracture site percutaneously from the top of the medial malleolus. Then, screw two 4.5 mm cannula screws along the two guide wires through the fracture site. Take care to avoid under-compression or over-compression between fragments, Confirm the position of the screws through arthroscopy and fluo-rosopic to ensure that they do not stand out from the articular surface and maintain an anatomical reduction(Fig.2)

1.3 Arthroscopic findings

Arthroscopy was found in cartilage lesions in 12 (57%) of 21 patients, 10 of which were located in the dome of the talus and 2 patients were located in the distal tibia. [On the basis of](#) the ICRS arthroscopic grading system, 7 are grade 1 and 5 are grade 2. Shaving and removing debris and worn cartilage or microfractures under arthroscopy respectively. No patients have combined tibiofibular syndesmosis or other ligament injuries.

1.4 Postoperative management

The next day after the beginning of the ankle joint active and passive range of motion (ROM), partial weight-bearing was allowed 3 weeks after surgery, 6 weeks after surgery can not completely weight-bearing, limit physical activity within 3 months.

Patients from July 2018 to October 2020 were followed up for 2 weeks, every month to 6 months, and 1 year.

1. 5 Outcome measures

The main result of the measures the American Orthopedic Foot and Ankle Society after foot (AOFAS) ankle scoring system to evaluate ankle function. 90-100 divided into excellent, 75-89 divided good , 50-74 divided into general, <50 was poor[14]. It was assessed at the 6 months and 1 year follow-up. The subordinate result of the measures the visual analog scale (VAS) and radiologic assessment. The VAS score was decided at 3 days and 2 weeks after the surgery. Radiographs were obtained immediately after surgery and every month until the fracture is healed

Results

2.1 Patient Report Outcome Measures

All the 21 patients were followed up for 8 ~ 15months, with an average of 12.5 months. The average VAS scores on the 3rd and 2nd week after surgery were 2.6 (range, 2-3) and 1.5 (range, 1-2). The average AOFAS ankle scores at the 6 months and 1 year after surgery were 80.2 (Range, 76-84) and 92.9 (range, 88-98). The AOFAS score at 1 year after surgery was significantly higher than at 6 months after surgery (Tab.2)

Table 2
Clinical outcomes

AOFAS, mean (range)	
At the 6 months postoperatively	80.2(76-84)
At the 1 year postoperatively	92.9 (88-98)
VAS, mean (range)	
At the 3 days postoperatively	2.6(2-3)
At the 2 weeks postoperatively	1.5(1-2)
Radiological fracture union Week,mean (range)	10.5(8-12)
Complications,n(%)	
Wound rupture	0
Infection	0
Superficial peroneal nerve injury	1(4.8)
AOFAS, American Orthopedic Foot and Ankle Society after foot ankle scoring system;	

VAS, visual analog scale;

ROM, range of motion

Complications

The wounds of all patients achieved first-stage healing without wound infection. One of the patients suffered superficial peroneal nerve injury and was given neurotrophic drugs, after two months complete recovery. Medial malleolus fracture healing time is 8-12 weeks, an average of 10.5 weeks.

Discussion

Medial malleolus fractures are commonly divided into 4 types according to the Herscovici classification [15], only patients with Herscovici B.C were collected. The reasons are as follows: 1) Type A avulsion fracture at the top of medial malleolus easily leads to fracture at the distal end of medial malleolus fracture during closed reduction, which affects closed reduction; 2) Type D is more common in the supination adduction type of ankle fracture, often complicated with distal fibular fracture, which requires open reduction and plate and screw fixation during operation[16].

Compared with traditional methods, the advantages of arthroscopic treatment of medial malleolus fracture includes: 1) arthroscopy can fully expose the articular surface, which is conducive to the reduction of fracture ends, and the magnification of arthroscopy can improve the accuracy of articular surface reduction. Takao et al [17]. compared the use of arthroscopic assisted technology to treat distal fibular fractures as the same as traditional ORIF. It is believed that arthroscopy is an effective technique for diagnosing and treating intra-articular ankle fractures. 2) hematoma, bone debris in the joint cavity can be cleaned up under arthroscopy. At the same time, it can be found whether there is cartilage damage in the joint. Stufkens et al[18] pointed out that the initial cartilage damage observed under arthroscope after ankle fracture is an independent predictor of the development of post-traumatic osteoarthritis. Therefore, early detection of cartilage damage helps reduce the chance of post-traumatic osteoarthritis occur in the future 3) the intraoperative trauma is small, which reduces the postoperative wound infection, and reduces the local blood supply damage of the fracture, which can promote the fracture healing and early ankle joint weight-bearing exercise.

Despite the above advantages, the arthroscopic method has potential limitations and complications including: 1) Technical difficulty. The learning curve is steep, especially arthroscopic assisted reduction surgery. 2) Lack of evidence-based research on the arthroscopic ankle fracture. Although Thorderson et al.[19] compared the application of arthroscopy and traditional techniques in ankle fractures, but the results did not show any significant differences between the two techniques. 3) For comminuted fractures, it is difficult to achieve arthroscopic reduction and fixation. Therefore, open reduction and internal fixation are required. Moreover, The superficial peroneal nerve is at risk for injury because of the proximity of the portals. Therefore, the nick-and-spread technique is important while creating the portals.

Conclusion

In summary, the ankle arthroscopy in the treatment of Herscovici B.C medial malleolus fractures is simple, safe and minimally invasive, and the incidence of postoperative complications is low, which is conducive to improving ankle function. However, this study is a retrospective analysis, and the number of cases is small(21), which needs further confirmation by a large sample and multi-center study. Moreover, the cases were followed up for a short time (8-15months), and there was no evidence of long-term curative effect. However, this surgical method is still a reliable and effective treatment scheme, which is worth popularizing in clinical practice.

Abbreviations

ORIF,open reduction and internal fixation;

AOFAS, American Orthopedic Foot and Ankle Society after foot ankle scoring system;

VAS, visual analog scale;

ROM, range of motion

Declarations

Acknowledgements

Not applicable

Ethics approval and consent participate

This study was approved by the Institutional Review Committee of the First People's Hospital of Jiangxia District, Wuhan City, Hubei Province, China

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Competing interests

The authors declare that they have no competing interests.

Authors' contributions

Yang Jun-Zhong: Made substantial contributions to conception and design,acquisition of data, data analysis, interpretation of data, and preparation of manuscript.

Zhang Jun: Made substantial contributions to conception and design, acquisition of data, and final manuscript review.

WangCheng-lin:Madesubstantialcontributions to conception and Design,interpretation of data, and preparation of manuscript. All authors have read and approved the final data.

Consent for publication

Not applicable.

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Figures

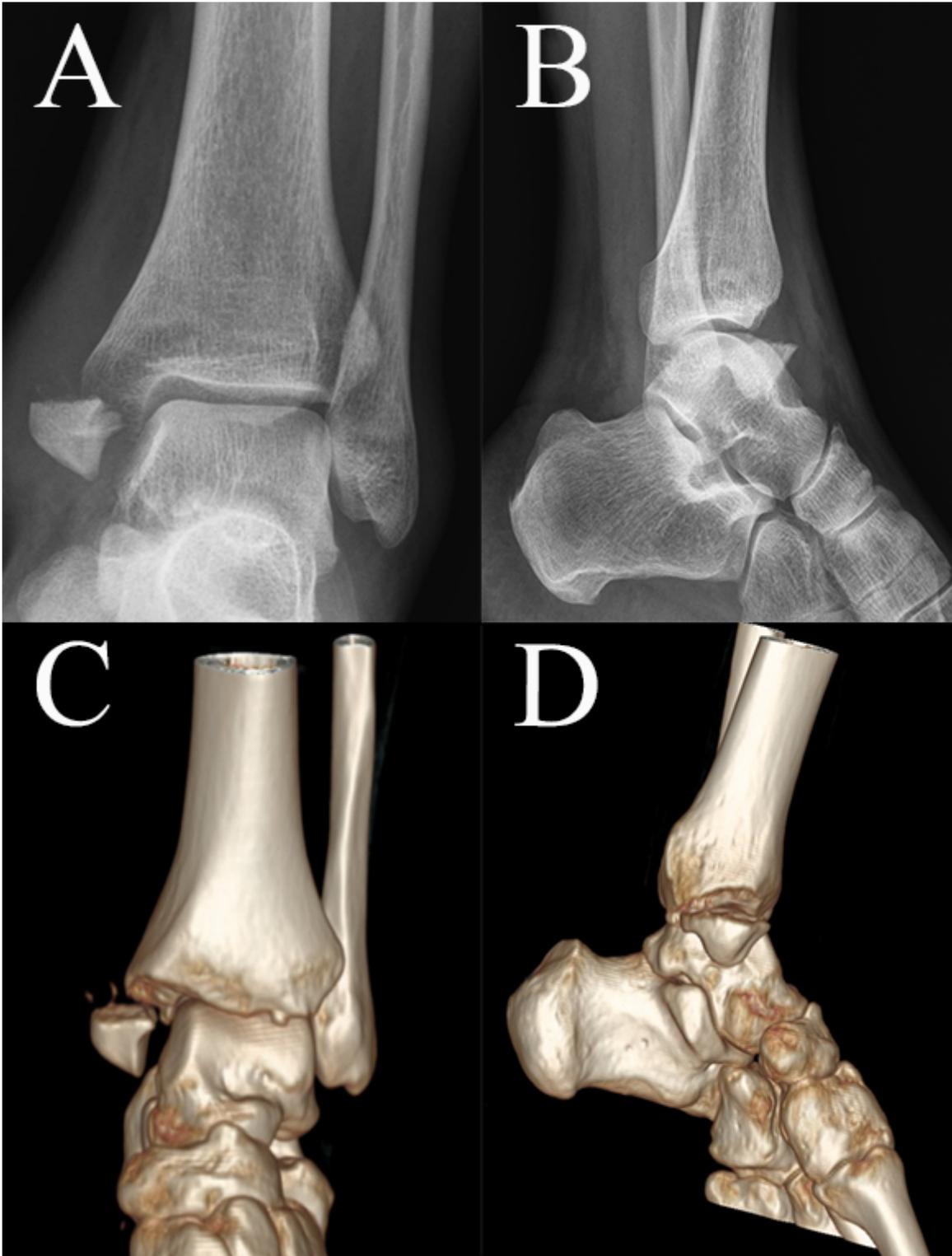


Figure 1

(A,B) Anteroposterior and lateral position of ankle, (C,D) Three -dimensional CT scan of ankle showing Herscovici Type C fracture.



Figure 2

(A.B) Surgical procedures (C.D) Intraoperative fluoroscopy