Observational Study

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Additional table for easier access to ankle fracture

A retrospective study of traditional positioning versus modified positioning

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Abstract

An interest in the fixation of posterior malleolus via the posterolateral approach has gained popularity recently. Most surgeons choose prone or lateral position during the surgery, and this study proposes an additional radiolucent table for easier access to the posterolateral anatomic structure of ankle joint, and compares it with traditional positioning.

From September 2014 to September 2018, 21 patients with trimalleolar fractures and 28 patients with posterior malleolus and fibular fractures receiving open reduction and internal fixation (ORIF) using the posterolateral approach with the utilization of an additional radiolucent table were included in Additional Table group. Patients of matched sex, age, and injury type using the same surgical approach with the traditional positioning were selected from the hospital database and included in the Traditional group. Baseline information and clinical parameters were recorded.

No significant differences existed concerning age, sex, or operative side between the 2 groups in patients with trimalleolar fractures. The time for positioning was significantly longer in the Traditional group (20.5 ± 6.45 minutes) than the Additional Table group (12 ± 3.5 minutes) ($P < .001$). Besides, the operative time in the Traditional group (75.28 ± 5.45 minutes) was significantly longer than the Additional Table group (58 ± 5.95 minutes) ($P < .001$). There was no case of nonunion and malunion in both groups. At 12-month follow-up, the American Orthopedic Foot and Ankle Society Scale (AOFAS) score showed no significant difference between the 2 groups ($P = .46$). In patients with fibular fracture and posterior malleolus fracture, no significant differences existed concerning age, sex, operative side between the 2 groups. The time for positioning was significantly longer in the Traditional group (16.5 ± 3.45 minutes) than the Additional Table group (11 ± 3.5 minutes) ($P < .001$). Besides, the operative time in the Traditional group (55.28 ± 8.45 minutes) was significantly longer than the Additional Table group (44 ± 7.95 minutes) ($P < .001$). There was no case of nonunion and malunion in both groups. At the 12-month follow-up, the AOFAS score showed no significant difference between the 2 groups ($P = .26$).

The novel positioning with an additional table is an excellent choice for trimalleolar fracture, posterior malleolus fracture, with/without distal fibular fracture.

Abbreviations: CT = computed tomography, FHL = flexor hallucis longus, ORIF = open reduction and internal fixation, PITFL = posterior–inferior tibiofibular ligament.

Keywords: additional table, posterior malleolus fracture, posterolateral approach

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1. Introduction

Ankle fracture is a common cause for patients visiting the orthopedic emergency department.[1] The mechanism of injury varies from simple fall onto the ground to high-energy motor vehicle accidents. The fracture patterns also vary according to the different injury mechanisms. A minimally displaced fracture can be treated conservatively with casting, whereas a severely displaced fracture must be treated surgically. As per the indications, both the treatment options show encouraging clinical results, but such treatment strategies are not perfect.[2] Recently, orthopedic surgeons focused more on the indication of surgical treatment of isolated lateral malleolus fracture and the need for the posterior malleolar fracture fixation using a posterolateral approach.[3–5] Most surgeons choose either the prone or lateral decubitus position for the posterolateral approach; however, such positions have certain disadvantages. In this article, we propose a simple solution for easier access in a slightly lateral position with the utilization of an additional radiolucent table for the surgical treatment of ankle fractures.

2. Methods

This study was approved by the ethical committee of Tongji Medical College, Huazhong University of Science and Technology, and written informed consent was obtained from each of the patients. From September 2014 to September 2018, 21 patients with trimalleolar fractures and 28 patients with posterior malleolus and fibular fractures receiving open reduction and internal fixation (ORIF) using the posterolateral approach with the utilization of an additional radiolucent table were included in the Additional Table group. Patients of matched sex, age, and injury type using the same surgical approach with the traditional positioning were selected from Hospital Database, and included in the Traditional group. Radiograph and computer tomography (CT) scan were routinely performed to evaluate the ankle fractures. Patients with serious underlying comorbidities, skin contusion or abrasion, and open fractures were excluded from the study.

2.1. Surgical technique

All the surgeries were performed under spinal anesthesia or general anesthesia without a pneumatic tourniquet. The patient was placed on the operating table in a slightly lateral position (30°–35° between the torso and the table) with a bolster placed underneath the back and buttock. The operating leg was placed in internal rotation with an extension of the hip joint and 90° flexion of the knee joint so that the ankle joint can be put on an additional radiolucent table with the lateral malleolus facing towards the ceiling (Fig. 1). An additional table (100 cm × 75 cm) was placed attached to the operating table so that the operative foot can be put on it and also easily accommodate the image intensifier below the table for intraoperative fluoroscopic imaging.

Figure 2 illustrates the appearance of the operative ankle using this position. During the surgical procedure, the operating surgeon and his assistant remained seated. The image intensifier was placed on the opposite side of the operating surgeon so that it could obtain the fluoroscopic image in anteroposterior (AP) and lateral position without repositioning it (Fig. 3). The standard posterolateral approach was used to expose the posterior malleolus and fibula (Fig. 4). If medial malleolus required fixation, the patient was placed in the supine position by removing the bolster.

Postoperative clinical and functional outcomes of ankle joint were evaluated using the American Orthopedic Foot and Ankle Society Scale (AOFAS) at 12-month follow-up.[6]

The statistical package for social sciences (SPSS 19.0 version; SPSS Inc., Chicago, IL) was used for statistical analysis. The categorical data were analyzed using the Chi-square test, and the continuous data were analyzed using Student *t* test. Fisher exact test was used under those circumstances with fewer subjects in groups of interest. Data were presented as mean ± SD (range), median (range), or n (%). $P < .05$ was considered significantly different.

3. Results

As shown in Table 1, no significant differences existed concerning age, sex, or operative side between the 2 groups in patients with

Figure 1. Appearance of the leg on the additional table.

Figure 2. Appearance of the ankle on the surgical table.

trimalleolar fractures. The time for positioning was significantly longer in the Traditional group (20.5 ± 6.45 minutes) than the Additional Table group (12 ± 3.5 minutes) ($P < .001$). Besides, the operative time in the Traditional group (75.28 ± 5.45 minutes) was significantly longer than the Additional Table group (58 ± 5.95 minutes) ($P < .001$). There was no case of nonunion and malunion in both groups. At the 12-month follow-up, the AOFAS score showed no significant difference between the 2 groups ($P = .46$).

As shown in Table 2, in patients with fibular fracture and posterior malleolus fracture, no significant differences existed concerning age, sex, operative side between the 2 groups. The time for positioning was significantly longer in the Traditional group (16.5 ± 3.45 minutes) than the Additional Table group (11 ± 3.5 minutes) ($P < .001$). Besides, the operative time in the Traditional group (55.28 ± 8.45 minutes) was significantly longer than the Additional Table group (44 ± 7.95 minutes) ($P < .001$). There was no case of nonunion and malunion in both groups. At the 12-month follow-up, the AOFAS score showed no significant difference between the 2 groups ($P = .26$).

4. Discussion

An additional table offers excellent visualization of posterior malleolus and requires a shorter time to prepare for patients'

Figure 3. Intraoperative images of the ankle on additional table.

Figure 4. Preoperative images and postoperative images.

positioning, resulting in less operative time compared with traditional positioning.

Posterior malleolus fractures manifest variable patterns and sizes, including small avulsion and large displaced fragments.[5] The attachment of the posteroinferior tibiofibular ligament (PITFL) to the posterior malleolus plays a vital role in ankle stability. The PITFL is likely to be intact in a large fragment; in such case, anatomic reduction and rigid fixation of the posterior malleolus usually restores the normal alignment and stability of the distal tibiofibular joint requiring no need of syndesmotic fixation.[7]

Anterioposterior (AP) and lateral radiographs alone are not sufficient to assess fracture patterns and their comminution or impaction, and plain films have low inter-observer reliability.[8,9] Several studies advocate the routine use of computed tomography (CT) scan to assess the actual size, shape, and displacement of the posterior malleolus and its relationship with the fibular notch.[8–10] Therefore, a CT scan for ankle fracture is mandatory at our institute.

The fixation of posterior malleolar fractures remains controversial.[11,12] There exists a general consensus that the posterior malleolar fractures comprising over 25% of the articular surface and having >2 mm of displacement require operative fixation. However, available data neither supports nor disproves this notion.[13] In clinical practice, the most important entity is the size of the fracture fragment and the stability of the ankle.[14]

Efforts to obtain an anatomic reduction of posterior malleolus fractures lead to the resurgence of the posterolateral approach in the treatment of trimalleolar fractures. Previously, the high complication rate was reported.[15] However, recent studies disproved this notion with a low incidence of complications, including wound dehiscence and infection.[16] The posterolateral approach, utilizing the interval between the peroneal tendons and the flexor hallucis longus (FHL), offers an adequate visualization and easier fixation of the fragment. This approach also provides the fixation of fibula through the single incision if necessary.

Several authors advocate for the prone position for the posterolateral approach[17,18]; however, it has a disadvantage of difficulty in obtaining intraoperative imaging. Lateral view of the ankle in the prone position often necessitates elevating the ankle then placing it back on the surgical table. This process is not efficient and might lead to inadvertent loss of reduction. Employment of metallic basin to elevate the ankle above the level of the contralateral leg has been proposed by certain surgeons.[19] However, the basin is a radiopaque substance, and AP views are not clear unless it is removed. Certain surgeons even advocated for the application of a radiolucent triangular tool,[19] but it is not easily employed as our proposal. Besides, there was a report that the prone position was associated with a mild reduction in cerebral perfusion and oxygenation in elderly patients.[20] Prone position results in the enhanced pressor response to ephedrine compared with the supine position during general anesthesia.[21]

Lateral position or sloppy lateral position allowing for rotational access to the medial structure has also been used at our institute. But the surgeons have to be in standing position during the procedures, and the lateral fluoroscopic view cannot be obtained without re-positioning the image intensifier, which might compromise the sterility of the surgical site. As for the supine position, it is obviously not an optimal choice for posterior malleolus fixation.

Table 1

Clinical data for patients with trimalleolar fractures.

	Traditional (n=21)	Additional (n=21)	*P* value
Age, y	46.4±7.9	46.3±8.1	.86
Sex, male:female	13:8	13:8	.96
Operated side, left:right	11:10	11:10	.79
Duration from injury to surgery, d	5.2±1.2	5.3±1.4	.76
Duration of surgery, min	75.28±5.45	58±5.95	<.001
Fluoroscopy times	17±11	7±3	<.001
Time for positioning, min	20.5±6.45	12±3.5	<.001
AOFAS scale	93±2.25	94±2.15	.46

AOFAS=American Orthopedic Foot and Ankle Society.

Table 2

Clinical data for patients with fibular and posterior malleolus fracture.

	Traditional (n=28)	Additional (n=28)	*P* value
Age, y	38.4±7.9	38.3±8.1	.69
Sex, male:female	18:10	18:10	.95
Operated side, left:right	15:13	15:13	.98
Duration from injury to surgery, d	4.7±1.2	4.8±1.4	.78
Duration of surgery, min	55.28±8.45	44±7.95	<.001
Fluoroscopy times	15±6	6±2	<.001
Time for positioning, min	16.5±3.45	11±3.5	<.001
AOFAS	93.7±2.8	94.3±2.6	.26

AOFAS=American Orthopedic Foot and Ankle Society Scale.

Nonunion is a serious complication that might be influenced by many factors.[22–25] However, there was no nonunion or malunion in either group, possibly due to the meticulous intraoperative dissection and anatomic reduction.

An additional radiolucent table, such as a wooden table, is easily obtained. Without overlapping the contralateral legs, the AP and lateral views are readily obtained without re-positioning the image intensifier. The additional table provides ample space for the placement of medical instruments, and all the surgeons can perform the surgery comfortably in a sitting position with a clear visualization.

However, this method has some inherent demerits that include: an extra additional radiolucent table is required. If the operating room is not spacious, it isn't easy to put another table in the room; this technique is difficult to perform in patients with hip and knee stiffness, as this technique requires the internal rotation of the operative leg, extension of hip, and flexion of the knee joint; and it is a retrospective study, and the results should be interpreted with caution.

5. Conclusion

The novel positioning with an additional table is an excellent choice for trimalleolar fracture, posterior malleolus fracture with/without distal fibular fracture.

Author contributions

Conceptualization: Bo Liu.
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