Role of Ankle Arthroscopy in Management of Acute Ankle Fracture

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Purpose: To report the operative findings of ankle arthroscopy during open reduction and internal fixation of acute ankle fractures. **Methods:** This was a retrospective review of 254 consecutive patients with acute ankle fractures who were treated with open reduction and internal fixation of the fractures, and ankle arthroscopy was performed at the same time. The accuracy of fracture reduction, the presence of syndesmosis disruption and its reduction, and the presence of ligamentous injuries and osteochondral lesions were documented. Second-look ankle arthroscopy was performed during syndesmosis screw removal 6 weeks after the key operation. **Results:** There were 6 patients with Weber A, 177 patients with Weber B, 51 patients with Weber C, and 20 patients with isolated medial malleolar fractures. Syndesmosis disruption was present in 0% of patients with Weber A fracture, 52% of patients with Weber B fracture, 92% of patients with Weber C fracture, and 20% of the patients with isolated medial malleolar fracture. Three patients with Weber B and one patient with Weber C fracture have occult syndesmosis instability after screw removal. Osteochondral lesion was present in no patient with Weber A fracture, 26% of the Weber B cases, 24% of the Weber C cases, and 20% of isolated medial malleolar fracture cases. The association between the presence of deep deltoid ligament tear and syndesmosis disruption (warranting syndesmosis screw fixation) in Weber B cases was statistically significant but not in Weber C cases. There was no statistically significant association between the presence of posterior malleolar fracture and syndesmosis instability that warrant screw fixation. **Conclusions:** Ankle arthroscopy is a useful adjuvant tool to understand the severity and complexity of acute ankle fracture. Direct arthroscopic visualization ensures detection and evaluation of intra-articular fractures, syndesmosis disruption, and associated osteochondral lesions and ligamentous injuries. **Level of Evidence:** Level IV, case series.

Acute ankle fracture refers to fracture or fracture dislocations of the ankle and is one of the commonest fractures in the lower limb. Anatomical reduction and stable fixation of the fracture proposed by Arbeitsgemeinschaft fur Osteosynthesefrage remains the main stream of treatment.[1] However, the final outcomes in acute ankle fractures are not as good as expected.[2-6] Besides fracture malunion, failure to address the disrupted syndesmosis and associated ligamentous or chondral lesions can be another reason of poor surgical outcome. Preoperative radiographs and intraoperative fluoroscopic stress view have limitations on the diagnosis of syndesmosis disruption.[7-9] Ankle arthroscopy is expected to be a more sensitive and accurate tool to diagnose syndesmosis disruption and other intra-articular pathologies and guide anatomical reduction of the syndesmosis.[10-13] The purpose of this study was to report the operative findings of ankle arthroscopy during open reduction and internal fixation of acute ankle fractures. We hypothesized that ankle arthroscopy would be a useful adjacent tool to fully understand the severity and complexity of the ankle injury. The intra-articular fractures, syndesmosis disruption, and associated intra-articular pathologies can be readily detected and evaluated by ankle arthroscopy.

Methods

This study has gained institutional review board approval in our institution. From January 2004 to June 2012, 254 consecutive patients with acute ankle fractures treated with open reduction, internal fixation, and

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ankle arthroscopy were included in the study. Open reduction, internal fixation of the fractures, and ankle arthroscopy were performed by the 2 authors (K.B.C., T.H.L.) exclusively, and the operative assessments and documentation were standardized. Patients with Pilon fracture, Tillaux fracture, triplane fracture, and physeal fracture were excluded. The fractures were classified according to Danis-Weber classification.[14] Preoperative assessments including radiographs and computed tomogram of both ankles were all evaluated and documented by the first author (K.B.C.). The distal fibular fracture would be fixed anatomically with a one-third tubular plate (Depuy-Synthes) with or without a lag screw across the fracture through the posterolateral approach.[1] Medial malleolar fracture would be temporarily fixed percutaneously with two 1.1-mm guide pins under fluoroscopic guidance. Any concomitant posterior malleolar fracture would also be fixed temporarily with guide pins through the posterolateral approach if it was displaced (>2 mm) and involved more than one-third of the articular surface.[1,15] After the temporary fracture fixation, intraoperative fluoroscopic stress tests (hook test and anterior drawer test) would be performed.[1,16] Ankle arthroscopy (2.7-mm 30° arthroscope) under thigh tourniquet was then performed using standard anteromedial and anterolateral portals without traction.[10,11] The ankle was assessed for (1) fracture reduction especially the medial malleolus[17]; (2) any syndesmosis disruption and any associated tear of the anterior-inferior tibiofibular, interosseous, and posterior-inferior tibiofibular ligaments[10-12]; (3) presence of osteochondral lesion (OCL)[13,18]; (4) status of deep deltoid and anterior talofibular ligaments; (5) any loose bodies; and (6) accuracy of syndesmosis reduction (Fig 1).

If direct arthroscopic visualization found that the intra-articular fracture was malreduced, the reduction was revised.[1] It was fixed with 4.0-mm cannulated screws after anatomical reduction was confirmed arthroscopically. The prevalence of revision fixation would be documented.

The stability of the syndesmosis was then assessed arthroscopically through the anteromedial portal.[12] The syndesmosis was assessed for any frank and occult disruptions by the intraoperative stress test in the coronal plane (classical hook test),[1] sagittal plane, and lastly the transverse (rotational) plane.[16,17] Frank coronal and sagittal syndesmosis instability is defined by 2-mm or more displacement of the lateral malleolus in the coronal (lateral displacement) or sagittal (posterior displacement) plane, respectively. Frank rotational syndesmosis instability (external rotation of the distal fibula) is defined as the displacement of the anterior border of the lateral malleolus at least 2 mm more than the displacement of the posterior border of the lateral malleolus. Occult syndesmosis diastasis in different planes is defined as corresponding to frank disruption in response to applied stress in different planes. Combined frank and occult lesions mean concomitant frank disruption in one plane and occult disruption in another plane.[12] The plane (coronal, sagittal, rotational) and status (frank, occult) of disruption were documented accordingly. At the same time, any tear of the anterior-inferior tibiofibular, interosseous, and posterior-inferior tibiofibular ligaments was recorded. Because the interosseous ligament could not be directly visualized arthroscopically, a probe was passed through the syndesmosis through the anterolateral portal. If it could pass through easily, there was complete disruption of the interosseous ligaments.

Then, the site and size of OCLs with full-thickness cartilage loss over the talus or distal tibial plafond if present were documented.[18] In the presence of OCLs, microfracture would be performed using the microfracture pick. Loose fragments or bodies would be removed. Lastly, the status of the anterior talofibular ligament and the deep deltoid ligament would be assessed and documented.

In case of syndesmosis disruption, it was reduced anatomically under arthroscopic guide and temporarily fixed with a large pelvic reduction clamp.[19,20] The clamp was applied along the axis of syndesmosis. It was stabilized by a 3.5-mm cortical screw through 4 cortices in case of frank disruption and 3 cortices in case of occult disruption.[20-22] The ankle was held in neutral position during the screw fixation.[23]

The syndesmosis screw would be kept for 6 weeks except for Maisonneuve or in another uncommon pattern of distal fibular fracture with an associated fixed posterior dislocation of the proximal fibular fragment being trapped behind the posterior tibial tubercle (Bosworth fracture). In Maisonneuve or Bosworth fracture, because the degree and extent of soft tissue trauma around the syndesmosis is expected to be more severe, the syndesmosis screw was kept for a longer period for syndesmosis healing. The screw was kept for 8 weeks for Bosworth fracture. In case of Maisonneuve fracture, the screw was kept until there was radiographic evidence of healing of the fibular fracture, which usually took approximately 12 weeks. Second-look ankle arthroscopy would be performed by the 2 authors at the time of removal of the syndesmosis screw. Any residual syndesmotic instability would be assessed again by applying manual stress in different planes after the screw was removed. The status of the anterior-inferior tibiofibular, interossei, and posterior-inferior tibiofibular ligaments, deep deltoid and anterior talofibular ligaments, and OCL would be assessed for healing. The severity of scarring at the tibiotalar joint would be documented.

Serial radiographs were taken to assess fracture healing, status of the syndesmosis, and ankle