

Intra-Articular Block Compared with Conscious Sedation for Closed Reduction of Ankle Fracture-Dislocations

A Prospective Randomized Trial

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Background: Ankle fracture-dislocations require urgent reduction to protect the soft tissues, to minimize articular injury, and to allow swelling to decrease. Conscious sedation is commonly used to provide analgesia for closed reduction of this injury. We hypothesized that an intra-articular block of the ankle would provide similar analgesia and the ability to reduce the ankle with a lower risk than conscious sedation.

Methods: Between September 2005 and January 2007, forty-two patients with an ankle fracture-dislocation presented to our emergency department and were enrolled in a prospective randomized study. The patients were given either conscious sedation or an intra-articular lidocaine block for the reduction and for the application of a plaster splint. After the reduction maneuver, the patients used a visual analog pain scale to rate the level of pain before, during, and after the procedure, from 1 (no pain) to 10 (severe pain). The senior authors reviewed the injury and reduction radiographs to confirm the reduction of the ankle joint.

Results: Twenty-one patients were randomized to each group. There was no difference in demographic data or fracture patterns between the groups. Both the sedation and the block reduced the pain to a similar degree. The pain reduction (the initial pain level minus the level of pain after medication was given or injected) was an average (and standard deviation) of 4.6 ± 3.3 for the block group and 4.2 ± 3.5 for the sedation group ($p = 0.64$). The average change in the level of pain between the initial presentation and during the reduction was 3.6 ± 3.8 for the block group and 4.1 ± 3.3 for the sedation group. Overall, there was no difference in analgesia provided by these two methods ($p = 0.71$). An acceptable reduction was achieved for forty-one of the forty-two patients with one failure in the sedation group. The average time for ankle reduction and stabilization in a splint was 81.5 minutes for the sedation group and 63.8 minutes for the block group.

Conclusions: Compared with conscious sedation, an intra-articular lidocaine block provides a similar degree of analgesia and sufficient analgesia to achieve closed reduction of ankle fracture-dislocations.

Level of Evidence: Therapeutic Level I. See Instructions to Authors for a complete description of levels of evidence.

Most ankle fractures are often the result of low-energy rotational injuries. With greater fracture-displacement, the talus may dislocate from beneath the tibia. When this occurs, the first step in management is to reduce the ankle joint. This is important because ankle dislocations may compromise vascularity to the foot, lead to pressure ischemia of the skin, and increase articular injury to both the talus and

the tibia¹. In addition, reasonable reduction improves patient comfort and allows soft-tissue swelling to resolve if fixation is delayed.

Reduction involves distal traction applied to the foot with forces directed to guide the talus beneath the distal end of the tibia. The reduction is maintained in a splint. Patients generally require analgesia for this procedure. Most com-

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Fig. 1
Clinical photograph demonstrating the area of intra-articular local anesthetic injection between the tibialis anterior tendon (straight line) and the medial malleolus.

monly, emergency physicians use a combination of narcotics and benzodiazepines to provide conscious sedation. These medications can induce respiratory depression and seizures and therefore require cardiorespiratory monitoring following their administration². This adds time and cost to the procedure as well as the reliance on other physicians and emergency staff to assist with the reduction³.

A hematoma block, with lidocaine, offers an alternative or adjunct to parenteral sedatives and analgesics. Several studies have investigated the safety and efficacy of this technique²⁻⁹. The majority of them focused on distal radial fractures and glenohumeral joint dislocations. None of those studies demonstrated a substantial infection risk or cardiac toxicity from the lidocaine.

To date, we could find only one retrospective study that had investigated the use of an intra-articular hematoma block for the reduction of ankle fracture-dislocations⁴. On the basis of our experience and a review of the literature, we hypothesized that an intra-articular block of the ankle would provide sufficient analgesia to allow successful closed reduction of an ankle fracture-dislocation compared with the use of conscious sedation.

Materials and Methods

After obtaining approval from our institutional review board, we instituted a prospective randomized trial to determine whether an intra-articular block provides a level of analgesia similar to conscious sedation. Between September 13, 2005, and January 30, 2007, forty-two consecutive, skeletally mature patients who sustained an ankle fracture-dislocation

(defined as complete dissociation of the talus and the tibia) were enrolled in this study. Patients with an open fracture, neurovascular injury, or an ipsilateral lower-extremity fracture were excluded from this study. After providing informed consent, the patients were randomized (with use of a sealed envelope method, with forty-two prenumbered opaque envelopes randomly chosen and marked either "sedation" or "local") to either conscious sedation or an intra-articular block for the reduction maneuver and the application of a splint. The medications used for conscious sedation were not uniform and were based on the discretion of the treating emergency-department physician. In all cases, they included a combination of benzodiazepines and narcotics (propofol, Versed [midazolam], morphine, or fentanyl). The ankle block consisted of 12 mL of 1% lidocaine, without epinephrine, injected with use of sterile technique into the ankle joint.

For the intra-articular injection, the patient was placed supine and the affected ankle was prepared with Betadine (povidone-iodine) solution. A 20-gauge needle was inserted into the medial aspect of the ankle joint, medial to the tibialis anterior tendon with use of sterile technique (Fig. 1). Once the joint was penetrated and hematoma was aspirated, confirming appropriate placement of the needle, the joint was injected with 12 mL of 1% lidocaine without epinephrine.

Following the administration of conscious sedation or the intra-articular block, a junior orthopaedic surgery resident, with indirect supervision by the attending surgeon, reduced the ankle fracture-dislocation and immobilized the ankle in a splint. Anteroposterior, lateral, and mortise radiographs were then made to confirm the reduction. If a reduction was not

TABLE I Comparison of Fracture Patterns, Pain Scores, and Time for Reduction in the Groups

	Block (N = 21)	Sedation (N = 21)
Average age (yr)	44	47
Fracture pattern (no. of ankles)		
Weber type B	11	11
Weber type C	10	10
Supination-external rotation type	13	14
Pronation-external rotation type	8	7
Repeat reductions (no. of ankles)	6	2
Average pain score before reduction	9.2	9.3
Average pain score after reduction*	3.6	4.1
Average time for reduction† (min)	63.8	81.5
Average rating of difficulty of reduction	4.1	4.1

*The difference between groups was not significant ($p = 0.71$).
†The difference between groups was not significant ($p = 0.43$).

achieved, the reduction maneuver was repeated until the talus was reduced.

Once there was radiographic confirmation of ankle mortise reduction, the patient completed a standard questionnaire pertaining to his or her experience. This tool included a visual analog pain scale to estimate pain from 1 (none) to 10 (severe) both before and after the procedure. The treating resident then completed the remainder of the questionnaire, recording the time at which the consultation was requested and the time when the fracture-dislocation was reduced and the splint had been applied. The fracture was classified with use of the Weber and Lauge-Hansen classification systems, and the direction of the dislocation was noted. If conscious sedation was used, the amounts and types of medications were noted. The resident graded the ease of the reduction on a scale from 1 to 10 (the most difficult), and the number of attempts that were required to achieve a satisfactory reduction were recorded.

The quality of the reduction, the fracture classification, and the direction of dislocation were confirmed on a retrospective review of radiographs by two of us (N.C.T. and K.A.E.). We used the Student *t* test to compare the data between the groups and the Student paired *t* test to analyze the data within each group. To estimate the number of patients required for the study, the difference sought between pain levels was set at 3 points. To achieve a power of 80%, twenty patients would be needed in each group to show a significant difference in pain between the groups.

Results

Twenty-one patients were randomized to each group. The average age of the patients was forty-seven years (range, twenty-four to seventy-nine years) in the sedation group and forty-four years (range, twenty-two to seventy-six years) in the

block group. There were five men and sixteen women in the sedation group and eleven men and ten women in the block group. The distribution of Weber type-B and type-C fractures (eleven Weber type-B and ten Weber type-C fractures in each group) and supination-external rotation fractures (fourteen in the sedation group and thirteen in the block group) was similar. All dislocations were lateral or posterolateral. There were no medial fracture dislocations. The fracture patterns and pain levels are detailed in Table I.

Both groups had patients who required more than one attempt to reduce the ankle fracture-dislocation. This occurred in two of the twenty-one patients in the sedation group and six of the twenty-one patients in the block group. While this difference appears to be clinically important, it was not significant ($p = 0.15$). In the sedation group, one fracture-dislocation was successfully reduced on the second attempt after the administration of additional medications, while the other fracture-dislocation failed three attempts at closed reduction. Each successive attempt in the patient required additional medication. The injury in this patient was a Weber type-B, supination-external rotation type-4 fracture pattern with a large posterior malleolar fragment. Ultimately, general anesthesia, administered in the operating room, was required to allow reduction of the fracture-dislocation, which was then stabilized in an external fixator until the swelling resolved to allow for definitive surgical management. In the block group, all six fracture patterns that required repeat reduction attempts (four required a second attempt and two needed a third attempt) were supination-external rotation Weber type-B fractures. This difference in the two groups in the number of repeat reductions was not significant.

The average rating (and standard deviation) given by the residents for the ease of reduction was 4.1 ± 0.5 for both the sedation and block groups ($p = 0.95$).

The average duration for the reduction and stabilization of the ankle in a splint was 81.5 ± 17.2 minutes for the sedation group and 63.8 ± 14.3 minutes for the block group. This difference was not significant ($p = 0.43$).

Data from the portion of the questionnaire completed by the patients showed that both the block and sedation provided similar degrees of analgesia. The initial or baseline pain levels were an average of 9.2 ± 2.1 for the block group and 9.3 ± 2.4 for the sedation group. The average reduction in pain before the reduction was performed (initial pain minus level of pain after medication was given or injected) was 4.6 ± 3.3 ($p < 0.0001$) for the block group and 4.2 ± 3.5 ($p < 0.0001$) for the sedation group. There was no significant difference in these values ($p = 0.64$). The two techniques also provided similar degrees of analgesia for the reduction maneuver. We assessed this by comparing the difference between the initial pain and the pain felt by the patient during the reduction maneuver. The average difference was 3.6 ± 3.8 for the block group and 4.1 ± 3.3 for the sedation group ($p = 0.71$). The difference between the pain level at the time of initial presentation and that after sedation or after injection was significant ($p < 0.001$ for the sedation group and $p < 0.0002$ for the block group). There

were no medical complications related to the injection of local anesthetic or to the administration of intravenous medications in this study.

Discussion

Previous studies have demonstrated the efficacy of a hematoma block as an alternative or adjunct to parenteral sedatives and/or narcotics. The majority of those studies have focused on Colles fractures and glenohumeral dislocations. They have shown that hematoma blocks safely provide a similar degree of analgesia for performing reductions. Infections resulting from this procedure have not been reported²⁻⁹.

In 2002, Miller et al., in a prospectively randomized study of glenohumeral dislocations, compared the reduction with sedation and the reduction with an intra-articular lidocaine block and demonstrated both the safety and effectiveness of the intra-articular block³. As well, they showed that the patient stay in the emergency department was significantly shorter with the lidocaine block ($p < 0.01$). At their institution, the average cost of anesthesia per patient was \$97.64 for the intravenous sedation group compared with \$0.52 for the lidocaine group. This difference in cost reflected the need for nursing and cardiorespiratory monitoring in the sedation group.

We could identify only one study that had investigated the application of an intra-articular block to ankle fracture-dislocations. Alioto et al. retrospectively assessed patient comfort when an intra-articular block was used as an adjunct to parenteral medications⁴. They found that patients who had received the block were more comfortable than those who had received parenteral medications alone. At an average of twelve months after the procedure, the patients were contacted by telephone and were asked questions to determine their impression of the procedure. The authors reported less pain in the patients who had received the block and no associated side effects. They recognized the preliminary nature of the study.

Our study is the first, as far as we know, to prospectively randomize patients to reduction with conscious sedation or to reduction with only an intra-articular block. The patient cohorts and injury patterns were similar in both groups. Both the block and conscious sedation reduced pain to a similar degree, and both allowed the treating physician to safely and successfully reduce the ankle fracture-dislocation in most (forty-

one) of the forty-two patients. No significant difference was found in the number of repeat reductions required, or the ease of reduction, and the time required to reduce the ankle and place it in a splint was similar in the two groups. It must be noted that the number of repeat reductions needed was higher in the block group (six compared with two in the conscious sedation group), and this number is clinically important, although we found no significant difference. In light of this, in a supination-external rotation type of injury, one must be certain to achieve a good reduction using the block technique, as all our repeat reductions were in patients with this injury pattern.

The limitations of our study include a small sample size and the fact that the sedation group received various non-uniform combinations of benzodiazepines and narcotics. In our institutions, emergency department physicians provide conscious sedation, different physicians utilize different medications, and the level of achieved sedation probably varies. We believe that comparing a uniform intra-articular hematoma block and a nonuniform sedation technique represents a model that more closely resembles that which is seen in practice. With regard to the time difference noted with the two techniques, the time for reduction included the time from the consultation to the final reduction. This time may be affected by various factors, including how busy the emergency department is and the response time of the orthopaedic surgeon. During the study period, no delays were recorded.

Compared with conscious sedation, an intra-articular lidocaine block provides a similar degree of analgesia and sufficient analgesia to achieve successful closed reduction of an ankle fracture-dislocation with minimal medical risks. It is a safe and reasonable alternative to conscious sedation. ■

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