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CURRENT FEATURES

How to Confirm Ankle Joint Penetration

by Michael Austin Johnson, MD, PhD; Nir J. Harish, MD, MBA & Peter Pryor, MD on September 8, 2013

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Suspicious lacerations should be investigated, even if the X-ray is normal. A step-by-step pictorial guide.

It is a busy Friday evening in the emergency department when you get called to the resuscitation bay for a 14-year-old female who was the restrained back seat passenger in a rollover motor vehicle crash. After a quick call to your significant other to ensure that your daughter is safe in bed, you proceed to evaluate this young patient. You are once again amazed by modern safety technology with the minimal amount of head, torso and abdominal trauma on this patient. After a thorough initial inspection you find that the patient has a large laceration to the lateral side of her left ankle, and swelling that suggests either a fracture or a severe sprain or dislocation. You do note that the laceration is directly over the ankle, and make a note that you will need to determine if that is an “open ankle” once you ensure there are no other life threatening emergencies. You order a set of ankle x-rays with the rest of your trauma work up and give the patient a dose of pain medications prior to shipping her off to get imaging.

Once the patient return from her x-rays you are relieved to see there’s no fracture, and you wonder if this could simply be a bad sprain with an overlying laceration. Can this laceration just be irrigated and closed in the emergency department, or do you some other service to weigh in?

Open ankle fractures are relatively common in trauma centers around the country. The majority of emergency physicians are comfortable taking care of these patients; they need IV antibiotics, immobilization, and urgent orthopedic evaluation. On the other hand, there is relatively little data on open ankle sprains (termed Severe Open Ankle Sprain – SOAR), and open ankle dislocations sustained without a fracture. The majority of these injuries continue to be case reportable, with the larger studies numbering in the teens of patients. From the few case reports and case control studies currently in the literature the majority of these injuries are the result of motor vehicle accidents and occur in the setting of significant plantar forces. Approximately two thirds of SOARs occur with the laceration on the lateral aspect of the ankle. In order to diagnose a SOAR or open ankle dislocation, the patient must have no fractures on x-ray, and the laceration must be confirmed to communicate with the joint space.

In order to determine if the laceration communicates with the joint space you need to perform a saline challenge test or a methylene blue challenge test. These procedures are virtually identical, except that the methylene blue challenge includes a small amount of methylene blue in the saline in order to aid in the visualization of fluid exiting the laceration. The approach to the methylene blue challenge of an ankle is very similar to an arthrocentesis to evaluate for a septic joint, but once the joint has been entered with a needle a dilute solution of methylene blue is injected into the ankle joint to see if it exits through the laceration.

The supplies needed to perform this procedure are:

- Sterile gloves

- Sterile drape
- Betadine or chorhexidine to create a sterile field
- Methylene blue vial (sterile)
- 500cc normal saline (sterile)
- 1% Lidocaine
- 20cc syringe
- 10cc syringe
- 18 gauge needle
- 20 gauge needle
- 27 gauge needle


fig 1: Identifying the medial maleolar sulcus

Procedure

In order to prepare the fluid for instillation into the ankle, 2mL of methylene blue should be added to 500cc of sterile normal saline. Methylene blue that is instilled into a joint space without dilution causes a significant inflammatory reaction, so it is imperative to dilute this solution well. Only a small amount of methylene blue is required to create a solution that is easily distinguished from normal body fluids.

The second step is to identify the appropriate landmarks on the ankle. The ankle joint is actually made up of two joints, the “true” ankle joint is a mortise joint made up of the talus articulating with the fibula laterally and the tibia medially, while the subtalar ankle joint is the result of the talus articulating with the calcaneus. The traditional approach to the ankle joint is through the medial maleolar sulcus, which is the depression between the talus and tibia bordered medial by the medial malleolus and laterally by the anterior tibial tendon (image 1). This area can more easily be identified if the patient is able to dorsiflex the foot, causing the anterior tibial tendon to become more prominent.

A second approach to identifying the medial maleolar sulcus is by using ultrasound localization. This is most helpful in patients with either a large amount of soft tissue overlying the ankle, or in patients with significant swelling obscuring the sulcus. A linear high frequency probe can be placed longitudinally over the medial side of the distal end of the tibia. Moving the transducer towards the foot allows visualization of the joint space between the tibia and talus (image 2). Using the ultrasound allows for the tendons and blood vessels to be easily identified and avoided. Ultrasound localization can be performed with subsequent marking of the skin prior to prepping and draping the patient’s ankle in a sterile fashion.

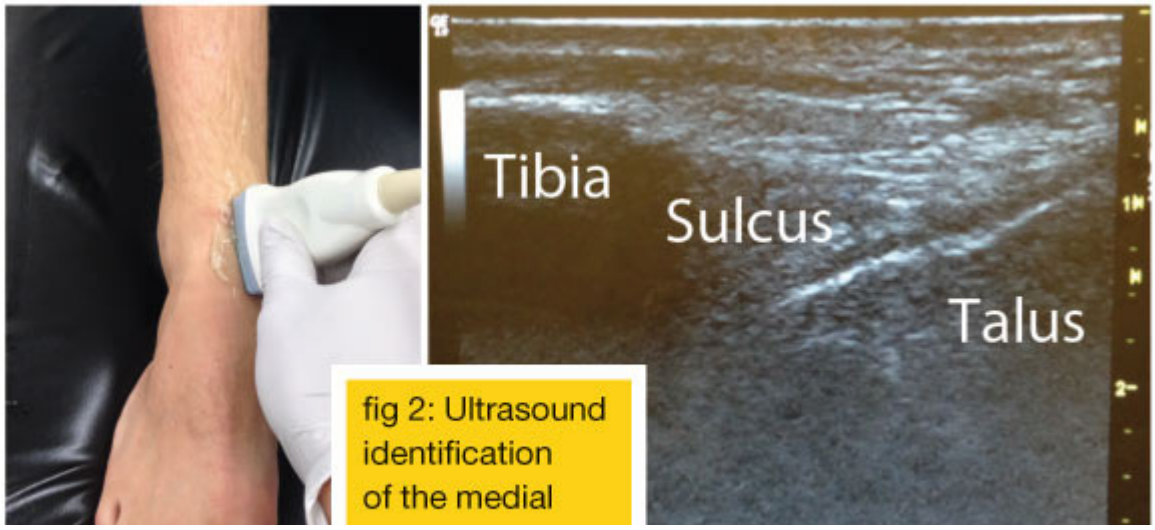
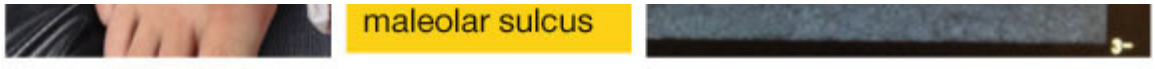


fig 2: Ultrasound identification of the medial

Once the appropriate anatomic location has been identified and the methylene blue solution has been prepared, place the patient’s ankle in slight plantar flexion. This will open up the joint space between the tibia



and talus. Sterilely prep and drape the patient's ankle with either betadine or chlorhexidine leaving a clear view of the laceration. The placement of several clean 4x4s or a white drape below the laceration will make it easier to identify any methylene blue exiting the wound. Create a sterile field on a mayo stand and place all the remaining required equipment on the sterile field.

Local anesthesia is obtained by injecting approximately 2-5mL of 1% lidocaine subcutaneously over the medial maleolar sulcus. If the patient is young or is already having significant amounts of pain, IV pain medications may help the patient relax, giving the practitioner the best chance at accessing the ankle joint on the first attempt.

While waiting for local anesthesia to occur, the 20cc syringe should be filled with the sterile methylene blue/saline solution. This can either be performed by having an assistant hold the normal saline bottle at an angle while filling the syringe using an 18 gauge needle, or by pouring the contents of the normal saline bottle into a sterile bowl filling the 20cc syringe. Ensure that there is no methylene blue on the syringe or on your sterile gloves so that the sterile field is not contaminated with blue fluid prior to injection of the joint space. The next step is to obtain access to the joint space. Using the pre-identified landmarks, insert a 20 or 22 gauge needle medial to the anterior tibial tendon aiming just lateral of the medial malleolus. The joint space lies 2-3 centimeters posterior to the skin in a normal adult. Confirmation of entry into the joint space occurs when a small amount of synovial fluid can be easily withdrawn into the syringe. Under normal circumstances, synovial fluid is straw colored, but as this is being mixed with your methylene blue solution it may be difficult to determine the color of the fluid. The return of any fluid should ensure that you are in the ankle joint. An alternative option is to use a 20 gauge angiocatheter. A similar approach is used to access the ankle joint and once the angiocather is in the joint space the needle can be withdrawn with the angiocather left in place.


fig 3: Injecting the joint with dilute methylene blue


fig 4: Blue fluid is seen extravasating from the wound

Once in the joint space, 20cc's of fluid is injected, while carefully watching for any blue fluid extravasating from the laceration. Any presence of methylene blue is an indication that the laceration communicates with the joint space. As soon as methylene blue is noted from the laceration no further fluid should be injected into the joint space, as this can be quite uncomfortable. If no methylene blue is seen, and there is a high suspicion of communication with the joint, the needle can be withdrawn and the ankle can be plantar and dorsi-flexed, which may allow fluid to more easily drain from the laceration. The use of a 20g angiocather is useful if this is planned, as the ankle can be ranged with the angiocatheter in place without the fear of damaging any joint structures. If the methylene blue challenge is negative, the methylene blue should be removed from the joint space, either by reinserting the needle into the joint space, or simply by removing it from the joint space through the angiocather.

The Case

In the case of the 14 year old female, as noted in the image, methylene blue did drain from the laceration, confirming that the laceration communicated with the joint space. The patient was diagnosed with an open ankle sprain, and orthopedics were consulted for further management. The patient was consented for surgery and taken to the operating room for further exploration of her laceration. Her ankle joint was copiously irrigated prior to closure of the laceration. Following her procedure the patient was placed on PO antibiotics, and was

followed in the orthopedic clinic with good outcome.

Dr. Michael Austin Johnson MD, PhD and Nir J. Harish MD, MBA are 4th year EM Residents at the Denver Health Emergency Medicine Residency Program. Dr. Peter Pryor is an Attending Physician at Denver Health and Assistant Professor of EM at the University of Colorado School of Medicine.

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