Does the anteromedial or anterolateral approach alter the rate of joint puncture in injection of the ankle?

A CADAVER STUDY

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Injection or aspiration of the ankle may be performed through either an anteromedial or an anterolateral approach for diagnostic or therapeutic reasons. We evaluated the success of an intra-articular puncture in relation to its site in 76 ankles from 38 cadavers. Two orthopaedic surgical trainees each injected methylene blue dye into 18 of 38 ankles through an anterolateral approach and into 20 of 38 through an anteromedial. An arthrotomy was then performed to confirm the placement of the dye within the joint.

Of the anteromedial injections 31 of 40 (77.5%, 95% confidence interval (CI) 64.6 to 90.4) were successful as were 31 of 36 (86.1%, 95% CI 74.8 to 97.4) anterolateral injections. In total 62 of 76 (81.6%, 95% CI 72.9 to 90.3) of the injections were intra-articular with a trend towards greater accuracy with the anterolateral approach, but this difference was not statistically significant (p = 0.25). In the case of trainee A, 16 of 20 anteromedial injections and 14 of 18 anterolateral punctures were intra-articular. Trainee B made successful intra-articular punctures in 15 of 20 anteromedial and 17 of 18 anterolateral approaches. There was no significant difference between them (p = 0.5 and p = 0.16 for the anteromedial and anterolateral approaches, respectively). These results were similar to those of other reported studies. Unintended peri-articular injection can cause complications and an unsuccessful aspiration can delay diagnosis. Placement of the needle may be aided by the use of ultrasonographic scanning or fluoroscopy which may be required in certain instances.

Injection or aspiration of the ankle is performed routinely by orthopaedic surgeons, rheumatologists and general practitioners for diagnostic and therapeutic indications. Aspiration of a joint effusion for sepsis or the management of arthritis and injections of a variety of therapeutic agents including corticosteroids and hyaluronic acid form part of the assessment and the treatment of pain caused by arthritis. Even in experienced hands a proportion of intra-articular punctures are unsuccessful. Our aim was to assess the frequency of successful intra-articular injections associated with two different techniques of puncture of the ankle.

Materials and Methods

We studied 76 ankles (38 right and 38 left) from 38 cadavers with a mean age of 76 years (59 to 98) which had been preserved using the method of Thiel. This unique embalming procedure was developed over a period of 30 years in the Department of Anatomy in the University of Graz, Austria. It preserves tissue colour and consistency as well as allowing an almost full range of movement at articular joints. Limbs which had physical signs of arthritis, evidence of trauma or other pathological changes were excluded. Pathological skeletal changes were detected using plain radiography. Two orthopaedic surgical trainees (A and B) were chosen to perform the injections into the ankle. Each undertook 38 punctures with 18 ankles punctured through an anteromedial and 20 through an anterolateral approach. Using a 14-gauge needle mounted on a 5 ml syringe, approximately 1 ml of methylene blue dye was instilled into each joint. An arthrotomy was then performed and the location of the injected dye recorded in each case. The absence of the dye within the joint was regarded as a failure. For the anteromedial approach, the space between the anterior border of the medial malleolus and the medial border of the tendon of the tibialis anterior was identified and the tibiotalar articular palpated. The needle was then inserted in a posterioromedial direction, aiming for the medial gutter of the ankle as the identified space. In the anterolateral approach, the needle was
inserted into the space lateral to the tendon of extensor digitorum longus at the level of the joint, in a postero medial direction. Forced plantar flexion of the foot placed the dorsal cutaneous branch of the peroneal nerve under tension, making it visible and hence facilitated its avoidance.

Statistical analysis. The proportion of successful injections was reported as a percentage with the 95% confidence interval (CI). Fisher's exact test was used to analyse the data. A p-value ≤ 0.05 was considered to be statistically significant.

Results
Of the injections through the anteromedial approach 31 of 40 (77.5%, 95% CI 64.6 to 90.4) were successful as were 31 of 36 (86.1%, 95% CI 74.8 to 97.4) anterolateral injections. In total 62 (81.6%, 95% CI 72.9 to 90.3) of the injections were intra-articular with a trend towards greater accuracy with the anterolateral approach, but this difference was not statistically significant (p = 0.16 for the anteromedial and p = 0.5 for the anterolateral approach).

In the anteromedial approach nine of 40 injections were intra-articular. Trainee B made successful intra-articular punctures in 15 of 20 anteromedial and 17 of 18 anterolateral approaches. There was no significant difference between them (Fisher's exact test, p = 0.5 for the anteromedial and p = 0.16 for the anterolateral approach).

In the anteromedial approach nine of 40 injections were in the soft tissues. In these cases the dye was located within the tendon sheath of tibialis anterior, superficial to the joint capsule and deep to the superficial fascia of the medial malleolus. In the anterolateral group five of 36 injections were extra-articular and tended to be either within the tendon sheath of extensor digitorum longus or superficial to the joint capsule. We did not observe any injection of the dye into a tendon or into either the long saphenous vein or the anterior tibial artery.

Discussion
Accurate placement of an intra-articular puncture is important for the aspiration of joint fluid for diagnostic purposes and for the instillation of drugs.9 The intra-articular placement of hyaluronic acid and corticosteroids is associated with improvement in the symptoms of degenerative and inflammatory joint disease.13,14,16 Unintended periarticular injection of steroids is associated with complications and these have been reported in the literature. Ford and DeBender13 described a series of 15 tendon ruptures, including one of the tendon of tibialis anterior, subsequent to injection of a depository steroid in or around the tendons. Gottlieb and Riskin10 also described ruptures as well as a bowstring deformity of a finger after treatment by injection of local corticosteroid for psoriatic tendonitis of a flexor tendon. Periarticular calcification is known to be associated with the use of triamcinolone hexacetonide and prednisone.17-19 We are aware of only two studies which have explored the rate of success in injection of the ankle. Lopes et al20 in a recent clinical study in patients with rheumatoid arthritis showed that 77% of injections were intra-articular in 54 ankles, although it was unclear which technique had been used. An intra-articular injection was associated with improved pain scores. Jones et al21 injected nine ankles and found that three of these punctures were extra-articular. Again the technique was not discussed in this study. In our study we injected 76 ankles and found that 82% of the injections were intra-articular. The choice of injection portal did not make a significant difference to the rate of intra-articular puncture which was unsuccessful in 18% of cases, comparable with the findings of previous studies.

The accurate intra-articular placement of needles can be difficult even in experienced hands. The aspiration of synovial fluid is a clear indicator of correct placement of the needle, but this is not possible when the joint has minimal synovial fluid. In these cases insufflation of the joint with physiological saline and subsequent aspiration may confirm placement of the needle but even this method cannot be relied upon in every case.20 The position of the needle can also be confirmed by fluoroscopy, but this requires the injection of contrast media and exposure to ionising radiation.21 An alternative is the use of ultrasonography with air as the contrast medium to allow real-time visualisation of intra-articular placement of the needle.22 A study by Reach et al23 showed an accuracy of 100% with intra-articular injection using ultrasonographic guidance. This method avoids the use of ionising radiation, but is technically demanding especially in smaller joints.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References


