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## Intravenous Regional Anesthesia for Surgery on the Foot and Ankle

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In 1908, Bier reported 134 cases using iv regional anesthesia for upper extremity surgery with no significant untoward effects.<sup>1</sup> Similar reports appeared during subsequent years. In 1963, Holmes improved the technique by varying the drug and the site of injection and by using a more sophisticated tourniquet.<sup>2</sup> He reported 30 patients and advocated regional iv anesthesia for injuries and surgery of the upper and lower extremity. Since then, further modification has occurred, and regional iv anesthesia has been used successfully for elective surgery of the extremities and for the treatment of fractures and dislocation of the upper extremity and occasionally the lower extremity.<sup>3-6</sup>

We report our experience with regional iv anesthesia for surgery of the foot and ankle.

### METHODS

Forty adult patients, ASA physical status I-III, scheduled for elective outpatient surgery of the foot and ankle, indicated during the preanesthesia interview their preference for regional anesthesia. The technique was described to each patient, and it was stressed that it could be abandoned in favor of general anesthesia at any time upon request. The patients, having fasted for 8-12 h, arrived at the ambulatory surgical unit 1-2 h before surgery.

After an iv line was established in an upper extremity, most patients received 0.05-0.15 mg of fentanyl and 2-5 mg of diazepam slowly iv for sedation. A standard adult arterial arm tourniquet was placed around the patient's calf, at its widest circumference, and at least 3 inches below the head of the fibula. A standard arterial thigh tourniquet was applied at the midpoint of the thigh. Both cuffs were connected by a Y-tubing to an oxygen-powered Zimmer® variable pressure inflation regulator. Two separate pressure regulators would add to the safety of the procedure, but since two regulators were not always available, we occasionally used a single regulator. A 22-gauge plastic

needle was inserted into a vein on the dorsum of the foot or into the greater saphenous vein at the ankle. After securing the needle, an injection site adapter was inserted into the needle hub.

The leg was elevated, an Esmarch bandage was used to exsanguinate the extremity, and the calf tourniquet was inflated to 300 mmHg. The thigh tourniquet was not inflated but was used as a "back-up" tourniquet. The leg was lowered to the operating table, and a test dose of 10 ml 0.5% lidocaine was injected. The patient was observed for 1 min for signs of systemic toxicity before the remainder (30-40 ml) of the lidocaine was injected. The dose of lidocaine was based upon the size of the limb rather than the patient's weight. We felt that the size of the limb was more relevant than the total body weight in predicting the dose of drug required to attain adequate anesthesia.

The iv needle was removed, and the extremity was surgically prepared. During the 10 min after the lidocaine injection, adequacy of anesthesia was tested, and if anesthesia was inadequate, another 5 min was allowed. Inadequate anesthesia after 15 min constituted block failure.

At the completion of surgery and application of the dressing, the tourniquet was deflated for 20 s, then reinflated for 1 min. This procedure was repeated three to four times while the patient was observed for signs of local anesthetic toxicity.

### RESULTS

Satisfactory anesthesia usually was achieved within 8-10 min; patients with large or muscular legs (judged by subjective and experienced observation), however, required 12-15 min before adequate anesthesia was achieved. In one patient, the foot became pink 5 min after the injection of lidocaine, and the thigh tourniquet was immediately inflated. In this patient, the tourniquet had slipped distal to the widest circumference of the calf, resulting in incomplete arterial occlusion. The procedure was completed with general anesthesia.

The patients tolerated the calf tourniquet, and only four required further sedation. Thirty-one patients stated that they were aware of its presence and described it as "uncomfortable" but not "intolerable." Twelve patients stated that they could feel pressure sensations at the surgical site, but none complained of surgical pain.

There were no complications related to the venipuncture site or the tourniquet. During and after release of the tourniquet, two patients experienced transitory dizziness. There were no other signs of central nervous sys-

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tem or cardiovascular toxicity. Recovery room stay for these patients was 30–60 min. All patients who had successful blocks (39) stated that the anesthesia experience was not unpleasant and that iv regional anesthesia was preferable to general anesthesia.

#### DISCUSSION

Numerous reports in the literature attest to the safety and reliability of iv regional anesthesia, although few discuss its application in the lower extremity. Holmes<sup>2</sup> and Bell *et al.*<sup>7</sup> mention anesthesia for lower-extremity procedures. Details of their respective techniques, their success rates, and the incidence of complications were not discussed. Recently, Lehman and Jones<sup>8</sup> reported 58 consecutive patients with fractures or recent injuries of the lower extremity at or below the knee. An arterial thigh tourniquet was used with a dose of 3.3 mg/kg of 0.25% lidocaine. Fifty-one of 58 anesthetics were judged satisfactory, and no serious complications were encountered. The authors did not speculate as to the cause of their failures.

In our report iv lidocaine anesthesia was used for patients undergoing elective podiatric surgery. The calf tourniquet limits surgery to those procedures at or below the ankle and was selected for two reasons: the dose of lidocaine necessary to produce adequate anesthesia (250 mg) would be well within safe range<sup>9</sup>; and a calf tourniquet is more comfortable than a thigh tourniquet. The calf tourniquet appears to be safe as long as it is placed at least 3 inches below the head of the fibula to avoid peroneal nerve compression. Although the double-tourniquet technique for upper-extremity procedures affords excellent patient comfort, its trial on the lower extremity failed. Attempts to use the double tourniquet on the calf resulted in loss of anesthesia while inflating the distal and deflating the proximal tourniquet. We feel that the reason for this is that the normal calf curvature prevented a firm fit of both components of the double tourniquet.

Upon completion of the procedure, the tourniquet was deflated and reinflated several times, in the hope that this

would decrease the incidence of toxic reactions. Kennedy *et al.*<sup>10</sup> reported a very high incidence of toxic phenomena associated with iv lidocaine anesthesia, concluding that continued use of the technique was not justified. In their series, the tourniquet was abruptly deflated at the completion of surgery. Mazze and Dunbar<sup>5</sup> also abruptly deflated the tourniquet, encountering few toxic reactions. These conflicting results are difficult to interpret, but they may be related to different techniques in patient monitoring.

In conclusion, a technique of iv lidocaine anesthesia for surgery at or below the ankle is described and is well suited for procedures lasting 1 h or less. The technique is especially useful for outpatient surgical procedures. Small doses of fentanyl and diazepam add to the patients' comfort and still allow for relatively short recovery room stays. The technique appears to be reliable, safe, and well accepted by surgeons and patients.

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#### Erratum

In the article "Bicitra® (Sodium Citrate) and Metoclopramide in Outpatient Anesthesia for Prophylaxis against Aspiration Pneumonitis," by L. Manchikanti, J. B. Grow, J. A. Colliver, C. H. Hadley, and L. J. Hohlbein (*ANESTHESIOLOGY* 63:378–384), in the abstract, eighth line from the end, the correct Group in parentheses should be Group 4, not Group 6.