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Physiology and Anatomy

Elixir Physio. & Anatomy 136 (2019) 53886-53888

ISSN: 2229-712X

Ankle Block in Orthopedic Surgery: A Review

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ARTICLE INFO

Article history:
Received: 13 July 2019;
Received in revised form:
14 November 2019;
Accepted: 29 November 2019;

Keywords
Anesthesia,
Ankle block,
Ankle surgery.

ABSTRACT

Foot surgery is characterized by intense postoperative pain, difficult to control even when using balanced multimodal analgesia associating paracetamol, anti-inflammatory drugs and opioids. Ankle blocks were all but abandoned. Complications are rare using regional anesthesia for postoperative analgesia even after extensive foot surgery, however the consequences of motoric or sensory deficits can be extremely devastating as it impacts mobility.Revival of ankle blocks are a perfect example of the high impact of new technological advances in improving ambulatory surgical care after foot surgery.

Introduction

Foot surgery is characterized by intense postoperative pain, difficult to control even when using balanced multimodal analgesia associating paracetamol, anti-inflammatory drugs and opioids. [1] Acute postoperative pain lasts significantly longer than 24 hours. [2]. Compared to the traditional multimodal approach, regional anesthesia and analgesia provides high quality pain relief, decreases opioids consumption and leads to very high satisfaction scores. [3,4]

With the introduction of the ultrasound guided blocks, most practitioners opted to use popliteal block, with or without catheter techniques. Ankle blocks were all but abandoned. Complications are rare using regional anesthesia for postoperative analgesia even after extensive foot surgery, however the consequences of motoric or sensory deficits can be extremely devastating as it impacts mobility. [5, 6]

Anatomic basics

Foot innervation is provided both by the sciatic nerve and the saphenous nerve. The sciatic nerve divides in 2 terminal branches: the common peroneal nerve and the tibial nerve. The sural nerve branches off the tibial nerve but some neural connections with common peroneal nerve are frequent at the level of popliteal fossa. It is a pure sensory nerve. Finally, the common peroneal nerve divides in 2 terminal branches: the deep peroneal nerve and the superficial peroneal nerve. All these five terminal branches (saphenous, tibial, superficial peroneal nerve, deep peroneal nerve and sural nerve) cover foot innervation. The saphenous nerve supplies skin innervation over the medial part of the ankle and foot, up to the head of the first metatarsal [7].

Skin innervation may have an extension toward the first toe with an average of 6.5 cm from the medial malleolus but may in some cases exceed 9cm [8]. The sciatic nerve, with its 4 terminal branches, provides innervation of the remaining parts of the foot. The tibial nerve innervates all the plantar face (bone and teguments) of the foot, as well as the dorsal side of the first phalanx of the 1st, 2nd and half of the 3rd toe. The deep peroneal nerve innervates bones of the dorsal side of the foot and a limited cutaneous area between the 1st and 2nd toe.

The superficial peroneal nerve innervates a large part of the skin of the dorsal side of the foot. The sural nerve innervates the external malleolus and the dorsal side of the 5th and 4th toe, running frequently until the 3th toe [9].

The tibial nerve

The needle is inserted between medial malleolus and Achille's tendon where the tibial nerve runs posterior to the palpated tibial artery. It is technically difficult and not reliable without eliciting paresthesia. Moreover, the tibial artery is not always readily palpable [10]. The tibial nerve usually lies posterior to the tibial artery but could also run anterior to the artery explaining the difficulty to block the nerve using landmark technique even if different techniques and puncture sites have been described.

The puncture site is situated at the antero-medial border of the Achille's tendon, 4-5 cm above the medial malleolus, just posterior to the tibial artery. The needle is advanced until a typical motor response is elicited: flexion of the toes [7]. Compared to landmark technique, nerve stimulation technique improves the success rate of tibial nerve block [11] but still has an increased risk of accidental vascular puncture.

The probe is placed transversally across the medial aspect of the lower leg, just above the medial malleolus. The needle is inserted posterior to the probe in the direction of the tibial nerve which usually lies directly behind the tibial artery. The tibial nerve requires a total of at least 5 to 7 ml of local anesthetic to be sufficiently blocked.

Deep peroneal nerve

The puncture site is situated between the extensor hallucis longus tendon medially and extensor digitorum longus laterally at the lateral border of the palpated anterior tibial artery. The deep peroneal nerve requires around 5 ml of local anesthetic to provide adequate block. [12].

The probe is placed at the anterior ankle joint on the

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anterior aspect of the tibia. The puncture site is located at the lateral end of the probe in the in-plane technique or caudal of the long axis of the probe in the out of plane technique. The deep peroneal nerve is usually lateral to the anterior tibial artery, lying on the anterior face of the tibia. The needle is placed towards the deep peroneal nerve, and 4 to 6 ml of local anesthetic is injected. If the nerve is difficult to identify, a perivascular injection can be used. Nerve stimulation technique can be also used in addition to ultrasound in order to confirm the needle position with a typical motor response from toes. [13]

Superficial peroneal nerve

This block is performed 2 to 4 cm above the lateral malleolus with a 3-5 ml semicircular subcutaneous infiltration from the tibial crest to the fibula. At this level the nerve has emerged either subcutaneously or deep to the fascia, which may explain a high failure rate using landmark techniques. In an anatomical study, in 20,1% specimens the superficial peroneal nerve branched before piercing the deep fascia [14]. Probe is positioned on the lateral aspect of the lower leg just proximal to the fibula.

The superficial peroneal nerve can be identified between the extensor digitorum longus and peroneus brevis muscles. It pierces the fascia in the lower third of the leg to become more superficial. Bowness et al demonstrated that the nerve was found to transfix the deep fascia of the leg just anterior to a point 30-31% along a straight line from the lateral malleolus to the head of the fibula [15]. The nerve can be blocked with 4-6 ml of local anesthetic either beneath the fascia or just after it has punctured the fascia. It is important to block this nerve as proximal as possible before its distal division.

Sural nerve

Landmark technique: this block is performed 2 to 4 cm above and posterior to the lateral malleolus with a 3-5 ml semicircular subcutaneous infiltration from the fibula to the Achilles' tendon. The sural nerve is known to be extremely superficial (at 0.5 cm to the skin surface). In fact using the short saphenous vein as a reference point on ultrasound has a much higher success rate in blocking the sural nerve [15].

The probe is positioned, on the posterolateral aspect of the leg, just proximal to the lateral malleolus. As previously mentioned using ultrasound to scan and pinpoint short saphenous vein very superficially is a very effective approach to the sural nerve. The sural nerve is often visible close to the vein on the lateral aspect of the lower leg just proximal to the medial malleolus. The short saphenous vein is identified, lying superficially between the Achilles' tendon and the peroneus brevis muscle. The sural nerve is enveloped in a perivascular sheath. If the nerve is not identifiable, perivascular local anesthetic injection on both sides of the short saphenous vein can be used to produce adequate block.

The saphenous nerve

Landmark technique: Again, a semicircular subcutaneous infiltration is used, 2 cm above the medial malleolus, injecting 3 -5 ml of local anesthetics, on both sides of the great saphenous vein.

The probe is placed transversally just proximal and anterior to the medial malleolus, identifying the great saphenous vein. At this level, saphenous nerve is so small (and already divided in terminal branches) that it can be difficult to clearly visualize and may lie anterior or even posterior to the vein. A perivascular technique can be adopted using local anesthetic injection to identify the nerve. The use of a tourniquet or careful positioning of the leg may help in pinpointing the position of the great saphenous vein.

The decision to perform a saphenous nerve block in addition to a sciatic nerve block or a block to the ankle depends on the planned surgery. Though the saphenous nerve block is mandatory for proximal osteotomy (bifocal osteotomy, Lapidus surgery), it may not be necessary for more distal osteotomies. [8]

The importance of tourniquet position

Foot surgery is often associated with the use of a pneumatic tourniquet which can be placed at the thigh, calf or ankle level. The tourniquet position depends on surgical preferences, and on the level of foot surgery. Hindfoot and midfoot surgical procedures are too close to the ankle to use tourniquet at this level. The most suitable indications for ankle blocks will therefore be forefoot surgery because tourniquet can be applied far from the surgical field and can be placed at the ankle level where it is generally very well accepted by the patient.

Conclusion

Ankle blocks provides excellent intraoperative anesthesia as well as long postoperative pain relief. Both perineural and systemic routes of dexamethasone provide comparable postoperative analgesia reducing total opioid consumption [16]. Revival of ankle blocks are a perfect example of the high impact of new technological advances in improving ambulatory surgical care after foot surgery.

References

1. Stefani, KC, Ferreira GF, Pereira Filho MV, Postoperative Analgesia Using Peripheral Anesthetic Block of the Foot and Ankle. Foot Ankle Int 2018; 39 : 196- 200.

2. Chaudier P, Bourdin M, Gauthier J, et al. Similar levels of pain are reported in forefoot surgery after management as a day case and admission for 48 hours: A continuous prospective study of 317 patients. Bone Joint J 2015; 97-B : 1645- 1650.

3. Mouton A, , Le Strat V, Medevielle D et al. Patient's satisfaction after outpatient forefoot surgery: Study of 619 cases. Orthop Traumatol Surg Res 2015; 101: S217-S220.

4. White PF, Issioui T, Skrivanek GD et al., The use of a continuous popliteal sciatic nerve block after surgery involving the foot and ankle: does it improve the quality of recovery? Anesth Analg 2003; 97 : 1303-1309.

5. Kahn RL, Ellis SJ, Cheng J et al. The Incidence of Complications Is Low Following Foot and Ankle Surgery for Which Peripheral Nerve Blocks Are Used for Postoperative Pain Management. HSS J 2018; 14 : 134-142.

6. Park YU, Cho JH, Lee DH et al. Complications After Multiple-Site Peripheral Nerve Blocks for Foot and Ankle Surgery Compared With Popliteal Sciatic Nerve Block Alone. Foot Ankle Int 2018; 39 : 731-735.

7. Mazzella NL, McMillan AM Contribution of the sural nerve to postural stability and cutaneous sensation of the lower limb. Foot Ankle Int, 2015; 36 : 450-456.

8. Lawson IR, Ingman SR, Masih Y et al. Reliability of palpation of pedal pulses as ascertained by the kappa statistic. J Am Geriatr Soc 1980; 28 : 300-303.

9. Doty R Jr, Sukhani R, Kendall MC et al. Evaluation of a proximal block site and the use of nerve-stimulator-guided needle placement for posterior tibial nerve block. Anesth Analg 2006; 103 : 1300-1305.

10. Antonakakis JG, Scalzo DC, Jorgenson AS et al. Ultrasound does not improve the success rate of a deep peroneal nerve block at the ankle. Reg Anesth Pain Med 2010; 35 : 217-221.

11. Benzon HT, Sekhadia M, Benzon HA et al. Ultrasound-assisted and evoked motor response stimulation of the deep

peroneal nerve. Anesth Analg 2009; 109 : 2022- 2024.
12. Prakash1, Bhardwaj AK, Singh DK et al, Anatomic variations of superficial peroneal nerve: clinical implications of a cadaver study. Ital J Anat Embryol 2010; 115 : 223-228.
13. Bowness J, Turnbull K, Taylor A et al. Identifying the Emergence of the Superficial Peroneal Nerve through Deep Fascia on Ultrasound and by Dissection: Implications for Regional Anaesthesia in Foot and Ankle Surgery. Clin Anat 2018;
14. Marty P, Rontes O, Chassery C et al., Perineural Versus Systemic Dexamethasone in Front-Foot Surgery Under Ankle Block: A Randomized Double-Blind Study. Reg Anesth Pain Med 2018; 43 : 732-737