

Ankle vs popliteal blocks in forefoot surgery

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Abstract

Background: Regional anesthesia is widely used in forefoot surgery, with ankle and popliteal sciatic blocks being the most common techniques. Studies suggest both provide effective analgesia but may differ in duration of pain relief, motor impairment, and implications for early mobilization and satisfaction.

Objective: To compare ultrasound-guided ankle block with ultrasound-guided single-shot popliteal block in forefoot surgery, focusing on postoperative pain control, complications, motor function, mobilization, and patient satisfaction.

Methods: A purposive PubMed search (1995–2025) identified peer-reviewed studies on hallux valgus, quintus varus, hallux rigidus, and hammertoe procedures. Findings were qualitatively synthesized.

Results: Popliteal blocks generally yield longer analgesia and reduce early opioid use but cause profound motor blockade and delayed ambulation. Ankle blocks offer adequate pain control, earlier mobilization, and high patient satisfaction, though they require multiple injections. Reported complication rates are low for both, but transient neurological events seem to appear more frequently with popliteal blocks. Data on quintus varus, hallux rigidus, and hammertoe surgery remain limited, though similar trends are observed. Combined ankle and popliteal blocks may enhance outcome in selected cases.

Conclusion: Both techniques are effective but reflect different trade-offs. Ankle blocks are preferable when early ambulation is desired, while popliteal blocks may be better for procedures with higher pain levels, such as hallux valgus or rigidus correction. Further high-quality trials are needed to establish best practice.

Keywords: Forefoot, Human / surgery, Popliteal Fossa / anesthesia, Nerve Block, Regional Anesthesia, Foot Diseases / surgery. All selected terms comply with the Medical Subject Headings (MeSH) nomenclature.

Introduction

Regional anesthesia is widely utilized in forefoot surgeries^{1,2}, with ankle blocks and popliteal blocks being the primary techniques employed. According to the 2020 PROSPECT guidelines³, ankle block is recommended and superior to wound infiltration and no block. Ankle blocks provide localized anesthesia by targeting the terminal branches of the sciatic and saphenous nerves, the superficial and deep peroneal nerve, the tibial nerve and sural nerve, whereas popliteal blocks anesthetize the sciatic nerve before its bifurcation⁴. The choice between these techniques can meaningfully impact postoperative pain

management, rehabilitation, and patient outcomes. Current debates focus on which technique offers adequate analgesia while minimizing complications and functional impairment.

Comparing popliteal and ankle block in forefoot surgery requires a clear understanding of the involved (neuro-)anatomy and the implications of each block on motor and sensory function.

The ankle block targets five main nerves supplying the foot at the level of the ankle: the tibial, deep fibular (peroneal), superficial fibular (peroneal), tibial (-> medial/lateral plantar; medial calcaneal), sural and saphenous nerves^{4,6}. The deep fibular supplies the first web space; the superficial fibular nerve

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supplies most of the dorsum; tibial branches supply the plantar surface and heel; the sural nerve supplies the lateral margin; and the saphenous nerve supplies the medial ankle/foot with variable distal extent.

The saphenous nerve is a sensory branch originating from the femoral nerve and is therefore not covered by sciatic nerve blockade. This is particularly relevant because classic textbook descriptions suggest the saphenous nerve provides medial sensory innervation as distally as the great toe, though several anatomical studies contradict this^{7,8}. When the great toe is targeted, only a small percentage of patients would possibly benefit from supplemental saphenous nerve blockade⁷. Instead, the great toe is mostly innervated by the deep and superficial fibular nerves and tibial nerve.

Functionally, ankle blocks primarily affect sensory fibers, generally preserving dorsiflexion and plantarflexion^{5,6}. Some intrinsic foot muscle movement may be impaired, however, but patients usually retain movement at the ankle joint⁶.

In contrast, the popliteal block acts to anesthetize the sciatic nerve before or at its bifurcation (in the common fibular and tibial branch) in the popliteal fossa. At this level, the nerve contains all motor fibers destined for movement in the lower leg^{6,9}; blockade of the sciatic nerve at this level will provide profound motor blockade at the ankle joint, foot and toes, possibly delaying ambulation.

The different impact on motor function is a critical consideration when selecting appropriate regional anaesthetic techniques, balancing the need for analgesia with the desire for early ambulation and rehabilitation.

Several studies have attempted to compare the efficacy of these two techniques. A study by Olofsson et al.¹⁰ found that popliteal blocks provide longer-lasting analgesia but are associated with increased motor impairment compared to ankle blocks. Similarly, a 2024 systematic review with meta-analysis by Schou et al.¹¹ - which included mixed foot and ankle surgery populations - suggests that while popliteal blocks offer extended pain relief, ankle blocks are superior in facilitating early mobilization. While these findings cannot be directly extrapolated to isolated forefoot surgery, which is the scope of this review, similar patterns may be observed. In this narrative review, we attempt to summarize current literature regarding these techniques in the setting of forefoot surgery.

The research question in this review was: 'How do ultrasound guided ankle block and ultrasound guided single-shot popliteal block compare for postoperative pain control, complications, motor function, mobilisation and patient satisfaction in forefoot surgery?'

By synthesizing current literature, this review sought to clarify the advantages and limitations of each technique and identify areas requiring further research.

Methods

This review was conceived as a narrative, practice-focused synthesis of current literature pertaining ankle and popliteal blocks in forefoot surgery. The aim was to summarize relevant evidence and highlight clinical considerations as they relate to current anaesthetic practice.

A pragmatic search of the PubMed (MEDLINE) database was performed to identify pertinent and recent studies using relevant keywords related to the topic. Reference lists of key papers were also manually screened to identify additional publications of interest. No formal systematic search strategy was applied.

Search terms used were related to regional anesthesia in forefoot surgery, including 'ankle block', 'popliteal block', 'sciatic block', 'hallux valgus', 'forefoot surgery', 'quintus varus', 'hallux rigidus', 'hammertoe', 'regional anesthesia', 'postoperative analgesia'.

Only articles published in English were considered. A time window of articles published between 1995-2025 was applied to encompass the period during which modern ultrasound-guided regional techniques were developed and refined. Earlier literature was considered less relevant due to changes in clinical practice.

Studies primarily addressing hindfoot or midfoot surgeries were not considered. Where broader 'foot and ankle' studies were identified, only forefoot-specific data was considered.

Articles were then selected based on population (adult patients in forefoot surgery), interventions (ultrasound-guided ankle block, ultrasound guided popliteal block) and outcome (analgesic quality, motor function, mobilisation, complications).

Given the narrative aim of this review, no duplicate screening, risk-of-bias assessment or meta-analysis were performed. Findings were therefore interpreted qualitatively.

Results

Pain Control, efficacy and postoperative care

General studies: Across studies, both techniques seem to yield effective analgesia. Single-shot popliteal block generally offers longer postoperative analgesia with less morphine requirements in the immediate postoperative phase¹², albeit with prolonged motor blockade. Ankle blocks are often

associated with faster ambulation and reliable pain control. Opioid requirements vary across studies¹³. The combined approach using both popliteal and ankle blocks has been evaluated. One randomized controlled, single-blinded study involving 63 patients by Samuel et al. (2008) suggests that combining these techniques may result in improved overall analgesia (as reported by lower pain scores and decreased need for supplemental analgesics), reduced opioid consumption, and enhanced patient satisfaction compared to ankle block alone¹⁴.

It is important to note that any observed differences may be attributed to heterogeneity in anesthetic type, concentration, volume as well as adjuvants or background multimodal analgesic regimens.

Hallux Valgus: Current PROSPECT guidelines already recommend ankle block for hallux valgus surgery. They could not recommend popliteal block, due to lack of eligible studies (not due to demonstrated inferiority). Studies indicate that ankle blocks provide effective analgesia for hallux valgus correction (bunion surgery), with comparable pain scores to popliteal blocks in the first 24 hours postoperatively¹⁵. Popliteal blocks may provide extended pain relief, reducing the need for supplemental analgesics on day 1 postoperatively¹². Motor block is generally not required after hallux valgus surgery as early postoperative ambulation is permitted, but was also longer in the popliteal block group (12 h vs 5.5 h) using bupivacaine 0.5%. This data was extracted from the PROSPECT guidelines regarding hallux valgus surgery³.

Quintus Varus: No direct comparative studies were found to compare the effect of different regional techniques in quintus varus (bunionette) surgery. Research regarding postoperative pain scores is also lacking. Similar to hallux valgus, ankle blocks are thought to be effective in numbing the affected area while allowing for early postoperative mobility. Popliteal blocks may offer longer pain control but at the expense of increased motor impairment⁶.

Hallux Rigidus: This condition often requires cheilectomy or arthrodesis¹⁶, where prolonged analgesia may be beneficial. The condition itself is generally experienced as very painful¹⁷, and thus the extended pain relief with popliteal block may generate higher patient satisfaction.

Hammertoe: Compared to hallux rigidus, hammertoe is associated with lower pain scores. If a block is used, one retrospective study found that VAS scores dropped significantly in the immediate postoperative period (median VAS 4 preoperatively to 2.8 postoperatively)¹⁸.

Motor Impairment and Functional Recovery

Ankle blocks allow for better postoperative mobility, likely because they affect proximal muscle function less profoundly¹⁹. Avoidance of foot drop associated with sciatic nerve blockade may improve patient safety. Distal lower limb blocks such as ankle block target sensory branches more selectively when compared to sciatic nerve block at the popliteal fossa^{6,9}.

Standardized outcome measures regarding ambulation readiness and motor blockade need to be used in further research in order to make direct statistical comparisons possible.

Complication rates

In a 2018 prospective observational study by Kahn et al., reported overall complication rates are low for both approaches¹⁹. No statistical difference was found between approaches when only forefoot surgery patients were considered, though due to study design and outcome heterogeneity, direct statistical comparison is limited. Minor adverse events, including transient nerve irritation, have been reported with both techniques but are more commonly associated with popliteal blocks. Popliteal blocks have a higher incidence of inadvertent vascular puncture and prolonged sensory deficits²⁰⁻²³. Infection rates and local anesthetic systemic toxicity are low for both approaches^{19,24}.

Patients with certain risk modifiers such as diabetes mellitus, active smoking, pre-existing peripheral neuropathy or anticoagulant therapy may be more susceptible to certain complications such as hematoma or nerve injury. These risk modifiers should be considered on a per patient basis and should guide individualized block selection.

Theoretically, ankle block avoids motor fiber block and thus could reduce the risk of postoperative falls compared to popliteal block. However, practitioners and patients should be aware that sensory loss can still impair balance and proprioception, thus predisposing the patient to falls in the early postoperative setting.

Tourniquet pain

We have not been able to find studies that compare tourniquet pain after ankle block versus popliteal block. Patients receiving regional anesthesia can still experience tourniquet pain postoperatively²⁵. Reports from mixed foot and ankle surgery patients suggest that tourniquet discomfort typically begins after 30–60 minutes²⁶, although tolerability differs tremendously according to tourniquet location (ankle vs calf), inflation pressures and the extent of anesthetic coverage. When using calf tourniquet,

as opposed to ankle tourniquet, popliteal block plausibly provides better anatomical coverage.

Evidence regarding tourniquet-related discomfort is scarce and inconsistent. Future studies on the topic should standardize parameters such as inflation pressure, location and duration. Rescue analgesia for tourniquet pain should also be documented.

Patient Satisfaction and Practical Considerations

Patients receiving ankle blocks report higher satisfaction, which may be attributed to the ability to ambulate sooner postoperatively. No studies were found that show any patient-perceived difference in effectiveness between the two blocks, even though there is considerably longer pain relief with popliteal block^{12,27}. As ultrasound-guided ankle block targets more and smaller, terminal branches, more injections are needed and it requires a higher level of practitioner expertise. In one study, patients receiving combined popliteal and ankle blocks had higher satisfaction rates with better pain relief²⁸.

Discussion

Both regional techniques are effective for forefoot surgeries, with distinct advantages and disadvantages. Ankle blocks provide targeted analgesia with minimal motor impairment, making them better suited for patients prioritizing early mobilization. Popliteal blocks however, while offering longer-lasting analgesia, may delay functional recovery due to more extensive motor blockade.

The existing literature suggests potential benefits of a combined approach, where using an ankle block in conjunction with a popliteal block could optimize pain control while minimizing motor impairment.

As the popliteal block provides extended pain relief, it may be advantageous in a specific surgical context associated with higher pain scores, such as hallux valgus or hallux rigidus correction. In other types of surgery with lower general pain scores (i.e. hammertoe correction), ankle block may be preferable due to faster ambulation while still providing adequate postoperative pain control.

Our recommendations

Because specific guidelines on early postoperative ambulation are lacking, protocols are typically institution- or practitioner-dependent. Postoperative pain should therefore be managed on an individual basis. Both blocks can be safely and effectively performed in appropriate settings, and the decision

often comes down to post-procedure expectations. Popliteal sciatic nerve blockade is an appropriate technique in cases where severe postoperative pain is expected, as is the case after hallux valgus correction³. Current PROSPECT guidelines recommend ankle block for hallux valgus surgery but cannot recommend sciatic nerve blockade due to insufficient evidence. Postoperative median VAS scores, however, were 5.1/10 with classic perioperative pain management²⁹. Furthermore, It is important to note that severe postoperative pain may also restrict early ambulation.

Evidence regarding postoperative VAS scores in other types of forefoot surgery is lacking, and therefore formal recommendations regarding regional anaesthetic technique is not straightforward. As ankle block appears to provide sufficient postoperative analgesia in these cases, and facilitates earlier ambulation, it could be preferable to sciatic nerve block in some cases.

As pointed out in the introduction, saphenous nerve coverage does not necessarily include the great toe, and thus theoretically the saphenous nerve could be omitted when performing an ankle block in forefoot procedures. This comes at the added risk of breakthrough pain despite otherwise adequate block, and therefore its omission should be considered cautiously.

For awake forefoot procedures, light (conscious) sedation may improve patient comfort. Options include low-dosage midazolam, propofol via target-controlled infusion (TCI) or dexmedetomidine infusion. Sedation depth should preferably remain light, as excessive depth of anaesthesia could possibly mask early signs of compartment syndrome.

Only limited literature exists to suggest that a combined popliteal/ankle block could prolong analgesia in selected high-pain procedures (e.g. hallux rigidus arthrodesis, hallux valgus), but this must be balanced against obvious disadvantages such as greater motor impairment, longer procedure time and added risk with multiple injections. Its use should be discussed on a per patient basis, also ensuring that patients understand the risk and potential for delayed ambulation.

Of note, it has been reported that postoperative pain after forefoot surgery is independently linked to anticipated or preoperative pain. Higher preoperative pain intensity was linked to more severe postoperative pain. Practitioners should therefore be aware of this with regard to postoperative pain management³⁰.

Limitations and Future Research

This review is limited by the inherent characteristics of its narrative and practice-focused design.

The literature search was primarily focused to keyword combinations rather than a predefined formal systematic search strategy. As a result, the selection of studies was not exhaustive and can solely be used to observe clinical trends. No duplication screening or risk-of-bias assessment was conducted, and therefore evidence can only be interpreted qualitatively.

Heterogeneity of included studies preclude direct comparison and limit the strength of conclusions.

Future research should focus on well-designed randomized controlled trials, comparing ultrasound-guided ankle block and ultrasound-guided popliteal block, in isolated forefoot surgery using standardized outcome measures.

Systematic reviews and meta-analyses using validated risk-of-bias tools and certainty-of-evidence framework (e.g. GRADE) could subsequently provide more definitive conclusions regarding optimal block strategy and safety profile.

Conclusion

Both ankle and popliteal blocks are both effective techniques for postoperative analgesia in forefoot surgery, with distinct advantages. Ankle blocks facilitate early ambulation with fewer motor complications, while popliteal blocks provide extended analgesia but delay mobility. A combined approach may offer superior outcomes, though further research should be conducted to refine best practices for regional anesthesia in forefoot procedures.

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