Many times, choice of ESP block over other techniques is influenced by contraindications to gold standard, lower complication risk, fewer medication side effect, missing personal with expertise to deliver gold standard RA technique. Many RCTs concluded that patients may benefit from ESP block when compared to systemic analgesia only. Only research in the future will show if there is more than statistical significance that makes ESP block attractive in clinical practice.

REFERENCES


SP30.1 ADJUVANTS OR DEXMETHASONE AS MULTIMODAL ANALGESICS AT HIGH DOSES?

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Peripheral nerve blocks’ effectiveness is limited by pain outlasting the analgesic duration of the nerve block. Different approaches have been used to counter this limitation, for example insertion of catheters for continuous infusion, increasing the total dose of the local anaesthetic or administering adjuvants.

A well-functioning catheter is an effective method for increasing analgesic duration, but placing catheters are relatively more time-consuming, require more expertise, and may not be suitable in an outpatient setting. Furthermore, catheters are limited in their effect by catheter migration away from the nerve, dislodgement, and leakage. Consequently, attempts to increase the duration of single-injection peripheral nerve blocks are warranted.

Local anesthetic volume and concentration

It is a common perception that higher concentrations of local anesthetics will increase the duration of nerve blocks, but the relationship between concentration and duration is not straightforward. Earlier studies showed no connection between local anesthetic dose and duration. Then, in connection with the development of ultrasound-guided techniques, and dose-finding studies focusing on ‘how low can you go’, evidence started to emerge showing decreased duration with decreased doses. Although the evidence between the previous and more recent studies may seem contradictory, the explanation seems to be that the relationship between local anesthetic dose and duration is not linear. In two studies by Nader et al.10 and Jæger et al.11, duration of nerve block following a wide range of volumes and concentrations was studied in a non-clinical setting. These studies demonstrated that administration of very low volumes or concentrations of local anesthetics reduced the effectiveness of the nerve block by reducing success rate and duration. In contrast, as long as a minimal effective dose of local anesthetics was used, ensuring a high success rate, there was nothing gained in duration by a simple increase in concentration or volume.

Adjuvants

Dexamethasone, dexmedetomidine, clonidine and fentanyl have all been shown to prolong sensory and motor block duration, as well as increasing the time to first analgesia. Among these adjuvants, dexamethasone seems to be the most effective.12–13 α2-adrenergic agonists

Clonidine prolongs sensory and motor block, and increases the time to first analgesia compared with placebo, but to a lesser degree than dexmedetomidine. Recent meta-analyses have shown that compared with placebo, dexmedetomidine prolonged a brachial plexus block by 292 minutes (95%
Dexamethasone

Dexamethasone increases time to first request of analgesics by 8.7 hours (95% CI: 6.6 to 10.8) compared with placebo. In comparison, the meta-analyses comparing the two α2-agonists to placebo have shown that dexmedetomidine prolongs analgesia by about five hours and clonidine by about three hours. A recent systematic review by Albrecht et al only retrieved one study directly comparing dexamethasone to dexmedetomidine, reporting that dexamethasone prolongs analgesic duration by about 2 hours. Because of the scarcity of direct comparisons, Albrecht et al performed an indirect comparison between perineural dexamethasone and perineural dexmedetomidine, finding that dexamethasone significantly prolongs the duration of analgesia by a mean difference of 148 minutes (95% CI: 37 to 259 minutes). The result of the indirect comparison was thus similar to the results of the direct comparison.

Furthermore, dexamethasone was associated with a lower rate of intraoperative hypotension and postoperative sedation, compared to dexmedetomidine. The high effectiveness and low rate of side-effects suggests that dexamethasone may be the most favorable adjuvant.

Mechanism of action

The mechanism by how the adjuvants increase block duration is unknown. Dexamethasone, clonidine dexmedetomidine and opioids all have analgesic properties, and their effect on block duration may be the result of systemic absorption rather than a block modulating effect. This assumption is supported by a study by Yilmaz-Rastoder, showing that neither dexamethasone, clonidine nor buprenorphine have any effect on isolated sensory Aδ and C pain fibers in rats, indicating an extrinsic effect of the adjuvants.

This assumption is supported by non-clinical studies in healthy volunteers. Using a bilateral setup, controlling for any potential systemic effect of the perineural adjuvant administered in on limb only, the studies found no clinically relevant difference in sensory block duration, between the limb receiving perineural adjuvant and the one without. The difference between perineural adjuvant and ‘systemic adjuvant’ (obtained by systemic absorption from the contralateral limb) was 1.5 h (95% CI: 3.5 to 0) for dexamethasone and 0.1 h (95% CI: -1.0 to 1.3) for clonidine. However, for dexmedetomidine, the mean difference was 2 h (95% CI: 1 to 3) when dexmedetomidine was used as an adjuvant for a saphenous block, and 5.2 hour (95% CI: 4.2 to 6.1) when used for an ulnar block.

Short and colleagues also investigated the local effect of dexamethasone in a non-clinical study, demonstrating that irrespective of dose (2, 4 or 8 mg), IV dexamethasone fails to prolong sensory anesthesia compared with no dexamethasone (0 mg). Thus, the nonclinical studies indicate no direct effect of dexamethasone or clonidine on the peripheral nerve block, while dexmedetomidine may have some local effect.

Perineural vs systemic administration

In a clinical setting, two meta-analyses have shown that perineural dexamethasone prolongs block duration compared with systemic administration, but the difference is only about 3–4 h. In a third review, using a more conservative statistical method, Hussain et al found no statistically significant difference between perineural and systemic dexamethasone. Considering its’ off-label use, the relatively modest difference questions whether perineural administration should be used routinely.

Liposomal bupivacaine

Liposomal bupivacaine is an extended-release formulation of bupivacaine designed to increase block duration. Meta-analyses comparing liposomal bupivacaine to plain bupivacaine for peripheral nerve blocks, found a statistically significant but clinically questionable reduction in pain scores at 24–72 hours postoperatively associated with liposomal bupivacaine. However, exclusion of an industry-sponsored trial further reduced the difference between treatments and rendered it non-significant (0.7 cm • h, 95% CI: −0.1 to 1.5).

Previous trials have compared liposomal bupivacaine to plain bupivacaine without adjuvants. In a recent trial, Kim and colleagues, however, compared liposomal bupivacaine to plain bupivacaine mixed with perineural dexamethasone. The study showed that liposomal bupivacaine provides non-inferior analgesia to plain bupivacaine + dexamethasone (mean difference −1.1, 95% CI: −1.8 to −0.4; P < 0.001 for noninferiority). Most interesting, liposomal bupivacaine did not extend duration of analgesia (26 h vs. 27 h; P = 0.851, liposomal bupivacaine and plain bupivacaine + dexamethasone, respectively). Considering the large difference in cost, plain bupivacaine with dexamethasone may be preferable.

Conclusion

For local anesthetic dose, concentration, and volume, as for most other aspects of life, moderation seems to be the key answer. Excessive volume or concentration do not increase duration but increase the risk of neurotoxicity and systemic toxicity. Conversely, very low volumes or concentrations of local anesthetics decrease the effectiveness of the block by reducing success rate and duration.

Adjuvants may help to increase analgesic coverage of single-injection peripheral nerve blocks, but the effect is moderate. Dexamethasone seems to be the most promising of the adjuvants, providing a 6-hour prolongation compared with placebo. Dexamethasone also seems to have the fewest side-effects, and may be administered systemically, avoiding off-label administrations. The combination of different adjuvants needs further investigation, especially regarding the safety of its use, both in terms of neurotoxicity and side-effects such as sedation. Finally, it should be noted that using the Grading of Recommendations Assessment, Development, and Evaluation system (GRADE), the quality of the evidence from most of the meta-analyses cited above are assessed as low.

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