

**INCORPORATING DEXAMETHASONE WITH LOCAL ANESTHETICS IN
SINGLE-SHOT NERVE BLOCKS: AN INTEGRATIVE REVIEW**

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Abstract

Prolonging the duration of analgesia in single-shot nerve blocks (SNBs) continues to be a problem in regional anesthesia. Both IV and perineural dexamethasone have proven to be effective in prolonging the duration of analgesia in SNBs. *Objective:* The purpose of this integrative review was to determine how IV and perineural dexamethasone effect duration of analgesia, pain scores, opioid consumption, and complications in patients undergoing SNB. *Methods:* An integrative review that included 12 peer-reviewed randomized-controlled trials (RCTs) and one meta-analysis was performed. *Results:* The results of the integrative review found that perineural dexamethasone prolonged the duration of analgesia, reduced pain scores, and reduced opioid consumption to a greater extent than IV dexamethasone. IV dexamethasone prolonged the duration of analgesia to a greater extent than local anesthetic with saline and local anesthetic alone. There were no major complications associated with the use of dexamethasone in SNBs. *Conclusions:* Perineural dexamethasone is a more effective adjunct in prolonging the duration of analgesia in SNBs compared to IV dexamethasone. IV dexamethasone is an effective, alternative adjunct that can be used to prolong the duration of analgesia in SNBs.

Keywords: intravenous dexamethasone, perineural dexamethasone, single-shot nerve block, peripheral nerve block.

Introduction

Despite ongoing advances in the prevention and treatment of postoperative pain, it continues to be inadequately managed in most of the surgical population.¹ Inadequate pain control during the postoperative period can negatively affect quality of life, functionality, and recovery while also increasing the risk of persistent postsurgical pain.² While opioids remain the mainstay for acute surgical pain, their use has been associated with many adverse effects and has proven to be consistently ineffective in meeting the analgesic needs of surgical patients.^{1,3}

As part of a multimodal approach, peripheral nerve blocks are one of the most widely used modalities to prevent and treat postoperative pain. The use of peripheral nerve blocks has been shown to reduce opioid consumption, limit opioid-related adverse effects, promote early ambulation, improve discharge readiness, and shorten hospital stays.¹⁻⁴ While both single-shot nerve blocks (SNBs) and continuous nerve blocks (CNBs) are effective, each has advantages and disadvantages. Historically, CNBs have been viewed as the gold standard in regional anesthesia, especially in shoulder surgery, due to their ability to provide continuous analgesia during the early-to-intermediate postoperative period.⁵ Despite this unique advantage, the invasive nature of the procedure lends itself to the potential for a number of both minor and serious complications.⁵⁻⁷ Additionally, the time, skill, and resources required to both insert and manage CNBs have led to a reduction in their use.⁷

While SNBs are easier to perform and require less time and fewer resources, they lack the superiority in analgesic duration that CNBs offer.⁸ In an effort to mimic the longevity of CNBs, many adjuncts have been used to prolong SNBs with variability in

their efficacy, side effect profile, and potential for neurotoxicity.^{9,10} Of the adjuncts used, perineural dexamethasone, a synthetic glucocorticoid, has been shown to consistently and reliably prolong SNBs.¹¹⁻¹⁴ Recent studies have also suggested that intravenous (IV) dexamethasone not only provides systemic analgesia^{15,16}, but also prolongs the duration of SNBs.¹⁷ The mechanism by which dexamethasone prolongs SNBs, potential for neurotoxicity when administered perineurally, off-label use, and dosing regimen are concerns that have left some skeptical regarding its use in regional anesthesia. The purpose of this integrative review is to determine how IV and perineural dexamethasone effect duration of analgesia, pain scores, opioid consumption, and complications in patients undergoing SNB for postoperative pain control. Based on this integrative review, recommendations for practice and future research are provided.

Methods

A comprehensive review of the literature was performed in the CINAHL, PubMed, Cochrane Library, and Google Scholar databases using the key words *IV dexamethasone, intravenous dexamethasone, perineural dexamethasone, peripheral nerve blockade, and peripheral nerve block*. Inclusion criteria included: (a) peer-reviewed randomized controlled trials (RCTs); (b) systematic reviews; and (c) meta-analyses comparing IV and perineural dexamethasone. All articles included patients receiving either an upper or lower extremity single-shot nerve block with at least the primary outcome measured. Articles were excluded if there was no direct comparison between IV and perineural dexamethasone or the article could not be retrieved in English. All studies published by July 2017 were considered for inclusion into the review.

Included studies were reviewed and critically assessed for relevance and reliability and organized in an evidence matrix.

The outcomes assessed included: duration of analgesia/sensory block, pain scores at 24 and 48 hours, opioid consumption at 24 and 48 hours, and complications associated with dexamethasone administration. When both duration of analgesia and sensory block duration were studied separately, duration of analgesia was used. Additionally, when determining pain scores and opioid consumption, “postoperative day-one” and “postoperative day-two” were assumed to be 24 and 48 hours postoperatively, respectively. Final studies for review included 12 RCTs and one meta-analysis (see Table 1).

Literature Review

Mechanism of Action

Dexamethasone and other glucocorticoids have long been used for their anti-inflammatory effects. They work primarily by binding to glucocorticoid receptors within the cytoplasm of target cells to directly or indirectly regulate the transcription of target genes responsible for inflammation.¹⁸ Through this interaction, glucocorticoids suppress arachidonic acid, prostaglandin, bradykinin, and pro-inflammatory cytokine production.^{19,20} Glucocorticoids are also thought to suppress the release of inflammatory neuropeptides from nerve endings.²⁰ Collectively, these systemic mechanisms are postulated to reduce postoperative inflammatory pain and nociceptive signaling in inflamed tissue.

In contrast with its systemic effects, several authors have proposed various mechanisms to describe the perineural actions of dexamethasone. Postulated perineural

mechanisms include inhibition of signal transmission in nociceptive C-fibers, inhibition of ectopic discharge in injured nerves,^{20,21} temporary attenuation of nerve conduction through a reduction in blood flow to the nerve,^{22,23} and inhibition of inflammation associated with injection of local anesthetics.²⁴

Duration of analgesia

Pain is a subjective and variable experience. Duration of analgesia is appropriate as a primary outcome because it defines the period at which patients begin to perceive pain. The ability of a SNB to prolong the attenuation of pain postoperatively is crucial to SNB success and postoperative outcomes. Based on study results, perineural dexamethasone prolongs the duration of analgesia to a greater extent than IV dexamethasone. Additionally, IV dexamethasone prolongs the duration of analgesia to a greater extent than local anesthetic with saline and local anesthetic alone. The findings of the meta-analysis²⁵ and 10 of 12 RCTs²⁶⁻³⁵ found longer durations of analgesia in the perineural dexamethasone group. In contrast, findings of one RCT found longer durations of analgesia in the IV dexamethasone group³⁶ and findings of another RCT found IV and perineural dexamethasone to have equal durations of analgesia.³⁷ Findings from seven RCTs^{27,29-33,35} found statistically longer durations of analgesia for the perineural group compared to IV dexamethasone, while findings from five RCTs found them to be statistically equal.^{26,28,34,36,37} The results of the meta-analysis found statistically longer durations of analgesia for perineural over IV dexamethasone.²⁵ In contrast to the IV and perineural dexamethasone comparison, IV dexamethasone prolonged the duration of analgesia to a greater extent than local anesthetic with saline or local anesthetic alone in seven of nine RCTs,^{26,28,33-37} five of which were statistically significant.^{26,33,34,36,37}

Perineural dexamethasone is believed to be superior to IV dexamethasone and IV dexamethasone and local anesthetic with or without saline in prolonging the duration of analgesia in SNBs as evidenced by findings from studies that are of high quality and quantity. Most of the SNBs were performed under ultrasound-guidance, were assessed for success prior to surgery, and were appropriately followed up on. Limitations of the findings include heterogeneity in statistical analysis, type of SNB and surgical procedure, local anesthetic concoction used, and operational definitions used to define duration of analgesia and/or sensory block duration.

Pain Scores

Pain scores are correlated with the severity of pain experienced by the patient. Pain scores are appropriate secondary outcomes because they characterize the quality of pain experienced by the patient. Reducing the severity of pain experienced by the patient is an important component of SNBs. Study findings indicate that perineural dexamethasone reduces pain scores to a greater extent than IV dexamethasone at 24 hours, but not at 48 hours postoperatively. Results from the meta-analysis²⁵ and six of seven RCTs^{26-29,32,35} found lower pain scores at 24 hours in the perineural dexamethasone group compared to the IV dexamethasone group.^{25-29,32,35} In contrast, results of one study found lower pain scores at 24 hours in the IV dexamethasone group compared to the perineural dexamethasone group.³⁷ Finally, five RCTs had no data on pain scores.^{30,31,33,34,36} Findings from one of seven RCTs found statistically lower pain scores at 24 hours for perineural dexamethasone compared to IV dexamethasone²⁹ while findings from the other six RCTs found no difference between the two groups.^{26-28,32,35,37}

The findings from the meta-analysis found no statistically significant difference between the two groups.²⁵

Pain scores were also analyzed at 48 hours in the meta-analysis and four RCTs. Results of one RCT favored perineural dexamethasone,²⁹ two RCTs favored IV dexamethasone,^{26,28} and one RCT favored neither.³² The results of the meta-analysis found lower pain scores at 48 hours in the perineural dexamethasone group.²⁵ Findings from one RCT found perineural dexamethasone to be statistically superior in reducing pain scores at 48 hours²⁹ while findings from the other three RCTs found them to be statistically equal.^{26,28,32} Findings from the meta-analysis also found them to be statistically equal at 48 hours.²⁵

Given the scope of this integrative review, it was not feasible to extrapolate data on pain scores at intervals other than 24 and 48 hours postoperatively. Some studies recorded pain scores outside the 24 and 48-hour postoperative intervals, but the data from these intervals was so limited it was not included in this integrative review. The results of all studies suggest perineural dexamethasone may have a slight advantage over IV dexamethasone in reducing the severity of pain patients experience in the postoperative period.

Opioid Consumption

There is mounting evidence to demonstrate that opioids cause adverse effects that negatively affect patients' postoperative recovery. Opioid consumption is an appropriate secondary outcome because it provides an estimate of the potential to reduce the adverse effects associated with opioids. Based on study results, perineural dexamethasone reduces opioid consumption to a greater extent than IV dexamethasone at 24 hours, but not at 48

hours postoperatively. The results of the meta-analysis²⁵ and five of six RCTs^{26-29,32,35} found lower opioid consumption at 24 hours in the perineural dexamethasone group.^{25,27-29,34,36} Results of only one study found lower opioid consumption at 24 hours in the IV dexamethasone group.³⁷ Six RCTs did not have data on opioid consumption.^{30-33,35,38} Findings from one RCT found statistically lower opioid consumption at 24 hours for perineural dexamethasone compared to IV dexamethasone^{25,29} while findings from the other five RCTs found no statistical difference between the two.^{27,28,34,36,37} The findings from the meta-analysis found statistically lower opioid consumption at 24 hours compared to IV dexamethasone.²⁵

Opioid consumption was also analyzed at 48 hours in two RCTs. The results of one study favored perineural dexamethasone²⁹ and one favored IV dexamethasone.²⁸ The meta-analysis did not provide data at this time interval. Findings from one RCT found perineural dexamethasone to statistically reduce opioid consumption at 48 hours²⁹ while another found them to be statistically equal.²⁸

Similar to pain scores, opioid consumption was examined in a select number of studies. The emergence of “opioid-free analgesia” makes this an evolving, important consideration in regional anesthesia. The study findings suggest perineural dexamethasone may have a slight advantage over IV dexamethasone in reducing opioid consumption in the intermediate postoperative period.

Complications with Dexamethasone

A priority of adjunct use in SNBs is ensuring they have a safe clinical profile. Therefore, complications associated with perineural and IV dexamethasone were reviewed. No significant complications were found in any of the studies related to the use

of dexamethasone in SNBs. Related specifically to neurological complications, only two studies reported symptoms of numbness or paresthesia, both of which were reported as self-limiting with resolution occurring within eight weeks of onset.^{28,31} In one of those studies, one of four participants received perineural dexamethasone and two of four received IV dexamethasone.²⁸ In the other study, one participant received IV dexamethasone.³¹

In addition to neurological complications, blood glucose levels and postoperative nausea and vomiting (PONV) have also been explored. Blood glucose levels were monitored in three studies and it was found in all three studies that IV dexamethasone increased blood glucose levels to a greater extent than perineural dexamethasone.^{26,29,32} These differences were not statistically significant. PONV was monitored in six studies and in three of those six studies perineural dexamethasone reduced PONV to a greater extent than IV dexamethasone, however, none were statistically significant.^{27,29,32} Three other studies were reviewed. IV dexamethasone was superior to perineural dexamethasone (in terms of anti-emetic doses) in one study³⁶ while two of three revealed no difference between the two.^{25,37}

The study findings suggest neither perineural nor IV dexamethasone contribute to clinically significant perioperative complications when combined with SNBs. In cases where neurological complications were noted, they were transient in nature, like most neurological complications seen with SNBs.⁷ The study findings also suggest perineural dexamethasone may offer a slight advantage over IV dexamethasone in reducing PONV with less increase in blood glucose levels. The importance of this is yet to be determined because the threshold for clinically significant blood glucose elevations remains to be

elucidated. Of note, the majority of participants recruited in these studies were healthy individuals so it is difficult to predict the degree of complications in those with underlying comorbidities.

Multi-Modal Perineural Analgesia

Multi-modal perineural analgesia describes the use of multiple adjuncts to improve the success of SNBs. Theoretically, administering a dose of both perineural and IV dexamethasone gives one the benefits of both routes of administration. Perineural dexamethasone would hypothetically provide superior analgesic duration with minimal fluctuations in blood glucose while IV dexamethasone would provide a synergistic effect on analgesic duration with the added advantage of PONV prophylaxis.

Using IV and perineural dexamethasone in conjunction with one another for multi-modal perineural analgesia was recently studied in single-shot intercostal nerve blocks for patients undergoing video-assisted thoracotomies.³⁹ In this RCT, perineural and IV dexamethasone administered concomitantly was superior to IV dexamethasone alone in prolonging the duration of analgesia. Other benefits of concomitant administration of both IV and perineural dexamethasone, as compared to IV dexamethasone alone, included reduced postoperative pain scores, reduced opioid consumption, and increased pulmonary function tests. This study finding suggests the concomitant administration of both perineural and IV dexamethasone may be more advantageous than administration by one route alone.

Discussion

Findings in this literature review parallel the results of four other meta-analyses on perineural dexamethasone.¹¹⁻¹⁴ The literature collectively supports perineural

dexamethasone in prolonging SNBs. Furthermore, perineural dexamethasone was superior to IV dexamethasone in prolonging the duration of analgesia, reducing pain scores, and reducing opioid consumption, albeit to a small degree in the latter outcome measures. Research on the effects IV dexamethasone has on SNBs is more limited than perineural dexamethasone. When IV dexamethasone was compared to local anesthetic with saline or local anesthetic alone, it was superior in prolonging the duration of analgesia in most of the studies. These findings parallel some of the early research on IV dexamethasone and SNBs.³⁸ The reasons for differences between perineural and IV dexamethasone are unknown.

The study results indicate dexamethasone may act both systemically and perineurally since both the perineural and IV routes are effective in prolonging SNBs. A common mechanism between perineural and systemic routes is its propensity to reduce inflammatory-induced nociception. While this may explain some of their prolonging properties, it doesn't describe their effects in full given the trivial amount of inflammation associated with the administration of SNBs. A distinct difference between the two routes of administration is the direct action perineural dexamethasone has on the nerve fibers themselves. While this differentiation may explain the superiority of the perineural route, it may also be the reason many remain skeptical. For example, direct inhibition of nociceptive C-fiber signal transmission is a desirable attribute that can effectively explain why the perineural route is superior. Reducing blood flow to the nerve may also explain the prolonging effects of perineural dexamethasone, but isn't necessarily a desirable attribute due to the potential to cause nerve ischemia.

Ultimately, the mechanism by which each route of administration contributes to SNBs is mostly speculation and remains to be elucidated. A distinct, conclusive mechanism would help providers make a decisive decision on which route of administration to choose. Given its unknown mechanism in prolonging SNBs, consideration should be given to the potential advantages and disadvantages based on postulated mechanisms of action, previous research, and the results of this integrative review.

Advantages and Disadvantages of Perineural Dexamethasone

It is clear that perineural dexamethasone effectively and reliably prolongs the duration of analgesia in SNBs. While this is the principle advantage of SNBs, it also effectively reduces pain scores and opioid consumption. A theoretical advantage of administering dexamethasone perineurally is that the degree of hyperglycemia associated with systemic administration can be avoided.¹⁵ A select number of studies in this literature review examined blood glucose levels and all three found perineural dexamethasone to increase blood glucose levels to a lesser extent than IV dexamethasone.^{26,29,32} These findings were not statistically significant and the clinical implications in both healthy and high-risk patients need to be further explored. Another advantage of perineural dexamethasone found includes its tendency to reduce PONV. Historically, IV dexamethasone has been used to reduce PONV. The prospects of perineural dexamethasone having a similar, and potentially better propensity to reduce PONV may be an important consideration in determining the best route of administration. Determining whether the antiemetic effect was related to a reduction in opioid consumption or due to systemic absorption also needs to be further explored.

Despite the advantages of perineural dexamethasone, its susceptibility to neurotoxicity and use as an off-label drug are lingering disadvantages. Ongoing debate regarding the safety of dexamethasone exists even though there have been no documented long-term complications with perineural dexamethasone. Many assertions associated with the safety of dexamethasone in regional anesthesia have been based on animal research. For example, in a study on isolated rat sensory neurons, the authors concluded that dexamethasone alone was less neurotoxic than ropivacaine alone.³⁹ When ropivacaine and dexamethasone were combined, however, they concluded that there was potential for neurotoxicity and a tendency to cause thermal hyperalgesia.⁴⁰

In contrast to this study, other animal studies have found no histological signs of neurotoxicity with dexamethasone.⁴¹ Furthermore, animal studies have found that dexamethasone may actually attenuate, rather than promote, bupivacaine-induced neuron injury.⁴² Others have concluded that it is the particulate steroids⁴³ and commercial preservatives⁴⁴ that contribute to neurotoxicity. These factors are not a consideration with dexamethasone given its non-particulate property and preservative-free availability.

Even though there is little evidence to support the notion that dexamethasone is neurotoxic, the Food and Drug Administration's (FDA's) lack of approval for perineural injection has led to its limited use in regional anesthesia. The FDA approval process is rigorous, requiring specific conditions be met for an off-label use to gain on-label status. Therefore, pharmaceutical companies often do not seek the FDA approval processes, and providers are left to use many drugs as off-label (i.e. fentanyl and 0.5% bupivacaine for spinal anesthesia). The FDA recognizes that such use is permissible and typically within the standard of care.⁴⁵ Furthermore, of all the adjuncts commonly used in regional

anesthesia including clonidine, dexmedetomidine, buprenorphine, tramadol, and epinephrine, only the latter is approved by the FDA for regional anesthesia. Coincidentally, it is one of the many adjuncts proven to be ineffective in prolonging the duration of SNBs.^{9,10}

Advantages and Disadvantages of IV Dexamethasone

Like perineural dexamethasone, IV dexamethasone has its own set of advantages. IV dexamethasone was found to prolong the duration of analgesia of SNBs in most studies in this literature review. Other advantages of IV dexamethasone include familiarity with its use in practice, PONV prophylaxis,^{20,46,47} analgesic and opioid sparing effects,^{15,16} and a long-standing history of systemic anti-inflammatory effects.¹⁸ IV dexamethasone also serves as an important biologic modifier of perioperative inflammatory responses and organ dysfunction.²⁰ Moreover, the incidence of neurotoxicity is nearly nonexistent with IV dexamethasone.

IV dexamethasone also has disadvantages that need to be considered. The primary shortcoming of IV dexamethasone in SNBs is its inferiority to perineural dexamethasone in prolonging the duration of analgesia, reducing opioid consumption, and reducing pain scores. Additionally, there is ongoing concern about IV dexamethasone promoting hyperglycemia and contributing to postoperative infections. While these concerns are largely unfounded, large-scale studies in major surgery with higher risk of wound and infection complications are needed to validate its relatively low rate of complications.²⁰

Gaps in Literature

Table 1 illustrates the diversity in dosing regimens used in practice. An optimal dosing regimen that allows for the smallest dose possible while obtaining optimal effects

still needs to be determined. In addition, further research is needed on perineural dexamethasone and PONV prophylaxis. There is a plethora of research to support the efficacy of IV dexamethasone and PONV prophylaxis.^{46,47} While the results of this literature review and another meta-analysis¹¹ suggest perineural dexamethasone is efficacious in PONV prophylaxis, larger sample sizes are needed to establish a clear equivalency to IV dexamethasone. Determining whether its antiemetic effects are related to a reduction in opioid consumption or due to systemic absorption also needs further research. Finally, more research is needed to evaluate outcomes associated with the use of multi-modal perineural analgesia. Given the postulated systemic and perineural mechanisms of dexamethasone, it can be hypothesized that the administration of dexamethasone by both routes can synergistically improve duration of analgesia, pain scores, and opioid consumption in SNBs. More research is needed on this topic.

Limitations

The results and findings of this integrative review are limited by the quality and rigor of the included studies. While the majority were rigorous in their design and methodology, there was significant heterogeneity in how the SNBs were performed, what procedures the SNBs were performed for, how the authors defined their various outcome measures, and how the authors defined statistical significance. Factors related to the block itself such as the nerve block site, dose of dexamethasone used, type of local anesthetic used (i.e. intermediate versus long-acting), addition of adjuncts other than dexamethasone, use of ultrasound, and timing of dexamethasone administration varied significantly among studies.

The threshold for statistical significance also varied tremendously among studies, leading many authors to different analytical conclusions regarding the prolongation of duration of analgesia. In several studies there were no statistical significances found in long-term complications associated dexamethasone due to lack of power. Given the low complication rates of SNBs, statistically significant findings related to complications associated with dexamethasone might only be found after a large volume of participants has been recruited. Therefore, the long-term sequel of dexamethasone use in SNBs might only be known after its use has increased.

Conclusions and Recommendations

Perineural dexamethasone is a more effective adjunct in prolonging the duration of analgesia in SNBs compared to IV dexamethasone. Perineural dexamethasone also reduces postoperative pain scores and opioid consumption without increasing complication rates. An intermediate dose (Table 2) of preservative-free perineural dexamethasone is recommended for prolonging the duration of analgesia in SNBs. An intermediate dose of IV dexamethasone at the time of SNB administration is an acceptable alternative for prolonging the duration of analgesia. Furthermore, given the confounding evidence in support of IV dexamethasone for PONV prophylaxis, the IV route is recommended over perineural dexamethasone when PONV prophylaxis is a priority. Further research regarding perineural and IV dexamethasone dosing, PONV prophylaxis with perineural dexamethasone, and the use of both IV and perineural dexamethasone as part of a multi-modal perineural analgesia regimen is warranted.

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Table 1
Summary of Literature Review Findings

Study	Sample	Type of Block and Surgery	Local Anesthetic Concentration and Volume	Additive	Dexamethasone Dose^a	Analgesia or Sensory Block Definition	Results^b
Abdallah FW, Johnson J, Chan V, et al., 2015 ³⁷	RCT n = 75	Supraclavicular block for forearm or hand surgery	30 mL 0.5% ropivacaine	None	8 mg	Time in hours to the first report of postoperative pain at the surgical site	<i>Saline</i> 13.2 h <i>PNdex</i> 25 h <i>IVdex</i> 25 h
Abdel Naim NH, Elshafaie KA, Soaida SM, Abdel-Haq MM, Nawar KM, 2016 ³³	RCT n = 63	Combined femoral and sciatic blocks for lower limb vascular surgery	20 mL 0.5% bupivacaine (each block)	None	8 mg (each block) ^c	Time of sensory loss until the time of demand for the first dose of rescue analgesia	<i>Saline</i> 13.1 h <i>PNdex</i> 17.4 h <i>IVdex</i> 15.7 h
Aliste J, Leurcharusmee P, Engsusophon P, et al., 2017 ³¹	RCT n = 150	Axillary block for forearm, wrist, or hand surgery	24 mL 1.0% lidocaine-0.25% bupivacaine dorsal to axillary artery and 6 mL around musculocutaneous nerve	5 mcg/mL epinephrine	8 mg	Time patient first experienced pain at the surgical site	<i>PNdex</i> 21.1 h <i>IVdex</i> 17.1 h

Chong MA, Berbenetz NM, Lin C, Singh S, 2017 ²⁵	Meta-analysis n = 11 RCTs and 1076 participants	Variable	Variable	Variable	Variable	The definition used by each individual study	<i>PNdex</i> 3.77 h greater than <i>IVdex</i>
Chun EH, Kim YJ, Hee JH, 2016 ³²	RCT n = 99	Interscalene block for arthroscopic shoulder surgery	12 mL 0.75% bupivacaine	None	5 mg	Time between end of operation and first request of analgesics by patient	<i>PNdex</i> 18 h <i>IVdex</i> 13.5 h
Dawson RL, McLeod DH, Koerber JP, Plummer JL, Dracopoulos GC, 2016 ³⁴	RCT n = 90	Ankle block for metatarsal osteotomy surgery	20 mL 0.75% bupivacaine	None	8 mg	Time until sensation or movement began to return	<i>Saline</i> 14.6 h <i>PNdex</i> 24.1 h <i>IVdex</i> 20.9 h
Desmet M, Braems H, Reynvoet M, et al., 2013 ²⁶	RCT n = 150	Interscalene block for arthroscopic shoulder surgery	30 mL 0.5% ropivacaine	None	10 mg	Time between block and first analgesic request	<i>Saline</i> 12.6 h <i>PNdex</i> 23.4 h <i>IVdex</i> 21.3 h
Kawanishi R, Yamamoto K, Tobetto Y, et al., 2014 ³⁵	RCT n = 39	Interscalene block for arthroscopic shoulder surgery	20 mL 0.75% ropivacaine	None	4 mg	Time between performance of block and first administration of analgesia	<i>Ropivacaine</i> <i>alone</i> 11.2 h <i>PNdex</i> 18.0 h <i>IVdex</i>

							14.0 h
Leurcharusmee P, Aliste J, Van Zundert TCRV, et al., 2016 ³⁰	RCT n = 150	Infraclavicular block for forearm, wrist, or hand surgery	35 mL 1% lidocaine -0.25% bupivacaine	5 mcg/mL epinephrine	5 mg	Time patient first experienced pain at the surgical site	<i>PNdex</i> 22.1 h <i>IVdex</i> 18.6 h
Morales-Muñoz C, Sánchez-Ramos JL, Díaz-Lara MD, González-González J, Gallego-Alonso I, Hernández-del-Castillo MS, 2016 ²⁹	RCT n = 81	Femoral block for knee replacement surgery	20 mL 0.5% ropivacaine	None	8 mg	Time from administration of the block to the first demand for rescue analgesia using the PCA system	<i>Saline</i> 3.1 h <i>PNdex</i> 19.2 h <i>IVdex</i> 2.7 h
Rahangdale R, Kendall MC, McCarthy RJ, et al., 2014 ²⁸	RCT n = 78	Sciatic block for ankle and foot surgery	0.45 mL/kg 0.5% bupivacaine	1:300,000 epinephrine	8 mg	Time to first pain not in the saphenous distribution	<i>PNdex</i> 13 h greater than saline and 6 h greater than <i>IVdex</i> <i>IVdex</i> 8 h greater than saline

Rosenfeld DM, Ivancic MG, Hattrup SJ, 2016 ³⁶	RCT n = 197	Interscalene block for shoulder surgery	28 mL 0.5% ropivacaine	None	8 mg	Time from injection until the patient detected complete resolution of sensory blockade in the shoulder/incision area	<i>Saline</i> 13.8 h <i>PNdex</i> 16.9 h <i>IVdex</i> 18.2 h
Sakae TM, Marchioro P, Schuelter- Trevisol F, Trevisol DJ, 2017 ²⁷	RCT n = 60	Interscalene block for arthroscopic shoulder surgery	20 mL 0.75% ropivacaine	None	4 mg	Time interval between a successful block and the complete recovery of the arm senses	<i>Saline</i> 28.8 h <i>PNdex</i> 38.7 h <i>IVdex</i> 27.4 h

Abbreviations: IVdex, intravenous dexamethasone; PNdex, perineural dexamethasone; h, hours

^aListed doses were for both the perineural and IV route, unless specified

^bResults expressed in either mean/median durations depending on what statistic the study used

^c8 mg was used in each block for a total dose of 16 mg of perineural dexamethasone

Table 2

Recommendations for Dexamethasone Use in Single-Shot Nerve Blocks

Recommended Dexamethasone Dose	Usual volume and concentration of long-acting local anesthetic (i.e. 0.5 % ropivacaine) + 4-5 milligrams preservative-free perineural dexamethasone
Alternative Dexamethasone Dose	Usual volume and concentration of long-acting local anesthetic + 4-5 milligrams IV dexamethasone at time of nerve block