In an operating room, DM may change how nerves respond to nerve blocks or neuraxial techniques during regional anesthesia. In practice for chronic pain management, PDN significantly lowers the quality of daily life accompanied by insomnia, which needs aggressive pain control using medication and interventional procedures. Therefore, here, we aim to discuss 1) what we should understand for optimal regional anesthesia in DPN and 2) which interventional procedures (invasive and noninvasive pain procedures) are available to manage PDN.

Regional Anesthesia in Diabetic Peripheral Neuropathy: Perspective of Anesthesiologists in an Operating Room

The development of DPN impacts the performance of regional anesthesia. Like other neuropathic pain conditions, such as postherpetic neuralgia, diabetic neuropathic nerves are more difficult to stimulate. The threshold of nerve stimulation has been markedly increased in DPN, and double guidance (usually ultrasonography and nerve stimulation) is safer while advancing needles. Notably, there is high inter-patient variability in stimulation threshold in such patients, and the precise value cannot be predicted accurately from detailed neurological testing (i.e., nerve conduction velocity).

According to the postulated pathophysiologic mechanisms, it is suspected that neuropathic nerves would be more sensitive to local anesthetics; therefore, lower doses of local anesthetics would be necessary for patients with DPN. Although the onset time of nerve blocks is not significantly different between diabetics and nondiabetics, DPN increases block duration. Theoretically, the decrease in nerve blood flow (deficient microcirculation) would lead to a prolonged washout phase, which was supported by Sertoz et al., that the regression time of motor block and sensory block during sciatic nerve block was significantly longer in the group with the higher HbA1C. The reasons for the prolonged block duration have yet to be clarified. However, both pharmacodynamic (more sensitive sodium currents) and pharmacokinetics (prolonged residence time of local anesthetics around the nerve due to decreased nerve blood flow) mechanisms have been suggested.

Regarding complications of nerve blocks in DPN, DM increases the risk of infection, mainly when catheters are used. Besides, a recent study by Lee CS et al. described that complicated DM increased the prevalence of deep spinal infection after epidural injections (in outpatient pain practice) three times more (odds ratio = 3.18; 95% CI = 1.30~6.7). However, despite evidence that diabetic nerves seem more sensitive to local anesthetics, there are no clinical data to suggest regional anesthesia should be withheld from patients in whom a good indication exists.

Painful diabetic peripheral neuropathy: Perspective of pain physicians

The most common DPN is distal symmetric polyneuropathy, with the characteristic of a glove- and stocking-like presentation of distal sensory or motor function loss. Because PDN is associated with increased mortality and morbidity, early recognition and preventive measures are essential. Nevertheless, diagnosing DPN or PDN is challenging, particularly in patients with early and mild neuropathy, and there is no established gold standard. Furthermore, there is no established DPN treatment other than improved glycemic control; only symptomatic management is available for PDN. However, thanks to health-conscious living, almost one-third of patients with PDN derive sufficient pain relief with existing pharmacotherapies. These include antidepressants (tricyclic acid, serotonin-norepinephrine reuptake inhibitor), anticonvulsants (calcium-channel blocker, sodium channel blocker), and others (sarpogrelate). A more detailed and distinct symptom profile from patients with PDN may help identify patients more responsive to one treatment versus another. In addition to pharmacological, physical, cognitive, or educational management for PDN, large randomized clinical trials are still lacking in identifying the most effective minimally invasive interventions. Transcutaneous electrical nerve stimulation, oriental acupuncture, pain scrambler therapy, sympathetic ganglion block, and botulinum toxin injections have been investigated as alternative therapeutic outcomes for PDN. In addition, spinal cord stimulation (SCS) has been suggested as a treatment option for patients with refractory PDN. According to a recent meta-analysis, more patients receiving SCS achieved at least a 50% reduction in pain intensity and improved health-related quality of life (using EQ-5D utility score) compared with the best medical therapy. Such findings demonstrate that SCS is an effective therapeutic adjunct to the best medical therapy in reducing pain intensity and improving health-related quality of life in patients with PDN.

REFERENCES

1. Ten Hoope W, Looije M, Lirk P. Regional anesthesia in diabetic peripheral neuropathy. *Curr Opin Anaesthesiol.* 2017.
2. Calcutt NA. Diabetic neuropathy and neuropathic pain: a (con)fusion of pathogenic mechanisms? *Pain* 2020 Sep;**161**(Suppl 1):S65-S86.
3. Sertoz N, Deniz MN, Ayanoglu HO. Relationship between glycosylated hemoglobin level and sciatic nerve block performance in diabetic patients. *Foot Ankle Int* 2013;**45**:85-90.
4. Lee CS, Park YJ, Moon JY, Kim YC. Deep spinal infection after outpatient epidural injections for pain: A retrospective sample cohort study using a claims database in South Korea. *Anesthesiology* 2021;**134**:925-36.
5. Duarte RV, Nevitt S, Maden M, Meier K, Taylor RS, Eldabe S, de Vos CC. Spinal cord stimulation for the management of painful diabetic neuropathy: a systematic review and meta-analysis of individual patient and aggregate data. *Pain* 2021 Nov 1;**162**(11):2635-2643.

#36972 REGIONAL ANAESTHESIA FOR CLAVICLE FRACTURES AND CLAVICLE SURGERY

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Clavicle fractures are common injuries, and both the injury itself, as well as fixation surgery, can be associated with moderate to severe pain.[1 2] Adequate analgesia provision is desirable for improved patient satisfaction and early return to function. Regional anaesthetic techniques can be useful for analgesia provision and can be a viable option for surgical anaesthesia during fixation surgery for high-risk patients. However, this region has a complex innervation that remains a controversial subject.[1-3] Varying fracture locations and injury patterns add a further layer of complexity. Current literature comprises of heterogenous studies, and several different regional anaesthetic approaches, as well as combinations of these approaches, have been previously described.[4] These include cervical plexus, selective supraclavicular nerve, superior trunk, and interscalene blocks.[4] Additionally, the widespread adoption of ultrasound-guided regional anaesthesia has led to the emergence of interfascial techniques, such as the clavipectoral fascial plane block.[5] Furthermore, local infiltration analgesia and haematoma block have also been described in the

literature.[6 7] Several studies have demonstrated the reliability of regional anaesthesia as a sole anaesthetic technique for clavicle fixation surgery.[4 8 9] The option to avoid general anaesthesia is attractive, as patients with clavicle fractures may have concomitant chest or pulmonary injuries.

The combination of a cervical plexus block and interscalene brachial plexus block was previously regarded as the technique of choice for if surgical anaesthesia is desired.[4] However, this approach is associated with the potential for hemidiaphragmatic paresis amongst other problems. This begets the question if some of the more novel, selective techniques or interfascial blocks can circumvent some of the issues from this 'traditional' approach whilst providing non-inferior surgical anaesthesia.

Innervation of the clavicle The complete innervation of the clavicular region has long been a subject of debate.[1-3] Nonetheless, most of its innervation seems to arise from branches of the cervical plexus and superior trunk of the brachial plexus. The supraclavicular nerve (C3,4) divides into medial, intermediate, and lateral branches to innervate the cephalad and ventral aspect of the clavicle along its entire length, as well as the sternoclavicular joint and, together with the lateral pectoral nerve (C5-7), the acromioclavicular joint.[10] However caudal and dorsal surfaces of the clavicle receive differing innervation – by the subclavian nerve (C5,6) at the medial and middle thirds, and by the lateral pectoral nerve at the middle and lateral thirds.[10] Although the suprascapular, spinal accessory, and long thoracic nerves have been implicated, their exact contribution to clavicular innervation remains contentious.[1 3]

Cervical plexus block and nomenclature Cervical plexus blockade has been well described in the literature. Analgesia provision occurs by inhibiting nociceptive input from the supraclavicular nerve; however, since this nerve does not supply the caudal and dorsal surfaces of the clavicle, cervical plexus block alone is usually not sufficient for surgical anaesthesia alone.[4 10 11] Most studies use a cervical plexus block to complement general anaesthesia or combine it with another regional anaesthetic technique such as an interscalene brachial plexus or clavipectoral fascial plane block if general anaesthesia is to be avoided.[8 9 11]

Studies examining the efficacy of a 'superficial cervical plexus block' might be difficult to interpret at face value due to inconsistent nomenclature and variability in in-text descriptions and sonographic images.[4] By definition, subcutaneous deposition of local anaesthetic along the posterior border of the sternocleidomastoid constitutes a superficial cervical plexus block.[12 13] If the needle tip is advanced deep to the investing fascia of the neck, while remaining superficial to the prevertebral fascia, this is termed an intermediate cervical plexus block.[12 13] The investing cervical fascia was once considered to be an impenetrable barrier to deeper local anaesthetic spread – rendering a superficial injection less effective. However, data from anatomical studies and carotid surgeries has suggested that this fascia is porous or incomplete and that a superficial injection is as efficacious as an intermediate block; although the clinical significance of this dichotomisation remains unclear.[12 13] Studies directly comparing the efficacy of superficial and intermediate cervical plexus blocks in clavicular surgeries are lacking, although a small study reported a 20% failure rate in patients receiving superficial *versus* intermediate cervical plexus block in conjunction with an interscalene block.[8] Alternatively, since the desired end-point is blockade of the supraclavicular nerve, ultrasound-guided block of this branch of the cervical plexus is an alternative that has been described.[4 14 15]

Interscalene brachial plexus block Interscalene block targets the C5 to C7 nerve roots, and might be expected to produce blockade of the subclavian nerve that originates from the upper trunk, and lateral pectoral nerve which arises from the lateral cord or from the anterior divisions of the upper and middle trunks. Its use in clavicular fractures has been well described in the literature, and when combined with cervical plexus blockade can produce surgical anaesthesia of the clavicular region and alleviate the need for general anaesthesia.[4 8] However, despite sonographic guidance and low-volume injections, interscalene block can be associated with undesirable side-effects such as phrenic nerve blockade, hoarseness, Horner's syndrome, and sensorimotor block of the ipsilateral upper limb.[9 11] This can lead to impairment in pulmonary function mechanics such as forced vital capacity and volume, although in most patients this appears to be well compensated, possibly by accessory muscles of respiration.[9 16] However, patients may have thoracic injuries which can place them at elevated risk of respiratory failure if phrenic nerve paresis were to occur. Despite its limitations, interscalene brachial plexus block coupled with a superficial/intermediate cervical plexus block is a reliable choice if surgical anaesthesia is desired.

Selective approaches In order to minimise the problems associated with an interscalene block, more selective approaches have been adopted which target the superior trunk or the 5th and/or 6th cervical nerve roots.[14] Intermediate cervical plexus block combined with targeted C5 and C6 is sufficient for surgical anaesthesia; while omission of the C6 component seems to be adequate if analgesia (but not anaesthesia) is the desired clinical outcome.[4 14] The superior trunk block has been described as a alternative to the interscalene block in clavicle fractures when performed in combination with a cervical plexus or supraclavicular nerve block, the latter of which has been termed a 'SCUT block'.[15]

Clavipectoral fascia and clavipectoral fascial plane block. The clavipectoral fascia lies deep to the clavicular part of the pectoralis major muscle. Medially this fascia fuses with the external intercostal membrane and first rib; laterally it thickens to form the costocoracoid ligament and attaches to the coracoid process. The clavipectoral fascia divides to enclose the subclavius muscle and attaches to clavicle superiorly, it also occupies the space between the pectoralis minor and clavicle.[17] Given that the clavipectoral fascial plane contains the subclavius muscle, it should, by extension, also envelope the subclavian nerve (or nerve to the subclavius). Furthermore, since the clavipectoral fascia also surrounds the clavicle, nerve endings that supply the clavicle should also be contained within this fascia. Terminal branches of the sensory nerves, such as the suprascapular, subclavian, lateral pectoral, and long thoracic nerves pass through the plane between the clavipectoral fascia and the clavicle itself.[17] Hence, the sensory innervation of the clavicle should penetrate the clavipectoral fascia, and local anaesthetic deposition within this fascial plane should at least anaesthetise the caudal and dorsal surfaces of the clavicle. Studies report success with either a single- or dual-injection approach; the latter is administered on both sides of the fracture site.[4 5 9 17] Given observations of some studies that clavipectoral block as a sole technique allows for surgical anaesthesia, and can provide coverage of the skin overlying the clavicle, there might be cephalad spread of the injectate into the investing layer of cervical fascia which produces supraclavicular nerve blockade. The comparable

anaesthetic coverage afforded by this block with a paucity of motor effects makes it an attractive alternative to the 'traditional' combination of a cervical plexus and interscalene brachial plexus block.[9]

Surgical site infiltration Surgical fixation under local infiltration analgesia alone has been reported in a few studies which typically use high volume local anaesthetic in combination with a vasoconstrictor.[4 18] Subcutaneous infiltration produces local nociceptive blockade, and deeper subperiosteal infiltration is postulated to facilitate endosteal local anaesthetic spread via nutrient vessels from the periosteum; thus blocking sensory fibers in the periosteum and within bone. On a similar note, the successful use of ultrasound-guided haematoma block for pain relief in the emergency department has been reported[7]; in this approach the fracture haematoma serves as a medium for local anaesthetic spread into the surrounding structures and periosteum. Even if expertise for regional block performance is unavailable, local anaesthetic infiltration should at least be considered in fixation surgeries performed under general anaesthesia alone.[4 6]

Other regional techniques Some small studies or reports have utilised other regional blocks, such as a supraclavicular brachial plexus or pectoralis (PECS) I or II blocks as part of the regional anaesthetic regimen with varying degrees of success.[4] The former likely targets the trunks or divisions distal to the origin of the subclavian and lateral pectoral nerves, while the latter mainly provides block of the medial and lateral pectoral nerves, although it can be argued that spread to muscles adjacent to the clavicle (such as the pectoral muscles) might play a role in nociceptive inhibition. These will not be elaborated upon given the paucity of evidence, somewhat limited mechanistic plausibility, as well as availability of other techniques which can provide better coverage.

Conclusion Several regional anaesthetic aproaches have been described in the literature, and the feasibility of awake surgical fixation has been well reported. The regional anaesthetic of choice depends largely on whether surgical anaesthesia is required or if analgesia provision without anaesthesia is sufficient for the clinical context. If analgesia desired as part of a general anaesthetic, a superficial/intermediate cervical plexus block or supraclavicular nerve block is may suffice. Although a superficial/intermediate cervical plexus block has previously been the technique of choice for surgical anaesthesia provision, it has a propensity for undesirable motor effects such as hemidiaphramatic paresis; which can be mitigated by the use of a clavipectoral fascial plane block with or without a cervical plexus block.[11] Clavipectoral fascial plane block may be a promising new tool in the anaesthesiologist's armamentarium for anaesthesia and analgesia provision in clavicle factures and fixation surgery.

REFERENCES

1. Tran DQ, Tiyaprasertkul W, González AP. Analgesia for clavicular fracture and surgery: a call for evidence. *Reg Anesth Pain Med.* 2013 Nov-Dec;**38**(6):539-43. doi: 10.1097/AAP.0000000000000012. Lee CCM, Beh ZY, Lua CB, Peng K, Fathil SM, Hou JD, Lin JA. Regional anesthetic and analgesic techniques for clavicle fractures and clavicle surgeries: Part 1-A Scoping Review. Healthcare (Basel). 2022 Aug 7;**10**(8):1487. doi: 10.3390/healthcare10081487.
2. Valdés-Vilches LF, Sánchez-del Águila MJ. Anesthesia for clavicular fracture: selective supraclavicular nerve block is the key. *Reg Anesth Pain Med.* 2014 May-Jun;**39**(3):258-9. doi: 10.1097/AAP.0000000000000057.
3. Moriggl B. ESRA19-0712 Clavicle innervation and implications for regional anaesthesia. *Reg. Anesth. Pain Med.* 2019;**44**:A63–A64.
4. Lee CCM, Beh ZY, Lua CB, Peng K, Fathil SM, Hou JD, Lin JA. Regional anesthetic and analgesic techniques for clavicle fractures and clavicle surgeries: Part 1-A scoping review. *Healthcare (Basel)*. 2022 Aug 7;**10**(8):1487. doi: 10.3390/healthcare10081487.
5. Valdés-Vilches L. Analgesia for clavicular surgery/fractures. Symposia 01: postoperative analgesia for orthopedic upper and lower limb surgery; proceedings of the symposium conducted at the 36th annual european society of regional anaesthesia and pain therapy (ESRA) congress; Lugano, Switzerland. 13–16 September 2017.
6. Yoo JS, Heo K, Kwon SM, Lee DH, Seo JB. Effect of surgical-site, multimodal drug injection on pain and stress biomarkers in patients undergoing plate fixation for clavicular fractures. *Clin Orthop Surg.* 2018 Dec;**10**(4):455-461. doi: 10.4055/cios.2018.10.4.455. Epub 2018 Nov 21.
7. DeJulio P, Korn R, Oswald J. Ultrasound-guided hematoma block for a clavicular fracture. *J Emerg Med.* 2021 May;**60**(5):648-650. doi: 10.1016/j.jemermed.2021.01.034. Epub 2021 Mar 5.
8. Arjun BK, Vinod CN, Puneeth J, Narendrababu MC. Ultrasound-guided interscalene block combined with intermediate or superficial cervical plexus block for clavicle surgery: a randomised double blind study. *Eur J Anaesthesiol.* 2020 Nov;**37**(11):979-983. doi: 10.1097/EJA.0000000000001300.
9. Zhuo Q, Zheng Y, Hu Z, Xiong J, Wu Y, Zheng Y, Wang L. Ultrasound-guided clavipectoral fascial plane block with intermediate cervical plexus block for midshaft clavicular surgery: a prospective randomized controlled trial. *Anesth Analg.* 2022 Sep 1;**135**(3):633-640. doi: 10.1213/ANE.0000000000005911.
10. Leurcharusmee P, Maikong N, Kantakam P, Navic P, Mahakkanukrauh P, Tran D. Innervation of the clavicle: a cadaveric investigation. *Reg Anesth Pain Med.* 2021 Dec;**46**(Epub 2021 Nov 1).
11. Abdelghany MS, Ahmed SA, Afandy ME. Superficial cervical plexus block alone or combined with interscalene brachial plexus block in surgery for clavicle fractures: a randomized clinical trial. *Minerva Anestesiol.* 2021 May;**87**(Epub 2021 Feb 16).
12. Ramachandran SK, Picton P, Shanks A, Dorje P, Pandit JJ. Comparison of intermediate vs subcutaneous cervical plexus block for carotid endarterectomy. *Br J Anaesth.* 2011 Aug;**107**(Epub 2011 May 24).
13. Pandit JJ, Dorje P, Satya-Krishna R. Investing layer of the cervical fascia of the neck may not exist. *Anesthesiology.* 2006 Jun;**104**(6):1344; author reply 1344-5. doi: 10.1097/00000542-200606000-00038.
14. Diwan S, Nair A, Sermeus LA, Patil AA, Attarde DS. Low-volume local anesthetics for C5 and supraclavicular nerve blocks for mid and lateral clavicle surgery: a case series. *A A Pract.* 2020 Oct;**14**(12):e01322. doi: 10.1213/XAA.0000000000001322.
15. Sivashanmugam T, Areti A, Selvum E, Diwan S, Pandian A. Selective blockade of supraclavicular nerves and upper trunk of brachial plexus 'The SCUT block' towards a site-specific regional anaesthesia strategy for clavicle surgeries – A descriptive study. *Indian J Anaesth.* 2021 Sep;**65**(Epub 2021 Oct 8.
16. Bergmann L, Martini S, Kesselmeier M, Armbruster W, Notheisen T, Adamzik M, Eichholz R. Phrenic nerve block caused by interscalene brachial plexus block: breathing effects of different sites of injection. *BMC Anesthesiol.* 2016 Jul 29;**16**(1):45. doi: 10.1186/s12871-016-0218-x.
17. Ince I, Kilicaslan A, Roques V, Elsharkawy H, Valdes L. Ultrasound-guided clavipectoral fascial plane block in a patient undergoing clavicular surgery. *J Clin Anesth* 2019;**58**:125–7.
18. Ahmad AA, Ubaidah Mustapa Kamal MA, Ruslan SR, Abdullah S, Ahmad AR. Plating of clavicle fracture using the wide-awake technique. *J Shoulder Elbow Surg.* 2020 Nov;**29**(Epub 2020 Jun 1.

#36929 THORACIC EPIDURALS FOR ERAS IN THORACIC AND ABDOMINAL SURGERY- STILL RELEVANT?

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Introduction In recent decades the high thoracic epidural analgesia (HTEA) has been increasingly replaced as the gold standard in minimal invasive surgical procedures. We strongly believe however it still is a viable (and maybe even essential) technique in major open surgery.[1] Adequate placement of a HTEA is difficult art to master.[2] Although published failure rates average from moderate to high, the lack of standardized definition of failure hampers a clear view on the problem.[3] Due to reduced caseloads since the (r)evolution of minimal invasive surgical techniques training and competence proficiency have also diminished seriously.[4]Fascial plane blocks (FPB), although extremely popular due to the advancement of ultrasound guided block techniques and the laparoscopic/