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The Anesthetic Technique for Clavicle Surgery in Remote Areas: Clavicopectoral Plane Block with Landmark Technique

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Abstract — Clavicopectoral plane block (CPB) is a relatively new regional anesthesia technique for clavicle fracture surgery. Methods: The study includes three cases of patients undergoing clavicle fracture surgery who received CPB in remote area. Results: The results show that CPB effectively prevents pain and provides high patient satisfaction. There were no complications during surgery, and pain scores remained low in the post-anesthesia care unit. Conclusions: Regardless, it can be concluded that CPB using the same technique yields satisfactory and effective anesthetic results in patients undergoing clavicle surgery. No complications occurred during surgery, and pain scores remained low in the PACU and during hospitalization. The three patients, including a 67-year-old female with a history of hypertension and Tuberculosis pneumonia, a 24-year-old male with an ASA score of 1, and a 54-year-old male with an ASA score of 2, reported a high level of satisfaction (9/10 to 10/10) with CPB regional anesthesia on a routine questionnaire before discharge

Keywords — Clavicle fracture; Clavicopectoral Plane Block; Remote Area; Health in Resource-Constrained Settings.

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INTRODUCTION

In this paper, the content will explain a suitable anesthesia technique for clavicle surgery in remote areas. The main point emphasized is the utilization of the Clavicopectoral Plane Block with Landmark Technique. Clavicular fractures, which account for 35% of injuries to the shoulder girdle, occur most commonly in men because of falls sustained during cycling and equestrian sports [1]. Clavicle fractures result for 2.6% of fractures in the Emergency Department (ED) and operating room. The midshaft is the common site of the fracture [2,19]. While stable fractures can be treated conservatively, fractures that are unstable, displaced, cause pain, impair function, or have neurovascular compromise may need additional care, such as fracture fixation. Clavicle fractures are linked to severe discomfort both before and after surgery [1]. Even though general anesthesia is frequently used, it is possible to execute clavicle fixation surgery under regional anesthetic, either with or without sedation, and this has been documented in the past. [19]. General anesthesia is the most common anesthetic option in clavicle fracture surgery, because regional anesthesia in this case has not become routine due to several complications such as ipsilateral nervus phrenicus parese in interscalene block for example [3]. Sonography has improved the safety of RA, increased the effectiveness of current techniques, and paved the way for the emergence of novel fascial plane blocks, such as the clavipectoral fascial plane, thanks to the widespread availability of ultrasound platforms and the adoption of real-time ultrasound guidance as the de facto gold standard [19].

What about in a remote area without access to ultrasound platforms? Using the landmark approach, either regional or general anesthesia was used for the clavicle operation [3]. The safest procedure in CPB when using the regional anesthetic landmark technique is superior to the interscalene brachial plexus block. The latter is linked to phrenic nerve motor blockage due to its near anatomical proximity, which can result in hemidiaphragmatic paresis and respiratory compromise in those who are vulnerable [4]. Moreover, a brachial plexus outflow blockage results in an immobile, insensate limb that necessitates

protection from harm, may limit function and postpone recovery, and may influence the surgical evaluation of neurovascular function [19]. It is still unknown for definite what nerve innervates the clavicle bone. Pain transmission following clavicle fracture and surgery may be mediated by the subclavian, supraclavicular, and long thoracic/suprascapular nerves, either alone or in combination. Currently available regional anesthetics for superficial cervical-interscalene plexus blocks in combination with interscalene blocks [4,10]. Clavipectoral plane block (CPB) is a relatively new regional anesthesia technique in clavicle fracture surgery. This technique was first introduced by Dr. Luis Valdes in 2017 at the European Society of Regional Anesthesia and Pain Therapy congress [5,9].

After a thorough review of the medical records, three patients undergoing surgery for a clavicle fracture were given the necessary intravenous midazolam (2 mg) and fentanyl (25 mcg) boluses for sedation. The filing of a case report was approved with informed consent.

Fig 1. Process of Occurrence Clavipectoral Plane Block

A CPB was performed using landmarks, first we identified the line of fracture by palpating the clavicle bone. Next we make a line of clavicle bone, make a mark 5 cm in proximal and distal of line fracture. Then we disinfected the site with povidone iodine and alcohol 70% (Fig 1).

CASE REPORT

2.1. Patient Mrs. A

A 67-year-old female (American Society of Anesthesiologists) ASA III (physical health status of the American Society of Anesthesiologists) with a history of hypertension, pneumonia, and tuberculosis. The CPB was administered using an landmark technique, 23 G needle Is used for injection in 5 cm proximal of line fracture and 5 cm distal to fracture line. The needle puncture hit the bone, then inject the local anesthesia. Ten cc 0,2% ropivacaine was given for each injection and 10cc 0,2% ropivacaine infiltration skin. Light sedation (midazolam 2 mg) proved to be without issues, and the post-anesthesia care unit (PACU) pain scores stayed at zero. One day following the procedure, the patient was sent home without receiving any opioids in the recovery room. The patient was administered intravenous ketorolac 15 mg (every 8 h for a day) and paracetamol 500 mg (every 6 h) in

ward and was sent home the day after the surgery, with oral medications (non-steroidal anti-inflammatory drug). Before being released from the hospital, the patient and the surgeon filled out a standard questionnaire and gave their regional anesthetic a 10/10 rating (Fig 2).

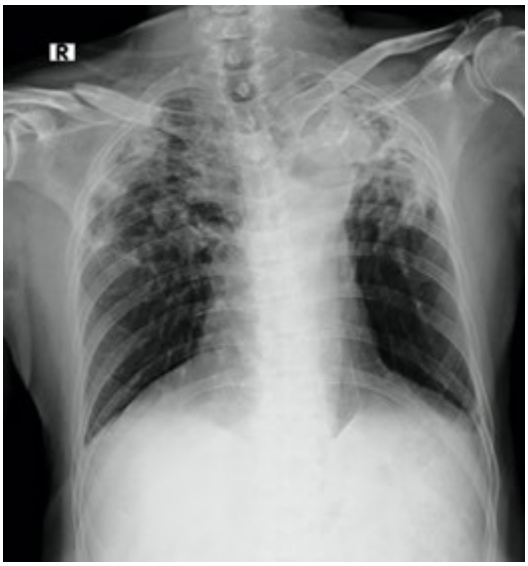

Fig 2. The Result of Chest Anteroposterior X-Ray Imaging Mrs.A

2.2. Patient Mr. A

A 24-year-old male with ASA score 1. The CPB was administered using same technique, 23g needle injection in 5 cm proximal of line fracture and 5 cm distal of line fracture. The needle puncture hit the bone, then inject the local anesthesia. 10 cc 0,2% ropivacaine was given for each injection site and 10 cc 0,2% ropivacaine infiltration skin. No complications were noted during surgery under a light sedation (midazolam 2 mg), and pain scores remained zero in the post-anesthesia care unit (PACU). No opioids were given in the Recovery room, and very low pain score during hospital stay after surgery. The patient was administered intravenous ketorolac 30 mg (every 8 h for a total of three doses) and paracetamol oral 500 mg (every 6 h) in ward after surgery and was sent home with oral medications (non-steroidal anti-inflammatory drug). At 48 hours postoperatively, the patient presented mild pain during movement (VAS 1/10). The patient and surgeon reported 9/10 satisfaction with his regional anesthetic on a routine questionnaire before discharged (Fig 3).

2.3 Patient Mr. A

A 54 year-old male with ASA score 2 with a history of hypertension. The CPB was administered with the same technique, 23g needle injection in 5 cm proximal of line fracture and 5 cm distal of line fracture. The needle puncture hit the bone, then inject the local anesthesia. 10 cc 0,2% ropivacaine was given for each injection and 10cc 0,2% ropivacaine infiltration skin . No complications were noted during surgery under a light sedation (midazolam 2 mg), and pain scores remained zero in the post-anesthesia care unit (PACU). No opioids injection were given in the Recovery room, and very low pain score during hospital stay after surgery. The patient was administered intravenous ketorolac 15 mg (every 8 h for a day) and paracetamol oral 500 mg (every 6 hour) in ward and was sent home the day after the surgery, with oral medications (non-steroidal anti-inflammatory drug).

Fig 3. The Result of Clavicular Anteroposterior Xray Imaging Mr.A

In the first 24 postoperative hours, the patient did not complain of pain at rest or with movement. At 48 hours postoperatively, the patient presented mild pain with movement (VAS 2/10), however, without the need for rescue analgesia. The patient and surgeon reported 9/10 satisfaction with her regional anesthetic on a routine questionnaire before discharged (Fig 4).

Fig 4. The Result of Clavicular Anteroposterior Xray Imaging Mr.A

DISCUSSION

This report discusses the first successful utilization of CPB in an adolescent patient, marking a significant advancement in its application. Given that males under 20 years old are prone to sports-related clavicular fractures, CPB is expected to become widely used in this demographic. Its application in pediatric cases offers advantages such as procedural simplicity and avoidance of certain complications. Furthermore, CPB may be beneficial for trauma patients with rib fractures and pneumothorax, particularly in situations where general anesthesia poses risks [20].

Various regional anesthesia techniques have been described, and the potential for awake surgical fixation has been extensively discussed. The choice of regional anesthesia method depends on whether surgical anesthesia is required or if

providing analgesia alone is sufficient. If analgesia is needed alongside general anesthesia, a superficial/intermediate cervical plexus block or supraclavicular nerve block may suffice. Although the superficial/intermediate cervical plexus block has traditionally been preferred for surgical anesthesia, it can lead to unwanted motor effects such as hemidiaphragmatic paresis. This issue can be addressed by using a clavipectoral fascial plane block alone or in combination with a cervical plexus block. The clavipectoral fascial plane block shows promise as a new tool for providing anesthesia and analgesia during clavicle fractures and fixation surgery [21]. Here is a step-by-step procedure for the clavipectoral nerve block:

1. Preparation

   Explain the procedure to the patient, addressing any concerns or questions they may have. Position the patient comfortably, typically in a supine or slightly reclined position.

2. Gathering Equipment

   Gather the necessary equipment, including sterile gloves, skin antiseptic, local anesthetic solution (e.g., lidocaine or bupivacaine), syringe, and needle (usually a 22- to 25-gauge needle).

3. Identifying Landmarks

   Identify the clavicle (collarbone) and the deltopectoral groove (the groove between the deltoid and pectoralis major muscles).

4. Skin Preparation

   Cleanse the skin overlying the deltopectoral groove with a skin antiseptic solution and allow it to dry.

5. Anesthesia

   Administer local anesthesia to the skin and subcutaneous tissue overlying the deltopectoral groove using a small-gauge needle. Wait for adequate anesthesia to take effect.

6. Needle Insertion

   Insert the needle at the lateral edge of the clavicle, just above the clavicle, and direct it toward the coracoid process (a bony prominence of the scapula). Advance the needle slowly while aspirating periodically to ensure it is not in a blood vessel.

7. Confirmation

   Once the needle tip is near the coracoid process, aspirate again to ensure there is no blood return, indicating inadvertent vascular puncture. Inject a small amount of local anesthetic to confirm proper needle placement. The patient should feel paresthesia or discomfort radiating along the distribution of the musculocutaneous nerve.

8. Injection

   Slowly inject the remaining volume of local anesthetic while continuously aspirating to avoid intravascular injection. Withdraw the needle slowly once the injection is complete.

9. Post-Procedure Care

   Monitor the patient for any signs of local anesthetic toxicity or adverse reactions. Provide post-procedure instructions to the patient, including information on expected pain relief and any potential side effects.

10. Documentation

    Document the procedure, including the amount and type of local anesthetic used, any complications encountered, and the patient's response to the block. Remember to adhere to sterile technique throughout the procedure to minimize the risk of infection. Additionally, ensure that appropriate monitoring and supervision are available during and after the procedure.

There is a dearth of knowledge about regional anesthesia for clavicle surgery because of the intricate innervation of the clavicle area [6, 11 ,12, 13]. There is limited data on regional anesthesia for clavicle surgeries, due to complex innervation of the clavicular bone and skin or subcutan glands. The skin innervation covering by the superficial cervical plexus (SCP). There is substantial uncertainty regarding the sensory innervation of the clavicle. the space shared by the long thoracic, thoracic, and supraclavicular nerves. For this reason, the clavipectoral fascia must be crossed by the sensory innervation of the clavicle [7]. The cervical and brachial plexuses supply the sensory innervation of the clavicle. The regional anesthetic technique chosen should be effectively tailored to the expected surgical approach and include the necessary innervation of the muscles, skin and bones of the clavicle. Therefore, depositing local anesthesia between periosteum and the clavipectoral fascia may block the complete innervation [8, 14, 15, 16, 19].

It is important to talk about the precise location of the LA (Local Anesthetic) deposition in a CPB further. The clavipectoral fascia fills the area between the clavicle and the pectoralis minor muscle, situated behind the clavicular head of the pectoralis major muscle and superficial to the subclavius. This fascia is bordered laterally by the coracoid process and joins medially with the external intercostal membrane. This fascia is punctured by a number of structures, including the nerve terminals that innervate the clavicle and the lateral pectoral nerve. To achieve sufficient dispersion and blockage of sensory conduction, LA deposition into this contained region is likely essential, hence the precise placement of the needle tip is crucial. The included studies' accompanying sonographic pictures showed evidence of LA deposition on the anterior or inferior surface of the clavicle (Fig 2,3,4). The subclavius is enclosed by a divided clavipectoral fascia. Since the clavipectoral fascia divides inferiorly to the subclavius muscle and clavicle, the subclavius' descent can indicate LA deposition above or below the fascia. Therefore, we believe that the needle tip should be positioned close to the clavicle, specifically at the antero-inferior to anterior surface of the clavicle [19].

Curiously, while not executing a distinct SCP block to give blocking of skin sensory innervation, CPB was demonstrated to be successful in preventing pain during surgery and post operation. Based on the superficial nature of the local anesthetic injection field during CPB and its close proximity to the skin, it is probable that either diffusion blockade of the presented or distal branch innervation to the skin also passes between the clavicular fascia and the clavicle. Regardless, it can be concluded that CPB using the same technique yields satisfactory and effective anesthetic results in patients undergoing clavicle surgery. No complications occurred during surgery, and pain scores remained low in the PACU and during hospitalization. The three patients, including a 67-year-old female with a history of hypertension and Tuberculosis pneumonia, a 24-year-old male with an ASA score of 1, and a 54-year-old male with an ASA score of 2, reported a high level of satisfaction (9/10 to 10/10) with CPB regional anesthesia on a routine questionnaire before discharge (Tabel 1). This success also included pain management without administering opioids in the recovery room, demonstrating the potential of CPB as a safe and effective anesthetic alternative, especially in the context of light sedation, for clavicle surgery in various patient groups like patient with more comorbid. Clavicopectoral Plane Block provided a similar analgesic effect like brachial plexus nerve block, but without motor block of upper limb, and the possible complication of phrenic nerve paralysis. Another recent study by Kukreja et al. [17]. Local infiltration over the subcutaneous plane of the clavicle may be provided to avoid brachial plexus block that can be paralyzed phrenic nerve.

Fact that the fracture was on the midshaft in these patients may have also helped explain why CPB was beneficial for surgically fixing clavicle fractures. To have enough data to prove this novel block's efficacy, more research with bigger sample numbers is required. In mid-collarbone surgery, the use of CPB for anesthesia and analgesia is supported by this case report. Not only is CPB safe and easy to use, but it also provides mild sedation, which makes it an excellent option if general anesthesia is

not necessary. CPB in this case avoided the added cost of administering opioid and large amount of sedation drug (propofol, etomidate, ketamine) and manipulating the airway during effect of general anesthesia.

The first case in which the CPB has been reported to be utilized safely and efficaciously in patient with higher comorbid or ASA III (pneumoniae problem and geriatric), and the youngest patient was accident in sport injury. the CPB is likely to be highly utilized in this population (people with high comorbid and sportsman. This technique can also be used for multi trauma patients with pneumothorax, rib fractures where general anesthesia may increase the risk of pneumothorax expansion and associated complications [18].

For surgery to repair clavicle fracture, the authors favor regional anesthesia, thus avoiding complications such as postoperative nausea and vomiting associated with large amount opioid and sedation drug during general anesthesia, as well as the approach and difficulty of accessing the airway during the intraoperative. The main complications associated with interscalene brachial plexus block are phrenic nerve block which can lead to respiratory function decline, particularly in patients with pulmonary conditions; Horner syndrome characterized by ptosis, myosis, and anhidrosis; and recurrent laryngeal nerve block resulting in dysphonia. The main complications inherent to supraclavicular brachial plexus block are also phrenic nerve block, Horner's syndrome , and pneumothorax [7]. The authors chose to perform a clavipectoral fascial plane block, combined with a infiltration local anesthesia in site of surgery, to prevent the complications.

Table 1. Current Definitions and ASA-Approved Examples

ASA PS Classification	Definition	Adult Examples, Including, but not Limited to:	Pediatric Examples, Including but not Limited to:	Obstetric Examples, Including but not Limited to:
ASA I	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use	Healthy (no acute or chronic disease), normal BMI percentile for age	
ASA II	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Current smoker, social alcohol drinker, pregnancy, obesity (30<BMI<40), well-controlled DM/HTN, mild lung disease	Asymptomatic congenital cardiac disease, well controlled dysrhythmias, asthma without exacerbation, well controlled epilepsy, non-insulin dependent diabetes mellitus, abnormal BMI percentile for age, mild/moderate OSA, oncologic state in remission, autism with mild limitations	Normal pregnancy*, well controlled gestational HTN, controlled preeclampsia without severe features, diet-controlled gestational DM.
ASA III	A patient with severe systemic disease	Substantive functional limitations; One or more moderate to severe diseases. Poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, history (>3 months) of MI, CVA, TIA, or CAD/stents.	Uncorrected stable congenital cardiac abnormality, asthma with exacerbation, poorly controlled epilepsy, insulin dependent diabetes mellitus, morbid obesity, malnutrition, severe OSA, oncologic state, renal failure, muscular dystrophy, cystic fibrosis, history of organ transplantation, brain/spinal cord malformation, symptomatic hydrocephalus, premature infant PCA <60 weeks, autism with severe limitations, metabolic disease, difficult airway, long term parenteral nutrition. Full term infants <6 weeks of age.	Preeclampsia with severe features, gestational DM with complications or high insulin requirements, a thrombophilic disease requiring anticoagulation.

ASA IV	A patient with severe systemic disease that is a constant threat to life	Recent (<3 months) MI, CVA, TIA or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, shock, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis	Symptomatic congenital cardiac abnormality, congestive heart failure, active sequelae of prematurity, acute hypoxic-ischemic encephalopathy, shock, sepsis, disseminated intravascular coagulation, automatic implantable cardioverter-defibrillator, ventilator dependence, endocrinopathy, severe trauma, severe respiratory distress, advanced oncologic state.	Preeclampsia with severe features complicated by HELLP or other adverse event, peripartum cardiomyopathy with EF <40, uncorrected/decompensated heart disease, acquired or congenital.
ASA V	A moribund patient who is not expected to survive without the operation	Ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction	Massive trauma, intracranial hemorrhage with mass effect, patient requiring ECMO, respiratory failure or arrest, malignant hypertension, decompensated congestive heart failure, hepatic encephalopathy, ischemic bowel or multiple organ/system dysfunction.	Uterine rupture.
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes			

This study is subject to several limitations. Firstly, clavicle fractures are categorized based on the site of the fracture into proximal, middle, and distal fractures, as well as by displacement status into nondisplaced, displaced, and comminuted fractures. However, this study did not account for the potential differing effects of various fracture sites and types. Secondly, given that clavicle fractures predominantly occur in young to middle-aged adults, the study primarily included non-elderly patients with relatively good physical function. Therefore, the applicability of the findings to elderly or critically ill patients warrants further investigation. Thirdly, the study revealed that most patients preferred not to remain conscious during surgery due to feelings of anxiety and fear despite not experiencing pain. Thus, the introduction of sedative medications, such as dexmedetomidine, into clinical practice may enhance patient comfort [20]. Comparison of Clavipectoral Nerve Block (CPB) with other specific procedures for similar situations in future studies, you can take several steps:

1. Search in Medical Databases: Utilize medical databases such as PubMed, Google Scholar, or Medline to search for recent research articles comparing CPB with other procedures for similar conditions. Use search terms like "Clavipectoral Nerve Block comparison" or "CPB compared to other procedures."
2. Refer to Clinical Guidelines: Check relevant clinical guidelines from leading medical organizations such as the American College of Surgeons, American Society of Anesthesiologists, or National Institutes of Health to see if there are recommendations or reviews regarding the comparison of CPB with other procedures.
3. Meta-Analysis and Systematic Reviews: Explore meta-analysis studies or systematic reviews that have synthesized data from multiple studies to assess the effectiveness of CPB compared to other procedures in similar situations.
4. Contact Experts: If possible, reach out to experts in the field of anesthesia or related fields who may have knowledge of recent studies or developments in comparing these procedures.
5. Conferences and Seminars: Look for presentations, posters, or papers from relevant medical conferences discussing the comparison of CPB with other procedures. Materials from medical conferences often provide insights into recent research in the field.

CONCLUSION

Although information on regional anesthesia for clavicle surgery is limited due to the complexity of innervation in the area, CPB has proven effective as a standalone or adjunctive peripheral nerve block. CPB not only effectively prevents pain but also yields high patient satisfaction, with post-anesthesia pain scores remaining low. Safety of CPB in both male and female patients over 20 years old has been confirmed, with consideration given to potential skin or supraclavicular nerve blockade. Three patients, including one with a history of hypertension and tuberculosis pneumonia, reported high satisfaction with CPB regional anesthesia. Fracture location at the midshaft of the clavicle may contribute to CPB's success in surgical fixation of such fractures. However, larger studies are needed to further establish CPB's effectiveness in clavicle surgery. Overall, this case report supports CPB as a safe and effective alternative to regional anesthesia, particularly in patients with midshaft clavicle fractures.

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