Intermediate Volume (15 ml) of Supraclavicular Brachial Plexus Block Combined with Supraclavicular Nerve Block as an Anesthetic Technique for Patients with Proximal End of Humerus Fractures during Corona Virus 2019 Outbreak in Thailand: 3 Cases Report

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Proximal humerus fractures increased in frequency over the past decades. To avoid general anesthesia, the author used a modified supraclavicular brachial plexus block with moderate volume (15 ml) combined with subcutaneous infiltration for supraclavicular nerves as an anesthetic technique for open reduction and internal fixation for proximal humerus fractures. Moderate sedation with various sedatives was added up for patient comfort. Oxygen supplement was necessary but airway intervention was not required. The safety means (prevention control for Corona Virus Disease 2019 according to the hospital policy) during the procedures were applied for all of the cases.

Keywords: Brachial plexus block, Covid 19, Humerus, Moderate sedation, Supraclavicular nerve

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Introduction

Anesthesiologists play important roles in perioperative care, intensive care unit and airway management during the Corona Virus Disease 2019 (Covid 19) outbreak. We faced with uncertain patients, patients under investigation (PUI) or Covid 19 patients.

Proximal humerus fractures increased in frequency over the past decades.[1] They are one of the most common osteoporotic fractures in elderly women. These fractures can lead to significant pain and loss of function. During Corona Virus Disease 2019 (Covid 19) outbreak in Thailand during March-April, 2020, I came across three patients with proximal humerus fractures who were scheduled for open reduction and internal fixation as an urgent operation. All of these patients had been cleared for Covid 19 by infectious doctors by structural questions without any virus culture. However I personally avoided general anesthesia during this period.

As already known, general anesthesia (GA) with airway intervention leads to aerosol generation. I decided to do supraclavicular brachial plexus block with superficial cervical plexus block with moderate sedation instead of combined general anesthesia (with endotracheal tube or laryngeal mask airway) and interscalene brachial plexus block that I normally had done previously.

Hospital and departmental policy about patient selection for surgery (who should or should not have operations), operation room preparation (including allocated staff, drugs, equipment) or level of personal protective equipment (PPE) for procedures would not be mentioned in this article. This report has been approved by Siriraj Institutional Review board (Si 365/2020)

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Case 1

A 85-year-old female with HT, DM, hypothyroid, gout, dyslipidemia, chronic kidney disease fell at home and had fractures at proximal end of right humurus. She was conscious but had dementia and spoke very little. Her medications were metformin (500 mg) 1x1, levothyroxine (50 mcg)1x1, pitavastatin (2 mg) 1x1 and diet control for HT. She was scheduled for open reduction and internal fixation with Philos plate and screw. Her BP was 150/80 mmHg, HR 80/min, RR 20/min. Laboratory investigations: Hematocrit 30%, creatinine 1.4 mg/dL, others were within normal limit. Chest x-ray (CXR) showed mild cardiomegaly with plate atelectasis. Electrocardigram (ECG) showed sinus rhythm with non-specific ST-T changes. Cardiologist was consulted and he said she could undergo surgery with intermediate risk. She was on nasal cannula 2 L/min and her oxygen saturation (SpO_2) was 98% (her room air SpO_2 was 92%).

In the operating room, the standard monitors were used; oxygen cannula 3L/min was given. The vital signs were BP 160/90 mmHg, HR 85/min, ECG: sinus rhythm, SpO_2 99%. Ketamine 10 mg was given intravenously for analgesia and sedation. The short axis view of subclavian artery and brachial plexus was obtained above clavicle (supraclavicular approach) with 11 Hz linear probe ultrasound and 0.5% bupivacaine 15 ml was injected carefully with 3-5 ml increment doses inside the cluster (divisions of the nerves)[2] and another 5 ml was injected at the superficial layer at the lateral half of clavicle to cover supraclavicular branches of cervical plexus. After 15 minutes, the sensorimotor block was tested but the patient did not answer the questions. However, she looked comfortable and did not complain any pain. Then the moderate sedation was given with ketamine 10 mg intravenously and propofol 1-3 mg/kr/hr. The sedation level was observed and the infusion rates of propofol were adjusted to adequate sedation level. Surgery was started at 40 minutes after the block (time included for positioning, skin scrubbing and applying the surgical drapes). The patient slept throughout operation which took 2 hours and 20 minutes. The total anesthetic time was 3 hours with total 280 mg of propofol and 30 mg of ketamine given for sedation. The vital signs were stable with good oxygen saturation without any need for airway manipulation or airway intervention.

Postoperative pain score at recovery room was 0. Postoperative pain medications were paracetamol 1 gram orally every 6 hours, nefopam 40 mg/day (continuous infusion), and morphine 2 mg (rescue pain) iv prn. for pain every two hours. Her pain scores were 0-2 and she did not ask for extra intravenous morphine. She was discharged postoperative day 4 with no postoperative complications.

Case 2

A 58-year-old female with Parkinsonism fell at home due to unstable gait and had fractures at proximal end of humerus. Her medications were Stalevo® (carbidopa 25 mg + levodopa 100 mg + entacapone 200 mg) 1x3, propranolol (10 mg) 2x2 and phenobarb (60 mg) 1x2. Her vital signs were normal and also her laboratory investigations. She was conscious, alert and co-operative. The supraclavicular approach for brachial plexus block was achieved with landmark and paresthesia technique in the first attempt, and then 0.5% bupivacaine 15 ml was injected and 0.25% bupivacaine 8 ml was injected at subcutaneous tissue above the lateral half of clavicle. The block was complete within 20 minutes and arm was scrubbed and draped. Oxygen 3 L/min (via nasal prongs) was given before starting moderate sedation with ketofol (ketamine 20 mg+ propofol 200 mg) 2-3 mg/kg/hr. The operative time was 3 hours and the anesthetic time was 3 hours and 40 minutes with total 500 mg of propofol and 50 mg of ketamine were given. Postoperative pain medications were paracetamol 1 gram orally every 6 hours, parecoxib 40 mg every 12 hours for one day and then etoricoxib (90 mg) 1x1 pc. Her pain scores were 1-2 in postoperative period. She was discharged postoperative day 4.

Case 3

A 82-year-old female with HT, DM, coronary artery disease (CAD) fell at home and had fractures at

proximal end of humerus. Cardiologist was consulted and echocardiogram showed good contraction.

Fentanyl 25 microgram (mcg) and 1 mg of midazolam were given before performing brachial plexus block (BPB), supraclavicular approach with ultrasound guidance. Fifteen mills of 0.5% of bupivacaine were injected for BPB and 0.25% bupivacaine 10 ml was injected at skin above the lateral half of clavicle. The block was complete within 30 minutes. Another 25 mcg of fentanyl was given and propofol infusion was started with 4 mg/kg/hr and gradually decreased to 3 and 2 mg/kg/hr. Postoperative pain medications were paracetamol 1 gram orally every 6 hours, neurontin® (300 mg) 1x2, and morphine 2 mg iv prn for pain every two hours. Only 4 mg or two doses of morphines were required. Her pain scores were 0-2 throughout postoperative period. She was discharged postoperative day 4.

Discussion

The interscalene brachial plexus block (ISB) although provides good analgesia or anesthesia can further compromise patient ventilation due to phrenic nerve paralysis.[1-5] The BPB, supraclavicular approach or supraclavicular block (SCB) can provide good pain control over the shoulder region with less phrenic nerve paralysis. However the incidence is still high up to 30-50%.[3-4] The great concern is potential risk of pneumothorax during block. The ultrasound can be used to minimize the risks. In case 2, I did use paresthesia technique which is not commonly used nowadays. In co-operate patient, I found paresthesia technique is fairly simple, easy, and quick to perform. The small volume BPB, supraclavicular approach (10 ml) had been used with great success for its analgesia[4], however lacked of evidence that it worked for anesthesia. We have to weigh risks and benefits of small (10 ml), intermediate (15 ml) or standard volume (20-30 ml) for BPB. The risks of smaller volume are inadequate block, slower onset or failed block. The benefit of small volume is phrenic nerve sparing and respiratory preserve.

In shoulder region, the nerve supplies cover the skin are supraclavicular nerves (lateral, intermediate and medial branches) arise from the cervical plexus and cross the clavicle to the skin over the humerus.[6] They arise from the same roots (C3, 4) as the phrenic nerve at deep cervical plexus. Avoiding phrenic nerve paralysis, intermediate cervical plexus block (plane block between sternomastoid and scalene muscles) can be used[3] or subcutaneous infiltration over the clavicle. For the muscles and bone (humerus), the nerve supplies from the brachial plexus (mostly upper trunk).[6] Many may be concerned about the inadequate block of upper trunk with SCB, I personally had never failed to block upper trunk with SCB but sometimes failed to block the lower truck (T8-T1) or ulnar nerve sparing. Avoiding pneumothorax, I never put the needle too far or too deep and sometimes missed the lower trunk. The block needs to be checked for complete or incomplete block. For partially or incomplete block, make alternative plans such as periarticular infiltration[7] or supplement block[8] or supplement systemic analgesia and sedation or general anesthesia.

The moderate sedation could be achieved with propofol with some analgesic effect from either ketamine or fentanyl. The sedation was considered necessary due to prolonged operation, uncomfortable position (roll at shoulder) and all of the patients wished to sleep throughout the operation. Propofol can potentially cause airway obstruction and respiratory depression in moderate to high dose, so the airway equipment such as nasal airway, oral airway, laryngeal mask or endotracheal tube need to be prepared. The combination with analgesic can reduce the doses of propofol (synergistic effect).

Low dose of ketamine is a good analgesic and less respiratory depression with stable hemodynamics. However, ketamine can cause some unwanted side effects such as hypersecretion, hallucination which is dose related. A joint of The American Society of Regional Anesthesia and Pain Medicine (ASRA) and the American Academy of Pain Medicine (AAPM) recommended that ketamine bolus dose should not

exceed 0.35 mg/kg, and infusions for acute pain generally do not exceed 1 mg/kg per hour.[9] Case 3 patient with CAD, I chose fentanyl over ketamine because ketamine can cause tachycardia, hypertension which increase oxygen demand of the heart. Midazolam combination can reduce the dose and some side effect of propofol. However, elderly patient has a greater risk of postoperative neurological dysfunction and midazolam can mask symptoms and signs or might contribute to postoperative neurological dysfunction.

None had postoperative neurological dysfunction. Regional anesthesia and good postoperative pain management combination with other cares undoubtedly play important role for enhanced recovery.

During Covid 19 outbreak, there are some guidances for neuraxial anesthesia and peripheral nerve bocks. The American Society of Regional Anesthesia and Pain Medicine (ASRA)[10] recommendations is shown in Table 1. According to the guidance, the ISB or SCB should not be performed due to the risk of phrenic nerve paralysis; however BPB, infraclavicular or axillary approach are not adequate for shoulder surgery. The block should be done in the operating room with most experienced anesthesiologists and should not be done in the block room or pre-holding area or common area.

The excessive or deep sedation should be avoided to reduce the need for any airway manipulation or interventions. Lie SA et al[11], suggested new method for $ETCO_2$ monitoring during sedation with Covid 19 contamination by using endotracheal tube connector together with a heat and moisture exchanger (HME) filter which was connected to the simple face mask. The side stream $ETCO_2$ was hooked with HME filter. They also monitored respiratory movement from the ECG dots.

The supplement oxygen should be given via simple face mask put over surgical mask with minimal flow. The recent review[12] stated that Hudson mask with O_2 4L/min showed oxygen travelling distance of 0.4 meter while oxygen cannula 5 L/min can travel caudally as long as 1 meter. Jet nebulizer and high flow nasal cannula should be avoided to reduce the risk of aerosol generator.

Table 1 Simplified version of Covid-19 guidance for regional anesthesia[10]

Safe practices	Right procedures	Be vigilant
Wear appropriate PPE	RA is not contraindicated	RA need to be tested before surgery to
RA is not aerosol-generating	Prepare and pack drugs in plastic bag	minimize the need for GA
Use of respirator mask (N95 or PAPR) is	Use block that least affects respiratory	Minimal supplemental oxygen enough for
not generally necessary unless prolonged	function such as infraclavicular or axillary	good oxygenation to reduce aerosolization
procedure in closed setting	BPB, avoid ISB or SCB	
Patient wears a surgical mask	Risks VS benefits for adjuvants and	Rule out thrombocytopenia before
	catheters	neuraxial anesthesia
Plastic cover ultrasound	Use ultrasound for peripheral nerve block	Prepare for hypotension after neuraxial
	to minimize the risk of LAST	anesthesia
		Postpone epidural blood patch

PPE=personal protective equipment, RA=regional anesthesia, PAPR = powered air purifying respirator, BPB= brachial plexus block, ISB = interscalene block, SCB=supraclavicular block, LAST = local anesthetic systemic toxicity, GA=general anesthesia

Conclusion

The 15 ml of 0.5% bupivacaine for SCB combined with subcutaneous infiltration for supraclavicular nerves could be successfully used and an anesthetic technique for open reduction and internal fixation of proximal humerus fracture. Moderate sedation was added up for patient comfort. The safety means during the procedures should be applied for all cases during Covid 19 outbreak.

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