Case report

Role of Ultrasound-Guided Hemidiaphragm Sparing Brachial Plexus Block in the Morbidly Obese Patient

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Abstract

Patients with Grade III obesity pose unique challenges to the treating anesthesiologists. The challenges range from difficulty in intravenous cannulation to airway management. Regional anesthesia is advantageous over general anesthesia as it avoids airway manipulation, prevents reduction in functional residual capacity, and provides good postoperative analgesia. Regional anesthesia has its pitfalls like identifying the landmarks accurately and hemi diaphragmatic palsy following brachial plexus block. Hemi diaphragmatic palsy is poorly tolerated in grade III obese patients leading to increased peri-operative morbidity which undermines the advantages of regional over general anesthesia. Ultrasound-guided costoclavicular brachial plexus block (CCBPB) has the benefit of reduced hemi diaphragmatic palsy, avoiding pleural injury, and wider distribution of sensory blockade. Costoclavicular block has been administered to obese patients in the past with great success. We are reporting a successful case of ultrasound-guided costoclavicular brachial plexus block performed in an obese patient with a BMI of 51.56 Kg/m2.

Keywords: Obesity, Functional residual capacity, Brachial plexus block, Hemidiaphragmatic palsy

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Introduction

Obesity is a complex metabolic disorder involving excessive body fat with a body mass index greater than or equal to 30Kg/m2. The prevalence of obesity in India is 40.3%(1). Obesity presents multiple technical challenges for anesthetists, like difficulty securing the airway and performing regional anesthesia. Obesity is associated with physiological changes like reduced functional residual capacity (FRC) and increased blood volume, blood pressure, and oxygen requirement, leading to an oxygen supply-demand mismatch (2). In addition, obesity may present with systemic illnesses like type 2 diabetes mellitus, hypothyroidism, coronary artery disease, and obstructive sleep apnea syndrome. The upper limb surgeries can be performed either under general anesthesia (GA) or regional anesthesia (RA). Conducting GA in obese patients would present multiple hurdles like difficulty in mask ventilation/intubation, further reduction in FRC, altered pharmacokinetics of anesthetic drugs, and excessive sensitivity to opioids leading to delayed recovery. RA might be an alternative to GA in obese

patients as it lacks the limitations above. Brachial plexus block (BPB) is the commonest RA technique for upper limb surgeries. In BPB, there is a risk of hemidiaphragmatic palsy (HDP), which will be detrimental in an obese patient with pre-existing reduced FRC. The incidence of HDP in different approaches of BPB is interscalene approach -92%, supraclavicular approach -66%, and costoclavicular approach - 2-5% (3). For an obese patient, it would be ideal to opt for a block with the least incidence of HDP, which would be the costoclavicular brachial plexus block(CCBPB). Though it has the least incidence of HDP, visualizing the cords in the costoclavicular space would be technically difficult in obese patients. Here we report a case of a 40-year-old grade 3 obese patient for whom surgery was done under the right costoclavicular brachial plexus block for right proximal both bone forearm fracture plating.

Case Report

A 40 yr old obese male patient with a BMI of 51.56 (HT-170cm, WT-149 Kg) was admitted for open reduction and internal fixation (ORIF) with plating of the right proximal bone forearm. He had no other co-existing illness. He was treated with oral steroids 6years back for retinal pathology. The patient underwent cataract surgery 6years ago under local anesthesia. On the preoperative assessment of the patient, he was found to have exertional dyspnoea with a METS score of 3. Airway assessment predictors revealed difficult intubation (MMPC4 and neck circumference 56cm). All baseline investigations were found to be normal. Cardiac evaluation with echocardiography was within normal limits. Though the patient had a history of snoring, he did not have other obstructive sleep apnea syndrome features. The patient was taken up for surgery under ASA PS III. On the day of surgery, the patient was shifted to the operation theatre, and minimal mandatory monitors were connected. We planned to perform a right costoclavicular brachial plexus block (CCBPB). Procedural sedation was given with 1mg midazolam and 100 mcg of fentanyl. Before performing the right CCBPB, the diaphragmatic excursions of the right hemidiaphragm were noted using an ultrasonogram with a curvilinear probe placed in the right hypochondrium in the long access (Video 1). The right CCBPB was done using the ultrasound machine with a high-frequency linear probe. The patient was positioned supine with their head turned to the left side.

Under strict aseptic precaution, the ultrasound probe was placed below the right clavicle to visualize the costoclavicular space. The cords of the brachial plexus (BP) were noted lateral to the axillary artery in the costoclavicular space at a depth of 5cm (Figure 1). Under ultrasonogram guidance, a 23G Quincke spinal needle was advanced from lateral to medial direction until it reached the BP. After confirming the needle tip's position, a local anesthetic mixture of 20 ml (10 ml of 0.75% ropivacaine, 9 ml of 2% lignocaine, and 4 mg of dexamethasone) was injected incrementally after repeated aspiration. The right intercostobrachial nerve was blocked by local infiltration in the medial part of the upper arm with 8 ml of 0.75% ropivacaine to facilitate tourniquet application. The block was confirmed to have taken up adequately after 20 minutes following injection. The sensory block extended from the hand up to the lower one-third of the arm. The Hemi-diaphragmatic excursion was measured following the block and was comparable to the pre-block excursions (Video 2). The patient was then put in the left lateral position. The patient was sedated using an injection of dexmedetomidine 75micrograms as a loading dose over 10 minutes and a maintenance dose of 75micrograms per hour. The surgery then lasted for three hours and was uneventful. Postoperatively the patient was monitored for 24 hrs in the postoperative ward. After the block, the patient regained motor and sensory functions at 10 and 14 hours, respectively. The patient was then discharged three days after surgery.

Discussion

BP block would be the anesthetic technique of choice in obese patients except for fear of HDP. HDP is a well-tolerated complication in normal patients but will affect the ventilation of an obese patient a lot more than a normal patient because of the reduced FRC. Unintentional HDP following supraclavicular brachial plexus block (SCBB) in a morbidly obese patient resulted in severe hypoxia and hypercapnia, leading to prolonged mechanical ventilation (3). Accidental

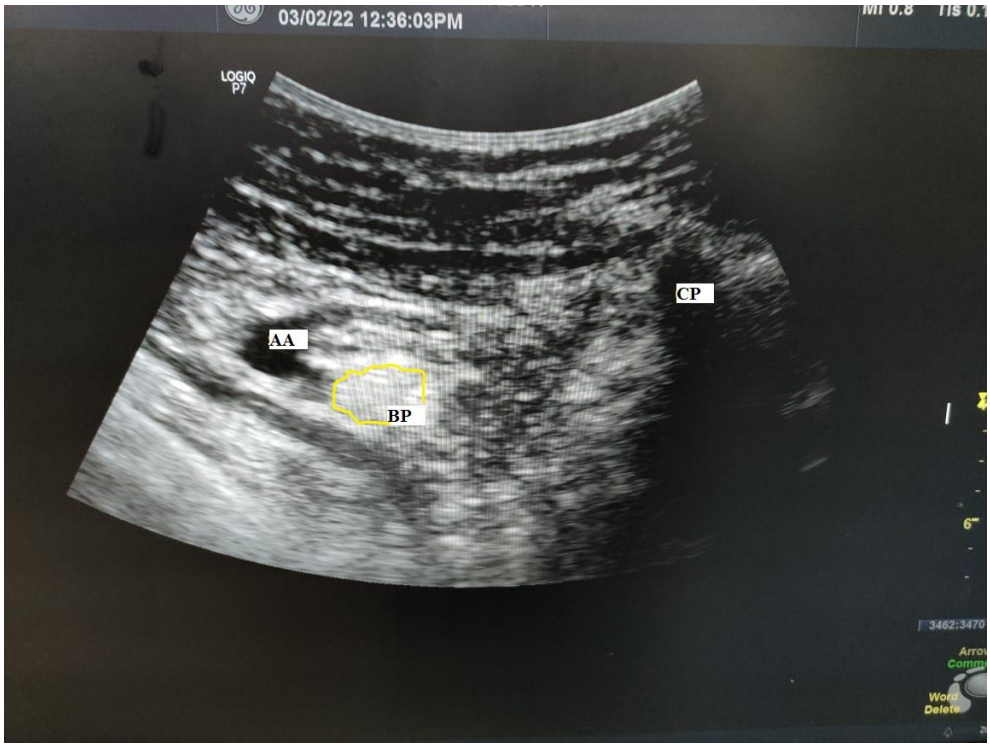

Figure 1. AA-Axillary artery, BP-Brachial plexus, CP-Corocoid process.

ipsilateral phrenic nerve palsy following SCBB in an obese patient resulted in severe dyspnea and chest discomfort warranting intubation (4). HDP due to phrenic nerve palsy following BP block can result in significant dyspnea in obese patients (5). It is clear from the above studies that HDP is poorly tolerated in obese patients.

It would be prudent to opt for CCBPB or axillary brachial plexus block (ABPB) in obese patients. CCBPB is a single injection technique with wider sensory coverage than ABPB (6). The incidence of HDP in CCBPB was 2.5%, with an injectate volume of 25ml (7). Taking the above factor into consideration, we gave a volume of 20ml.

Ultrasonogram plays a pivotal role in managing obese patients as it provides adequate surgical anesthesia and avoids conversion from RA to GA (8). Ultrasound-guided CCBPB was safe and effective in providing surgical upper limb anesthesia in morbidly obese patients (9). Ultrasonogram ensures safe BP blockade, monitors diaphragmatic excursions, and rules out other causes of dyspnea like pneumothorax in morbidly obese patients.

Conclusion

Ultrasound-guided CCBPB would be a better choice for grade III obese patients coming for upper limb proximal forearm surgeries because it avoids the complications of GA, monitors diaphragmatic excursions, and has a lower incidence of HDP compared to other approaches of BPB.

Acknowledgment

None.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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