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A reversible upper limb deficit following Serratus plane block in video-assisted mitral valve repair

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Video-assisted mitral valve repair (VA-MVR) is now extensively used in valvular cardiac surgery (1). Despite being minimally invasive, right lateral thoracotomy VA-MRVs often induce post-operative pain (2). First described in 2013, the Serratus plane block (SPB), a novel type of thoracic nerve block (3), has increasingly been employed as an effective and safe means to manage postoperative pain following VA-MVR (4).

This report concerns a case of a transient upper limb deficit associated with continuous SPB following VA-MVR. Note the patient concerned gave informed consent for this publication.

CASE REPORT

A 51-year old woman with a history of mitral valve regurgitation and atrial fibrillation was admitted for an elective VA-MVR. Furthermore, the patient agreed to have postoperative continuous SPB for postoperative pain management.

The patient's medications include Furosemide and Rivaroxaban, the latter having been held three days prior to surgery. Pre-operative examination did not reveal any signs of heart failure, a BMI of 21 kg.m⁻² and no concerns for airway management. Preoperative transthoracic cardiac ultrasound revealed a large prolapse of the A2 leaflet of the mitral valve, a preserved left ventricular ejection fraction, and moderate pulmonary hypertension. General anesthesia (GA) was administered consisting of Propofol, Sufentanil and Cisatracrium. Anesthesia was preformed and monitored as per hospital protocol via the use of an orotracheal tube, a left radial artery catheter, a central venous access line inserted through the right internal jugular vein, a urinary catheter with body temperature monitoring, and a transesophageal ultrasound.

Surgery was performed through a right lateral mini-thoracotomy in the fourth intercostal space using a cardio-pulmonary bypass (CPB) with femoral cannulation. Anesthesia and surgery occurred without any immediate complications. A CPB time of 92 minutes and aortic clamp time of 63 minutes were recorded.

After surgical closure, ultrasound-guided SPB with catheterization was performed. The needle was inserted in the third intercostal space at the right mid-axillary line. A bolus of forty milliliters of 0.5% Ropivacaine (3 mg.kg^{-1}) was injected between the latissimus dorsi and serratus anterior muscles. A multi-orifice catheter (PlexoLong Nano Line, Pajunk, Germany) was inserted at a depth of four centimeters, though which a continuous infusion of 0.2% Ropivacaine at 10 mL.h^{-1} was administered. Parenteral systemic analgesia was also administered to the patient in the form of 1000 mg of Acetaminophen, 20 mg of Nefopam, and 100 mg of Tramadol.

Following surgery, the patient was admitted to the Intensive Care Unit (ICU). Four hours after admission, hemodynamic and respiratory stability had been confirmed, and excessive bleeding ruled out; the patient was then extubated. At that time, the patient was awake, alert and without pain or neurological deficit of note.

Eight hours following admission to the ICU, the patient was noted as having a complete sensory and motor deficit of the right arm. There was, however, no other neurologic abnormality noted on physical exam. When the deficit was noted, the Ropivacaine infusion via SPB was immediately stopped. Following said evaluation, an urgent cerebral MRI was conducted; it also revealed no discernable abnormality. Two hours after having held the SPB infusion, the patient began to recover both motor and sensory abilities in her right arm.

On Post-operative day 1, only minor residual paresthesia remained in the patient's right arm whereupon she was transferred from the ICU to the surgical ward for recover. By post-operative day 2 the patient had intact sensation and motor function over her right arm, and the SPB catheter was removed.

An Electromyogram (EMG) study of the patient's right arm was performed on post-operative day 6 and did not demonstrate any degree of peripheral nerve lesion.

On post-operative day 10, the patient was discharged from hospital without any residual symptoms.

DISCUSSION

SPB has been used extensively for over 4 years in the management of post-operative pain associated with VA-MVR (4). A recent randomized controlled study (RCT) demonstrated that, in the early postoperative period, combined SPB and systemic analgesia is superior in terms of pain control and quality of recovery when compared to systemic analgesia alone. As such, it seems as though continuous SPB is as effective as thoracic epidural analgesia for pain relief following thoracotomy (6).

To date, no comparative studies have been undertaken comparing the efficacy of GA alone to GA with regional anesthesia in the context of cardiac surgery with mini-thoracotomy. Although thoracic epidural analgesia and intrathecal morphine injection can help reduce pain, these techniques do not have any apparent impact on in-hospital length-of-stay or other major outcomes (7). Furthermore, these techniques can produce severe side effects, such as epidural hematomas (7). As such, SPB appears to be a promising and safer alternative to the aforementioned techniques in

such a surgical setting. The newly described erector spinae plane block may also be efficacious in such surgery but would require mobilization of patients into the lateral decubitus position for catheter placement (8).

To our knowledge, this report is the first description of any adverse effects related to SPB.

It is theorized that the adverse effects observed may be related to inappropriate positioning of the multi-orifice catheter. Indeed, due to the positioning of chest tubes, it was necessary to place the SPB needle in the 3rd intercostal space, which is one intercostal space above that initial described for this technique (3). Moreover, the catheter was inserted above the serratus anterior muscle, and no particular attention was given to its direction and the position of its distal tip. The distal tip of the catheter was likely placed in the axillary region of the brachial plexus. The symptomatology observed seems to be consistent with the infusion of Ropivacaine administered; symptoms commenced eight hours after the initial bolus of Ropivacaine. Moreover, the complete resolution of symptoms observed following discontinuation of the infusion, and the absence of findings of both the cerebral MRI and EMG, seem to confirm the reasoning outlined above.

Thus, this report constitutes the first characterization of adverse effects observed following continuous SPB in the context of VA-MVR. The adverse effects witnessed were likely due to inappropriate placement of the distal tip of a multi-orifice catheter in the axillary region of the brachial plexus resulting in a reversible paralysis of the ipsilateral upper limb.

In patients with obstacles to catheter placement as described in the original technique, one may seek to confirm proper catheter placement during SPB as below

the serratus anterior muscle, perhaps by radiological means, in order to reduce the risks of such complications from occurring in future.

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