



# Awake Cranioplasty in a Patient with Rheumatic Heart Disease: A Novel Approach

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## Abstract

### Keywords

- awake cranioplasty
- rheumatic heart disease
- severe mitral stenosis
- transverse abdominis plane block

Cranioplasty is a surgical procedure that restores the normal anatomy following craniectomy. Restoring the skull bone ensures protection and normalizes the physiology as well as the cerebrospinal fluid dynamics. This surgical procedure usually requires administration of general anesthesia for retrieving the bone placed in the abdominal region and thereafter placing it in the cranium. We report the anesthetic management of a high-risk case who had severe mitral stenosis and was scheduled for cranioplasty. The anesthetic management of a patient with rheumatic heart disease, with severe mitral stenosis, posted for cranioplasty, is extremely challenging. The presence of cardiac pathology necessitates the need to balance patient's hemodynamics in accordance with the cardiac grid and tests the limits of the anesthesiologist's preparedness. We describe our experience of conduct of this case in regional anesthesia using scalp block on the defect site with an oblique transverse abdominis plane block for abdominal bone retrieval.

## Introduction

Decompressive craniectomy is done to manage intractable rise in intracranial pressures following brain injuries and sometimes following evacuation of high-risk tumors or following aneurysm surgeries. Cranioplasty, done following normalization of intracranial pressures, improves cerebral hemodynamics, prevents hydrocephalus, trephined syndrome, and problems associated with hemispheric collapse.<sup>1,2</sup>

Maintaining normal patient hemodynamics during conduct of anesthesia, for cranioplasty, in patients with cardiac pathology can be extremely challenging. We report the anesthetic management of one such high-risk cardiac case posted for cranioplasty.

## Case Report

A 36-year-old female (height 156 cm, weight 60 kg, body mass index = 24.6 kg/m<sup>2</sup>), was admitted for cranioplasty, following previous decompressive hemicraniectomy for left anterior and middle cerebral artery infarction, done under general anesthesia. The intraoperative course was uneventful. Postoperatively, patient was electively ventilated, eventually weaned off, and discharged with a Glasgow Coma Scale score of E<sub>4</sub>V<sub>4</sub>M<sub>6</sub>.

She was a known case of rheumatic heart disease (RHD) with severe mitral stenosis (MS), on medication, with rate-controlled (heart rate 70–80 beats/min) atrial fibrillation (AF) and right-sided hemiparesis. Chest radiograph showed

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left atrial enlargement and left heart border straightening. A noncontrast computed tomography (NCCT) scan head revealed skull defect in the left fronto-temporo-parietal region. Preoperative echocardiogram showed mitral valve area of  $0.9\text{ cm}^2$  and 21/12 mm Hg gradient across the valve, suggesting severe MS. Pulmonary artery (PA) pressure was 36 mm Hg and left atrial clots were absent. Patient was on tablet amiodarone 20 mg twice daily, digoxin 0.125 mg once daily for 5 days a week, diltiazem 30 mg three times a day, and warfarin 2 mg once daily. Tablet warfarin was stopped 1 week prior to the surgery, and low molecular weight heparin (enoxaparin) 0.6 mL subcutaneously twice daily, was started for bridging anticoagulation, which was discontinued 24 hours before surgery. Tablet amiodarone, digoxin, and diltiazem were continued in the perioperative period. Prior to the surgery, patient was counseled and asked to communicate in sign language in case she experienced any pain following the block.

Regional anesthesia (RA) was planned, including scalp block for cranioplasty and oblique transverse abdominis plane (TAP) block for abdominal bone retrieval. In accordance with the patient's comorbidities, appropriate emergency drugs and equipment were kept ready in the operation theater. Preoperatively, she had a heart rate of 70 to 80 beats/min, blood pressure (BP) of 128/74 mm Hg, and room air saturation of 98%. She was administered oxygen at  $\text{FiO}_2$  0.6 and  $\text{EtCO}_2$  line was placed in situ. Left radial arterial cannulation was done for invasive BP monitoring. Intravenous dexmedetomidine infusion was started (loading dose of 1 mcg/kg for 10 minutes, followed by 0.4–0.8 mcg/kg/h infusion), titrated to desired sedation and analgesia. Scalp block was administered unilaterally (landmark-guided) using 20 mL local anesthetic (LA) (10 mL of 2% lignocaine + adrenaline [1:200,000] and 10 mL of 0.25% bupivacaine) for blocking supraorbital, supratrochlear, zygomaticotemporal, auriculotemporal, greater occipital, and lesser occipital nerves. Since we expected dura mater to be adherent to the scalp in the defect area, shorter length needle (24G) was used for block administration and LA was injected slowly after repeated aspirations by a well-experienced anesthesiologist. For bone-flap retrieval, ultrasound-guided oblique TAP block was given unilaterally, using 10 mL of 2% lignocaine + adrenaline (1:200,000) and 10 mL of 0.25% bupivacaine. Intraoperative course, of approximately 120 minutes, was uneventful. Postoperatively, the patient received oral tablet paracetamol 500 mg 6 hourly and was put on mechanical thromboprophylaxis (TED stockings). After a postoperative NCCT scan, and 24 hours postsurgery, enoxaparin and warfarin were resumed, with discontinuation of enoxaparin after 5 days. Patient was discharged on the fifth postoperative day.

## Discussion

Incidence of cardiac pathologies is 0.7% in 18 to 44 years age group.<sup>3</sup> Isolated MS is present in 25% patients with RHD, while 40% have both MS and regurgitation.<sup>4</sup> The American College of Cardiology/American Heart Association (-

ACC/AHA) guidelines recommend that occurrence of severe valvular disease be considered a major clinical predictor of cardiac risk. Further, brain surgery is considered to have high surgery-specific cardiac risk ( $> 5\%$ ).<sup>5</sup> Perioperative strategy in these high-risk patients includes achievement of stable hemodynamics, optimal preload and afterload, avoidance of hypoxia, hypercarbia, acidosis, and hypothermia.<sup>6</sup>

Patients with severe MS need to undergo mitral valve replacement. Our patient was advised the same, but she did not give consent due to financial constraints. Further, she felt that RHD was not hampering her day-to-day activities. As per the current ACC/AHA guidelines 2020, asymptomatic patients with moderate or greater degrees of rheumatic MS with less than severe pulmonary hypertension (PA systolic pressure  $< 50$  mm Hg) can undergo elective noncardiac surgery.<sup>7</sup> Our patient was asymptomatic, with severe MS and PA systolic pressure of 36 mm Hg. Hence she was posted for cranioplasty.

Though awake craniotomies are commonly done for mapping and resection of lesions in vitally important brain areas where imaging is not very sensitive, however, previous literature is deficient with regards to the use of RA in cranioplasty. RA is considered a safe technique in cardiac patients as it avoids the hemodynamic alterations associated with general anesthesia, need for airway manipulation with its inherent risks, and use of opioids. It attenuates stress response and provides prolonged postoperative analgesia. As the patient is awake following RA, the sympathetic tone remains intact and rapid postoperative recovery ensures early neurologic status assessment.

It is important to be very careful while administering scalp block in such high-risk patients. The inherent scalp defect in postcraniectomy patient may be associated with altered bony landmarks, with the dura mater being adherent to the scalp. Scalp also has a very rich nerve supply.<sup>8</sup> Thus, extreme caution must be exercised while giving scalp block, which should be administered by a trained anesthesiologist. In addition, LA dose should be meticulously calculated, not exceeding maximum safe limits. Previously, maximum volumes of 40 to 60 mL of lignocaine with adrenaline and bupivacaine have been used for giving this block.<sup>8</sup>

For abdominal bone flap retrieval, we administered ultrasound-guided oblique TAP block, wherein the drug is administered along the oblique subcostal line, in the plane above the transverse abdominis muscle, starting from the xiphoid process, approaching the anterior part of iliac crest ( $\rightarrow$  Figs. 1 and 2). This tends to block the thoracolumbar intercostal nerves originating from anterior divisions of spinal nerves T6 to L1.<sup>9</sup>

Intraoperatively, patient was sedated using intravenous dexmedetomidine. Dexmedetomidine preserves the respiratory drive, maintains target heart rate, provides analgesia, decreases cerebral metabolic rate of oxygen, and prevents  $\text{CO}_2$  retention, thereby maintaining cerebral blood flow. Dexmedetomidine decreases opioid dose and reduces new-onset postoperative AF.<sup>10</sup> It allows the conduct of neurological examination while maintaining smooth sedation and analgesia within the targeted therapeutic window.<sup>11,12</sup>



**Fig. 1** Linear probe placement parallel to the costal margin (CM, costal margin).



**Fig. 2** Sonoanatomy for administering oblique transverse abdominis plane (TAP) block. Red line: Plane of administering oblique TAP block. RM, rectus muscle; EO, external oblique; TA, transverse abdominis.

To conclude, in high-risk neurosurgical patients, a meticulous preoperative evaluation along with a good technique that balances the anesthetic requirements of both the cardiac and neurologic disease helps in achieving a successful outcome. The conduct of novel awake cranioplasty is advantageous in patients with challenging comorbidities.

#### Conflict of Interest

None declared.

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