© Malaysian Journal of Anaesthesiology 2022; 1:32-37
*Case series/Case report*
*https://doi.org/10.35119/myja.v1i1.8*

# Anaesthetic management of awake craniotomy in a patient with sick sinus syndrome: a case report

Naeema **S. Masohood**, Fadhli Suhaimi **Abdul Sukur**, Vanitha **Sivanaser**

*Department of Anaesthesiology and Critical Care, Hospital Kuala Lumpur, Kuala Lumpur, Malaysia*

## Abstract

Awake craniotomies (AC) have been mainly used in functional neurosurgery, tumour resection in eloquent regions, and epilepsy surgery. However, evidence of the practice of AC for other indications is scarce. Furthermore, there is limited evidence of AC performed on patients with severe comorbidities, especially those with poor cardiorespiratory reserve. We report a successful case of AC on a patient with bilateral acute on chronic subdural haemorrhage with sick sinus syndrome on a permanent pacemaker with multiple other comorbidities presenting for emergency bilateral burr hole and drainage. We were able to achieve a stable haemodynamic profile perioperatively with no untoward complications. The patient had improved neurological outcome immediately postoperatively that eliminated the need for close monitoring in ICU and allowed earlier hospital discharge.

*Keywords:* awake craniotomy, scalp block, sick sinus syndrome

**Correspondence:** Dr. Naeema S. Masohood, Department of Anaesthesiology and Critical Care, Hospital Kuala Lumpur, Jalan Pahang, 50586 Kuala Lumpur, Malaysia.
E-mail: naeema.sm@gmail.com

## Introduction

There is scarce evidence of awake craniotomy (AC) in patients with a poor cardiorespiratory reserve and severe systemic disease. We report the first case of AC for a patient with underlying sick sinus syndrome (SSS) on a permanent pacemaker with multiple comorbidities presenting for emergency bilateral burr hole and drainage of subdural hematoma.

## Case presentation

A 64-year-old man with American Society of Anaesthesiologists (ASA) Physical Status Class 3 presented with a history of generalized weakness for 2 weeks and intermittent headache with no prior history of trauma. Glasgow Coma Scale (GCS) on arrival was E4V2M6 (12/15), which dropped to E3V2M5 (10/15) in the ward. Non-contrasted computed tomography of the brain revealed acute on chronic subdural haemorrhage in the fronto-temporo-parietal regions bilaterally. He was posted for bilateral burr hole and drainage of the subdural haemorrhage under the emergency list.

He had been diagnosed with SSS and coronary artery disease for which a percutaneous coronary intervention (PCI) and a drug-eluting stent was placed with subsequent insertion of a permanent dual-chamber pacemaker 10 months prior. He had been on dual antiplatelets (aspirin and clopidogrel) post-PCI. The latest transthoracic echocardiography reported a left ventricular ejection fraction of 42% with no other significant abnormalities. He also had end-stage renal disease on regular haemodialysis, diabetes mellitus type 2, and essential hypertension.

A cardiology consult was obtained, and it was confirmed that the pacemaker was in good function with strong battery life. There was no indication to change to asynchronous mode for the surgery as it was a dual-chamber pacemaker in DDD mode (no rate modulation function) and thus the patient was not pacemaker dependent. This was also evident from the recent electrocardiogram (ECG), which showed sinus rhythm with an intrinsic rate of 65 bpm and no pacing spikes preceding p-waves nor QRS complexes.

On assessment in the operating room, GCS was E4V3M5 (12/15), pupils measured 2 mm bilaterally and were reactive to light, blood pressure (BP) was 127/86 mmHg, and pulse rate was 63 bpm. Oxygen saturation ($SpO_2$) was 96% on room air with a respiratory rate (RR) of 24 and lung examination revealed bibasal fine crepitations. Blood investigations were unremarkable except for urea of 12 mmol/L, creatinine of 347 μmol/L, and venous blood gas showing $HCO_3$ of 19.6 mmol/L and base

excess of -3.2. We planned for AC with bilateral anterior scalp block and monitored anaesthesia care (MAC) using target-controlled infusion (TCI) propofol for sedation. Anaesthetic consent was obtained from the family due to his fluctuating GCS status.

He was attached to a standard 5-lead ECG that did not show any pacing spikes intraoperatively. He was also connected to continuous pulse oximetry monitoring and intermittent non-invasive BP monitoring at 5 minutes intervals. Five L/min of oxygen was applied via a simple face mask with continuous capnography monitoring. An 18G intravenous (IV) access was inserted for venous access. Transcutaneous pacing pads were then attached to the patient's chest in the event of pacemaker failure with a defibrillator machine on standby nearby. Emergency drugs and equipment necessary for conversion to general anaesthesia were prepared for standby. Electromagnetic interference during surgery was minimized with the usage of bipolar diathermy.

We employed MAC technique with TCI propofol sedation using effect-site target (Schneider model, Injectomat TIVA Agilia™, Fresenius Kabi, Bad Homburg, Germany) with effect-site concentrations maintained between 0.3 to 0.5 µg/ml. The patient remained sedated with Modified Observer's Assessment of Alertness/Sedation (MOAA/S) score between 2 to 3, $SpO_2$ above 95%, and RR of 16 to 20. The scalp was cleaned and a scalp block was then performed via aseptic technique. Ropivacaine 0.5% (total concentration 70 mg, 2–3 ml at each site) was used to block supraorbital, supratrochlear, zygomaticotemporal, and auriculotemporal nerves bilaterally which were identified via landmark technique. Further 40 mg of ropivacaine was given to the surgeon to supplement with a field block at incision sites and wetting the burr hole sites. Total ropivacaine dose used did not exceed 3 mg/kg body weight (patient's weight estimated at 55 kg, total dose administered 110 mg). Patient was positioned supine with his head rested on a horseshoe with the bed tilted head up 15°. A tent was created under the surgical drapes to allow visualization and access to the patient. Four units of platelets were transfused to reduce the risk of intraoperative bleeding as the patient had been on dual antiplatelet.

Surgery then proceeded with minimal blood loss and no adverse events. IV fentanyl 10 µg boluses were given prior to scalp block, skin incision, and duratomy as supplemental analgesia (total 40 µg throughout the procedure). Haemodynamics and oxygen saturation were stable with minimal fluctuations throughout the procedure. TCI propofol was stopped at the end of the procedure and the patient regained a GCS of E4V4M6 (14/15) and appeared more alert and communicative. Oxygen was weaned off and $SpO_2$ remained 98% on room air with a RR of 20 to 24. The patient was later transferred to the Neuro High Dependency Ward for close observation and later discharged home after 2 days.

## Discussion

There is limited evidence of the performance of AC in patients with poor cardiorespiratory reserve and significant comorbidities. To date, there have been only a few case reports and case series of AC being safely performed in patients with severe systemic diseases with good perioperative outcomes.[1-3] Evidence of AC in patients with cardiac disease is even more scarce. D'Antico *et al.* reported successful AC and local anaesthesia (LA) infiltration for a patient with unrepaired complex cyanotic congenital heart disease undergoing emergency craniotomy for cerebral abscess.[4] Heifets *et al.* reported performance of AC for recurrent third ventricular colloid cyst in a patient with severe pulmonary arterial hypertension in the setting of Eisenmenger syndrome.[5] Meng *et al.* performed AC with MAC for a young man with non-ischemic four-chamber dilated cardiomyopathy and low-output cardiac failure.[6] These three case reports demonstrated stable haemodynamic profile throughout surgery without much intervention. To date, no literature can be found on AC being performed on patients with SSS on pacemaker.

Many studies have found scalp block to be effective and superior to LA infiltration in blunting haemodynamic and stress responses during craniotomy, specifically during incision, head pinning, and emergence.[7-9] As this patient had SSS on a permanent pacemaker and other significant comorbidities, our main aim was to ensure strict haemodynamic stability and minimize the risk of cardiac arrhythmias. Furthermore, maintenance of stable haemodynamics is of paramount importance to ensure stable cerebral perfusion pressure, as the patient had clinical evidence of increased intracranial pressure due to his fluctuating GCS. Thus, AC with scalp block technique and sedation with TCI propofol was chosen as the main anaesthetic technique over general anaesthesia.

As the patient required bilateral burr holes, a scalp block technique was chosen to enable targeted nerve blockade with the calculated dose of LA not exceeding the maximum allowable dose to avoid the risk of LA toxicity. Ropivacaine was chosen as LA due to its better cardiovascular profile and long duration of effect, which extends to the postoperative period and serves as postoperative analgesia, hence reducing the need for other strong analgesics such as opioids.

Careful titration of sedation was of utmost importance as oversedation may lead to apnoea, hypoxemia, hypercapnia, and cerebral swelling, whereas undersedation may result in agitation, hypertension, and tachycardia. Ultimately, we had to ensure optimal brain relaxation for the surgical evacuation of the subdural haematomas whilst avoiding all the possible complications. Thus, a TCI sedation technique was chosen due to its ease of titratability to achieve the exact plane of sedation without compromising the patient's haemodynamics and avoiding oversedation, especially

as he already had a fluctuating GCS. Propofol was chosen over dexmedetomidine as the sedative agent of choice due to undesirable side effects of the latter, namely bradycardia and hypotension.

A further advantage of AC in this patient was the ability to continuously monitor neurology intraoperatively and prevent neurological deterioration as he had fluctuating GCS. The continuous monitoring of the patient's neurology also allowed earlier detection of possible surgery-related complications such as intracranial or epidural haematoma.[10] The patient's neurology improved immediately post-procedure, allowing for faster hospital discharge on postoperative day 2 and eliminating the need for ICU monitoring postoperatively.

## Conclusion

AC with MAC is a useful tool in the armamentarium of anaesthesiologists when faced with patients with serious comorbidities presenting for craniotomy. AC is a safe and reliable technique for patients with SSS, pacemakers, and other significant comorbidities, even when done in the emergency setting. Nevertheless, careful selection of patients based on sound clinical judgment and refined anaesthetic techniques tailored to individual patients is imperative to avoid complications.

## Declarations

**Informed consent for publication**
An informed written consent was obtained from the patient's family prior to anaesthesia for the purpose of this case report write-up and submission.

**Competing interests**
The authors declare no conflicts of interests.

**Funding**
None to declare.

**Acknowledgements**
None to declare.

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