“Brain Under Pressure, Heart Under Strain: A Regional Anaesthesia Triumph”

Scalp Block as Sole Anaesthesia for Emergency Burr Hole Craniotomy in a Patient with Congenital Single Ventricle Heart Disease

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INTRODUCTION

- **Anaesthetic management of patients with complex congenital heart disease (CHD)** poses significant challenges, especially in emergency surgical settings. Among them, **single ventricle physiology** has an incidence of 1 in 100,000 and represents one of the most fragile circulations, with limited compensatory reserve and a delicate balance between systemic and pulmonary blood flow.

- In such patients, the use of **general anaesthesia can be hazardous**, often associated with risks of hemodynamic instability, hypoxia, and worsening right-to-left shunting.

This case explores the use of **scalp block as the sole anaesthetic technique** in a young adult with **complex cyanotic congenital heart disease,** posted for emergency neurosurgical procedure—**burr hole craniotomy for cerebellar abscess.**

PATIENT MEDICAL HISTORY

Patient : A 24 year old male presented to the emergency department with sudden-onset headache, vomiting, unsteady gait, decreased responsiveness and drowsiness for the past 2 days.

2000

Diagnosed with congenital single ventricle physiology in infancy

2002

History of exertional dyspnea, cyanosis, and easy fatigability since early childhood

Blalock- Taussig shunt done

2024

Advised corrective cardiac surgery multiple times and blood thinners but not compliant

Presented in EM

GENERAL EXAMINATION

Build: Thin, undernourished. Weight : 45 kgs Height: 167 cm **BMI: 16.1**

Febrile 100.7
Not oriented with time, place and person

Clubbing: Grade III clubbing (all fingers and toes)

Cyanosis: Present (central) – lips, tongue

No pallor, icterus, lymphadenopathy or edema.

Vitals:

- BP: 110/60 mmHg
- HR: 50/min
- SpO_2: 84% on room air, 90% on O_2 @ 6L/min

SYSTEMIC EXAMINATION

CARDIOVASCULAR SYSTEM

Inspection

- Precordial bulge : present (chronic cardiac enlargement)

Palpation

- Apex beat : Displaced laterally (5th/6th ICS, anterior axillary line)

Auscultation:

- S1, S2 (+)
- Murmur: Continuous murmur over pulmonary area

SYSTEMIC EXAMINATION

RESPIRATORY SYSTEM

- **Inspection**: No chest deformity, equal chest expansion
- **Percussion**: Resonant bilaterally
- **Auscultation**:
  - Vesicular breath sounds
  - No crepitations or wheeze
  - **SpO_2**: 85% on room air

CENTRAL NERVOUS SYSTEM

- **Consciousness**: Drowsy but arousable
- **GCS**: E3V3M5
- **Pupils**: Equal, reacting to light
- **Focal neurodeficit**: Mild cerebellar signs (nystagmus)

2D ECHO FINDINGS

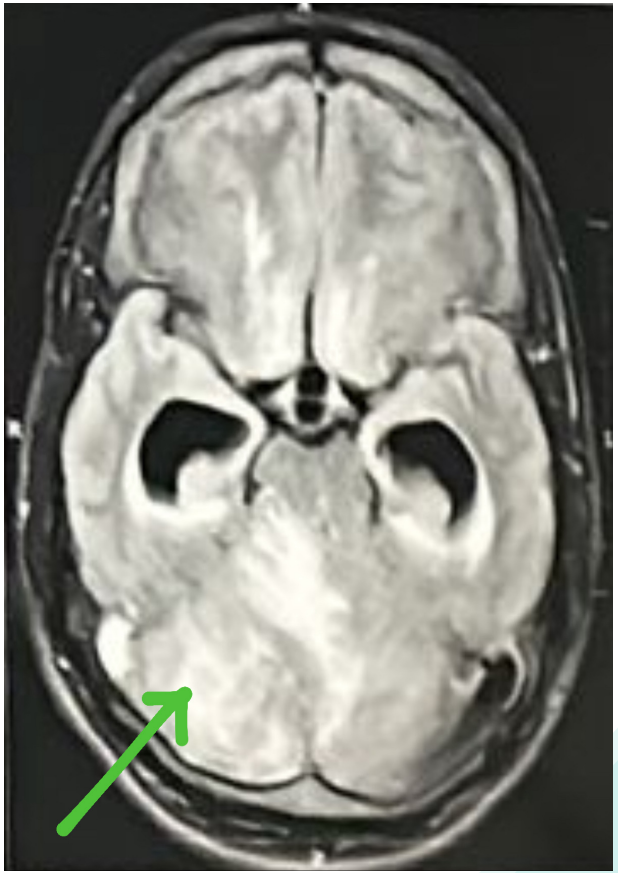
- Single functional ventricle (morphological LV) EJECTION FRACTION (%) **55%**
- **Left Atrium**: Mildly dilated
- **Left Ventricle**: Dominant single ventricle (morphological LV), normal systolic function
- **Right Ventricle**: Hypoplastic
- **AV Valve**: Single atrioventricular valve, trivial regurgitation
- **Great Arteries**: Malposed
- **BT Shunt**: Right-sided modified BT shunt noted; patent with continuous flow
- **Pulmonary Arteries**: Hypoplastic but confluent
- **IVC & Pericardium** : Normal
- **No Clot / Vegetation**

MRI FINDINGS

- **Right cerebellar abscess** ~5 × 3 cm
- **Fourth ventricle compression → Obstructive hydrocephalus** with **Severe cerebral oedema**
- Right lateral sinus thrombosis
- Abnormal T1 signal in intracranial **bilateral internal carotid arteries (ICA)**—suggestive of **slow flow**

Impression:

- Right cerebellar abscess with raised ICP and obstructive hydrocephalus, complicated by lateral venous sinus thrombosis and impaired cerebral venous outflow

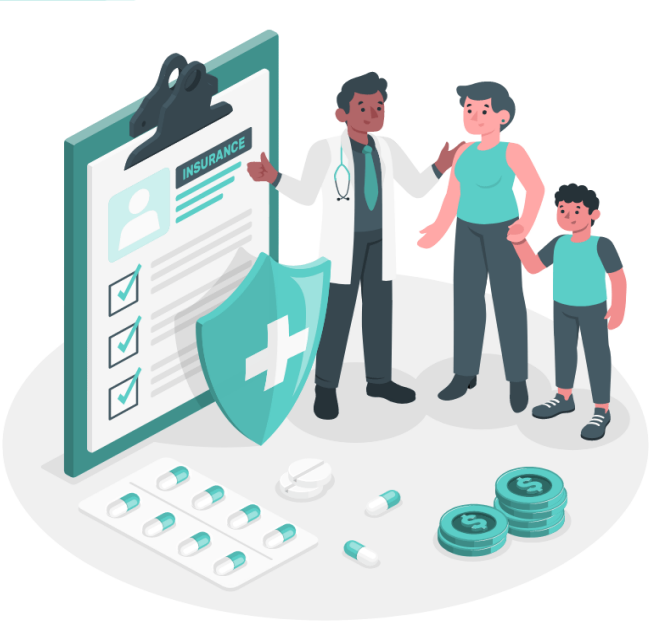


INVESTIGATIONS

Lab Investigation	Value
Hemoglobin	19.8 g/dl
TLC	7270 /uL
Platelet Count	2.16L
Urea	44 mg/dl
Creatnine	0.68 mg/dl
Serum Electrolytes (Na/K/Cl)	136/4.65/100 mEq/L
PT/INR	12.7sec /1.09
Trop-I	40.6ng/L
CKMB	<0.18 IU/L
LFTs	2.72/0.13/1.7
RBS	110 mg/dl
Serology	Non-reactive
Blood Group	O Positive

DIAGNOSIS

Cerebellar abscess with raised intracranial pressure in a patient with uncorrected cyanotic congenital heart disease (post-BT shunt) posted for Emergency burr hole craniotomy for abscess drainage



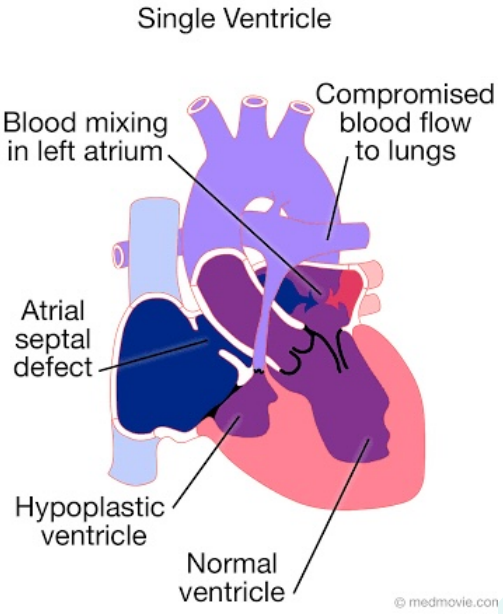
SINGLE VENTRICLE PHYSIOLOGY

Definition:

- A group of complex congenital heart defects where only one functional ventricular chamber supports both systemic and pulmonary circulation
- Common variants: Tricuspid atresia, Hypoplastic left heart syndrome, Double inlet ventricle

Circulatory Consequences :

- Mixing of oxygenated and deoxygenated blood in a single chamber → chronic cyanosis
- Delicate balance between pulmonary and systemic flow
- Fixed cardiac output with poor tolerance to stress or preload changes



SINGLE VENTRICLE PHYSIOLOGY

Surgical Palliation Overview:

- Initial palliation with BT shunt (systemic to pulmonary shunt) to increase pulmonary blood flow
- Followed by:
  - Glenn shunt (SVC to pulmonary artery)
  - Fontan procedure (IVC to pulmonary artery)

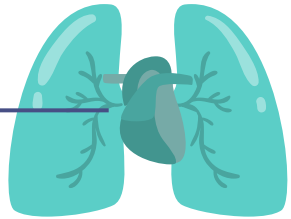
In this patient:

- BT shunt performed at age 2, Glenn and Fontan not performed

Key Point: The absence of staged palliation leaves the patient extremely vulnerable to physiological stress.

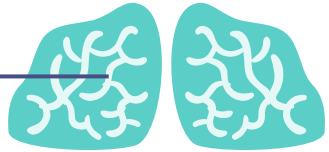
PRE-OPERATIVE CONCERNS

Cardiac Concerns – Cyanotic Congenital Heart Disease



- Single ventricle physiology post-BT shunt
- Fixed cardiac output; limited ability to compensate for anaesthetic-induced drops in SVR
- Risk of increased right-to-left shunting with hypotension or hypoxia
- High-risk for arrhythmias and hemodynamic collapse under GA

Neurological Concerns – Raised Intracranial Pressure



- Cerebellar abscess with obstructive hydrocephalus
- Risk of herniation
- Need to avoid increase in ICP (coughing, straining, intubation)
- Sedatives and induction agents could worsen cerebral perfusion

ANAESTHETIC PLAN

Choose a technique with minimal physiological disruption

→ Scalp block

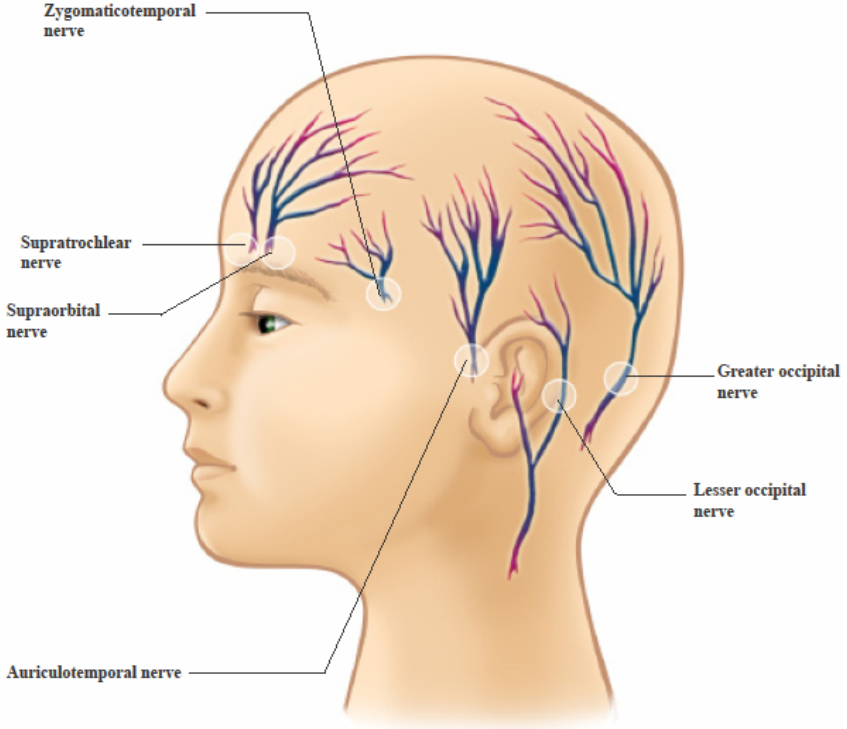
Why Scalp Block over General Anaesthesia in This Case?

Disadvantages of General Anaesthesia	Advantages of Scalp Block in This Scenario
○ Cardiovascular Instability	○ Stable Haemodynamics
○ Positive Pressure Ventilation Hazards ○ Hypoxia and Hypercarbia Risk (V/Q mismatch)	○ Preserved Spontaneous Ventilation
○ Increased Intracranial Pressure	○ Minimal Impact on Intracranial Pressure
	○ Rapid post op recovery -> early neuro assesment

SCALP BLOCK TECHNIQUE

Nerves Targeted (6-point block):

1. **Supraorbital nerve**
2. **Supratrochlear nerve**
3. **Auriculotemporal nerve**
4. **Zygomaticotemporal nerve** (optional)
5. **Greater occipital nerve**
6. **Lesser occipital nerve**



Local Anaesthetic Used:

- **0.25% Bupivacaine**
- Total volume: - 15 mL (each side)

Precautions: ***Aspirate before injecting*** *(vascularity of scalp and Monitor for* ***LA systemic toxicity (LAST)***

PERIOPERATIVE COURSE

PREPARATION

- Monitors attached: ECG, NIBP, SpO_2
- IV access secured with wide-bore cannula (18G)
- Supplemental oxygen via nasal prongs at 4 L/min
- Positioning: Supine, head turned to opposite side with head-ring support
- Emergency drugs and airway cart ready

ANAESTHETIC TECHNIQUE

- Sole anaesthesia with scalp block
- Local anaesthetic used: ➤ 0.25% Bupivacaine ➤ Total volume: ~15–20 mL (each side)

PERIOPERATIVE COURSE

INTRA-OPERATIVE MONITORING

- Vitals stable:
  - HR: 50–60/min
  - BP: 100–110/60 mmHg
  - SpO_2: 90% on 6L O_2
- No episodes of desaturation, bradycardia or agitation
- No signs of increased ICP intraoperatively

SURGICAL PROCEDURE

- Emergency burr hole and aspiration of cerebellar abscess
- Duration: ~45 minutes

POST OPERATIVE OUTCOME

- Patient was shifted to the neurosurgical ICU in stable condition with preserved airway, spontaneous breathing and full neurological monitoring was initiated.

DISCUSSION

- Patients with single ventricle physiology present significant anaesthetic challenges due to chronic hypoxia, and poor haemodynamic reserve. General anaesthesia can precipitate these conditions. In this high-risk neuro-emergency, a scalp block provided stable anaesthesia, preserved spontaneous ventilation, and allowed prompt postoperative neurological assessment.
- **This case highlights the importance of tailored anaesthetic planning, showcasing how regional techniques can offer safe, effective alternatives in select critical scenarios.**

LIMITATIONS

• **Single-case experience**: Findings may not be generalisable to all patients with single ventricle physiology.

• **Emergency setting**: Limited time for preoperative optimization or advanced investigations.

• **Regional technique limitations**: Scalp block alone may not be adequate for more extensive or prolonged neurosurgical procedures.

KEY-TAKEAWAYS AND CONCLUSION

Scalp block

Can be a safe and effective alternative in select high-risk neurosurgical patients

Regional Anaesthesia

Deserves broader consideration in managing high-risk cardiac patients.

Multidisciplinary planning and real-time adaptability

Are crucial in managing complex congenital heart disease patients undergoing non-cardiac surgery

When the heart is fragile and the brain is in danger, regional anaesthesia can be the bridge between safety and success.

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▶ Describes technique, indications, and advantages of scalp block.

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6. **Mahajan R, Swami AC.** Regional anesthesia in neurosurgery: recent trends and advancements. *Indian J Anaesth.* 2022;66(2):89–95.

▶ Highlights the evolving role of regional blocks in neurosurgical practice.

THANK YOU