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CASE REPORT

Anaesthetic Management of Bilateral Inguinal Hernia Repair in a Patient with Single Ventricular Morphology and Chronic Kidney Disease: A Case Report

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ABSTRACT

A 44-year-old man with single ventricular morphology, hypoplastic pulmonary artery, transposition of the great arteries, and chronic kidney disease presented for bilateral inguinal hernia repair. Preoperative evaluation showed cyanosis, clubbing, NYHA class III dyspnoea, haemoglobin 17.7 g/dL, serum creatinine 2.15 mg/dL, and a room-air oxygen saturation of 84%. General anaesthesia was considered unsuitable because of the risk of myocardial depression and limited respiratory reserve, while central neuraxial anaesthesia risked catastrophic sympathectomy-induced hypotension in univentricular physiology. Ultrasound-guided bilateral ilioinguinal and ilio-hypogastric nerve blocks with minimal sedation (fentanyl 30 µg, midazolam 1 mg) provided satisfactory operating conditions. The patient remained haemodynamically stable throughout the 75-minute procedure with preserved spontaneous ventilation and adequate oxygenation, and recovery was uneventful with discharge on day 4. This case demonstrates that peripheral nerve blocks offer a safe and effective anaesthetic alternative in high-risk cardiac patients in whom conventional techniques are contraindicated.

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Keywords: Single ventricular morphology, chronic kidney disease, ilioinguinal nerve block, congenital heart disease, regional anaesthesia, inguinal hernia repair

INTRODUCTION

Single ventricular morphology is a complex congenital defect in which one functional chamber receives blood from both atria, lacks ventricular interdependence and shows abnormal systolic and diastolic function.[1] Improved medical and surgical care has increased survival into adulthood, and these patients increasingly present for non-cardiac surgery.[2] The single ventricle is exquisitely vulnerable to the haemodynamic perturbations produced by anaesthetic agents, airway manipulation and surgical stimulation.[3] Coexisting chronic kidney disease (CKD) further complicates management through altered drug handling, fluid and electrolyte derangement, and increased cardiovascular vulnerability.[4] We report the successful use of ultrasound-guided peripheral nerve blocks in an adult with single ventricular morphology and CKD undergoing bilateral inguinal hernia repair.

CASE REPORT

A 44-year-old man (45 kg, 150 cm) presented with one month of progressively enlarging, reducible bilateral groin swellings. He had known congenital heart disease since the age of 10 years and CKD for two years on conservative management, with dyspnoea on minimal exertion (NYHA class III), taking furosemide 40 mg, enalapril 2.5 mg, and febuxostat 40 mg daily.

Examination revealed clubbing, central cyanosis, room-air oxygen saturation 84%, respiratory rate 24/min, and a low-volume pulse of 64/min. Blood pressure was 100/60 mmHg in the right upper limb and 130/86 mmHg in the left lower limb. Femoral pulses were well felt without radio-femoral delay, and the lower-limb pressure exceeded the upper-limb pressure — the reverse of the gradient produced by coarctation of the aorta — so there was no clinical evidence of coarctation. Aortic and pulmonary thrills were palpable with a pansystolic murmur and jugular venous pressure raised 2 cm. Two reducible inguinal swellings (left 2.5 × 2.5 cm, right 2 × 2 cm) with expansible cough impulse indicated bilateral indirect inguinal hernias.

Electrocardiography showed right ventricular hypertrophy with atrial enlargement and first-degree atrioventricular block (Figure 1). Echocardiography showed a single ventricle giving rise to both great vessels, transposition of the great arteries, a hypoplastic pulmonary artery with severe supravalvular and subvalvular stenosis (peak gradient 88 mmHg), a patent foramen ovale, mild atrioventricular valve regurgitation, and a dilated inferior vena cava (Figures 2 and 3). The chest radiograph showed cardiomegaly (Figure 4). Haemoglobin was 17.7 g/dL, urea 44.1 mg/dL, and creatinine 2.15 mg/dL; blood glucose, leucocyte count, platelets, electrolytes, and coagulation were normal. Abdominal ultrasonography showed grade I bilateral renal parenchymal changes. He was classified as ASA physical status IV.

After multidisciplinary consultation with the surgical and cardiology teams, the patient and family were counselled about perioperative risks. General anaesthesia was rejected because of myocardial depression by induction and volatile agents, respiratory depression reducing

pulmonary blood flow, haemodynamic perturbation from airway instrumentation, and the absence of desaturation reserve.[4] Spinal anaesthesia was rejected because the sympathectomy-induced fall in systemic vascular resistance cannot be compensated by a univentricular heart.[5] Transversus abdominis plane and quadratus lumborum blocks were avoided because of the larger volumes required.[6] Ultrasound-guided bilateral ilioinguinal and ilio-hypogastric blocks were therefore selected.

No cardiac catheterisation was performed at any point in this patient's care; the anatomical and haemodynamic diagnosis rested on clinical evaluation and echocardiography alone. The patient was kept nil by mouth for 6 hours for solids and 2 hours for clear fluids as per standard fasting guidelines, and received oral premedication with pantoprazole and ondansetron.

Standard ASA monitoring was established, and ceftriaxone 1 g was given intravenously for infective endocarditis prophylaxis. Under strict asepsis, a linear probe was placed transversely medial to the anterior superior iliac spine to identify the three muscle layers, and a 22-gauge 100-mm needle was advanced in-plane. The solution comprised ropivacaine 0.2% 20 mL, lignocaine 2% with adrenaline 1:200,000 10 mL, and dexamethasone 4 mg, made up to 40 mL with 0.9% saline. Five milliliters were deposited perineurally around each nerve (20 mL total), and the remainder was infiltrated into both hernia sacs. After confirming block adequacy by pinprick, sedation was limited to intravenous fentanyl 30 µg and midazolam 1 mg, preserving spontaneous ventilation and airway reflexes.

No arterial or central venous line was placed; monitoring remained limited to standard ASA parameters. The patient received supplemental oxygen via face mask at 4 L/min throughout the procedure. Phenylephrine (50 µg/mL) was drawn up and kept immediately available at the bedside but was not required. Intravenous fluid

Fig-1 ECG

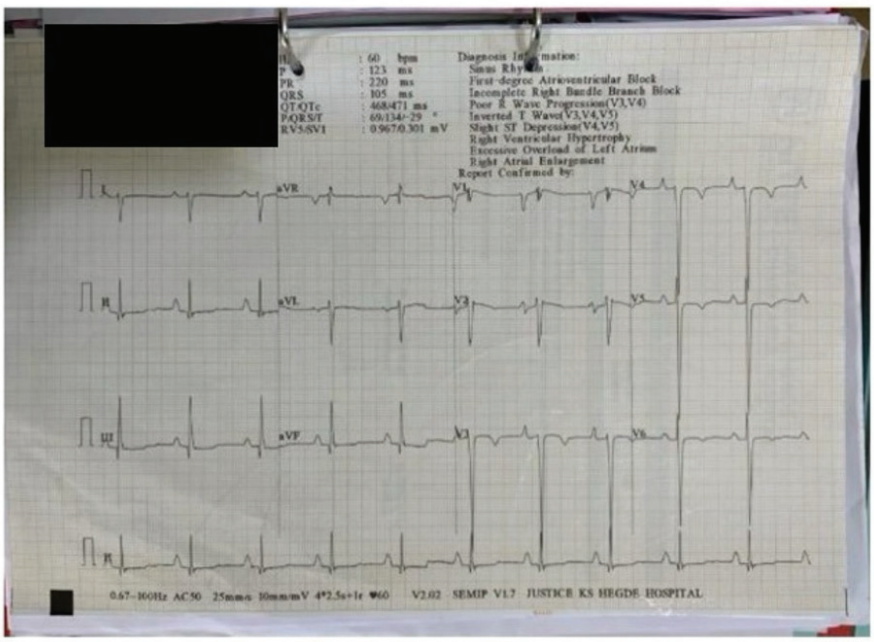


Figure 1: 12-lead electrocardiogram (ECG) showing sinus rhythm with first-degree atrioventricular block, incomplete right bundle branch block, right ventricular hypertrophy, and atrial enlargement.

was given as 0.9% saline at 75 mL/h, totalling 150 mL over 2 hours, to avoid volume overload in the non-compliant single ventricle. Urine output was monitored hourly and totalled 100 mL over this period, with an estimated blood loss of approximately 100 mL.

Throughout the 75-minute procedure, the heart rate remained 60–75/min, blood pressure within 10% of baseline, and oxygen saturation ≥79%, with spontaneous ventilation maintained and no arrhythmia (Figure 5). He was observed in the post-anaesthesia care unit on day 0, moved to the ward on day 1, and discharged on day 4 with cardiology and nephrology follow-up. Postoperatively, intravenous fluids (0.9% saline/Ringer's lactate at 50 mL/h) were continued until oral intake resumed 4 hours after the procedure, following which he was maintained on his usual oral medications. On cardiology review, no further corrective or palliative cardiac surgery was advised, as the patient remained independent in his activities of daily living.

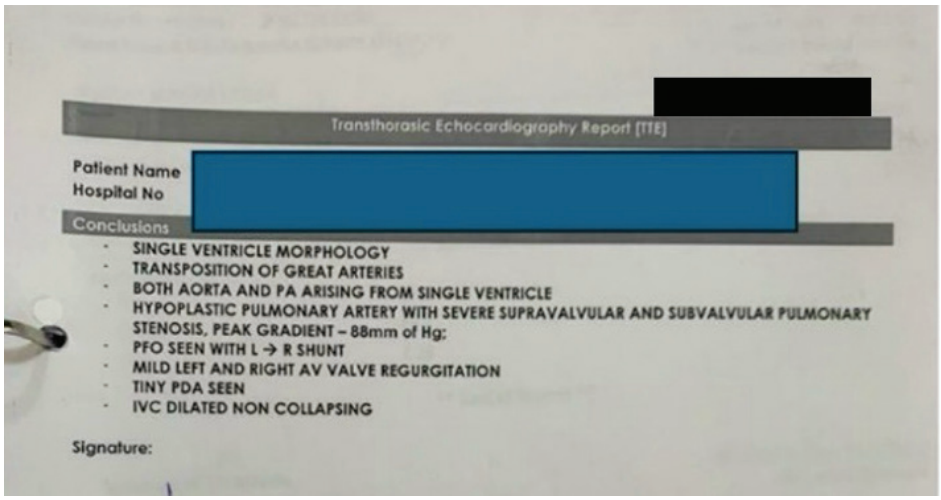


Figure 2: Transthoracic 2D echocardiography report summarising single ventricular morphology, transposition of the great arteries, both great vessels arising from the single ventricle, and a hypoplastic pulmonary artery with severe supravalvular and subvalvular stenosis (peak gradient 88 mmHg).

Fig 3: 2d Echocardiography

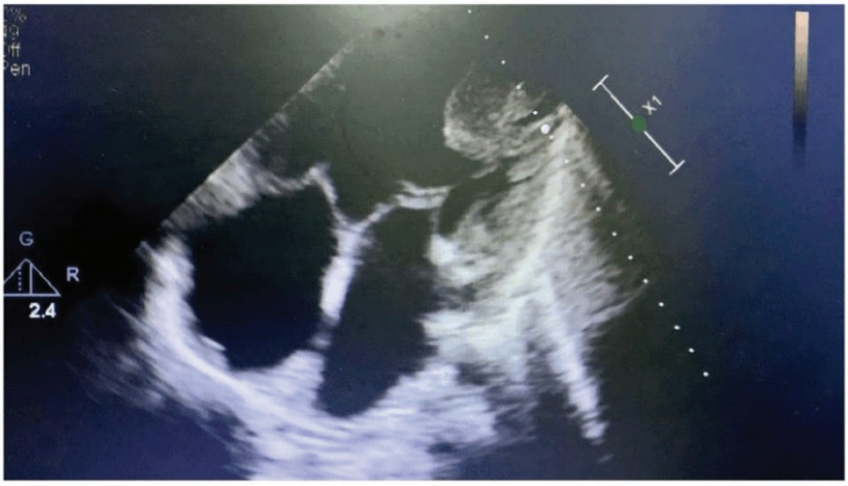


Figure 3: 2D Transthoracic Echocardiogram showing the common ventricular chamber receiving both atrioventricular inflows, with absence of the interventricular septum.

Fig 4: Chest X-Ray

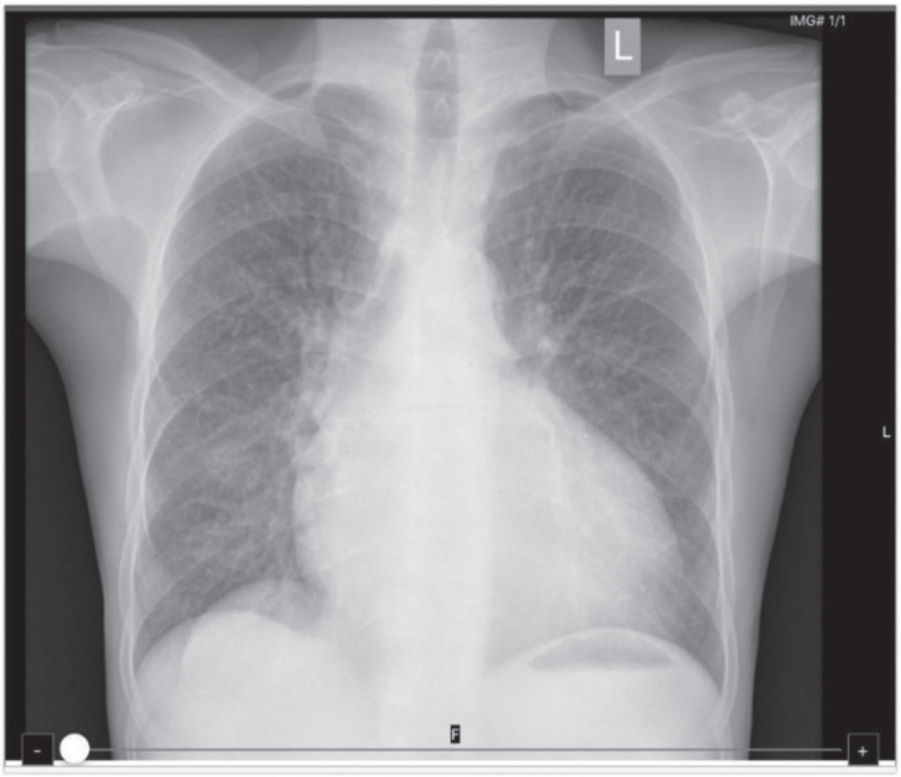


Figure 4: Postero-anterior chest radiograph showing cardiomegaly with a prominent cardiac silhouette and oligaemic lung fields.

Fig 5: Intra-operarive Monitor



Figure 5: Monitored intraoperative vitals: HR 75/min, NIBP 131/102 mmHg, SpO_2 79–80%.

DISCUSSION

In univentricular physiology, a single chamber supports both circulations without the ventricular interdependence of a biventricular heart, producing volume overload with reduced compliance and contractility.[1] The ventricle operates near the peak of the Frank–Starling curve, so any fall in preload or rise in afterload may precipitate acute decompensation.[3] Chronic hypoxaemia from obligatory intracardiac mixing with severely restricted pulmonary blood flow drives compensatory polycythaemia — haemoglobin 17.7 g/dL here — raising viscosity and thrombotic risk.[5]

The objectives were therefore to avoid negative inotropy, preserve spontaneous ventilation and pulmonary blood flow, keep preload and afterload within narrow limits, prevent paradoxical embolism through meticulous line management, and provide endocarditis prophylaxis.[7] Most intravenous induction agents are negative inotropes and vasodilators, volatile agents are dose-dependent myocardial depressants, and positive pressure ventilation reduces venous return.[4] Neuraxial blockade produces a sympathectomy this patient could not compensate for, with the added danger of further reducing pulmonary blood flow from an already marginal saturation.[5]

The ilioinguinal and ilio-hypogastric nerves, terminal branches of L1, supply the inguinal region, and their blockade is established for hernia repair.[8] Compared with fascial plane blocks, it requires far less local anaesthetic (about 5 mL per nerve), causes no sympathectomy, preserves respiratory mechanics, and needs minimal sedation.[6,8] Ultrasound guidance improves perineural accuracy over landmark techniques and raises success rates above 90%.[9] Ropivacaine was chosen for its lower cardiotoxicity than bupivacaine[10]; adrenaline hastened onset and limited absorption, and perineural dexamethasone prolonged the block.

Chronic kidney disease influenced drug selection, with minimal fentanyl and midazolam doses being used given reduced clearance.[4] Fluid volume required careful balance: restriction promotes thrombosis in polycythaemia, while overload is poorly tolerated by a non-compliant single ventricle.[5] Intraoperatively, 0.9% saline was chosen in preference to a balanced salt solution to avoid adding potassium in a patient with CKD receiving an angiotensin-converting enzyme inhibitor. Saline can, however, cause hyperchloraemic metabolic acidosis, and in a randomised trial in renal transplant recipients it was associated with more hyperkalaemia and acidosis than Ringer's lactate,[11] so a balanced crystalloid would have been an acceptable alternative. With only 150 mL infused intraoperatively, the chloride load was negligible.

CONCLUSION

Peripheral nerve blockade offers a safe and effective alternative in high-risk cardiac patients in whom general and neuraxial techniques are contraindicated. Understanding the underlying pathophysiology and using selective ultrasound-guided regional techniques permits safe perioperative care of adults with univentricular hearts and chronic kidney disease undergoing non-cardiac surgery.

AUTHORS' CONTRIBUTIONS

Concept and design: BAG

Literature review: KN

Compilation of manuscript: RG

Manuscript editing and proofreading: BAG, RG, KN

DECLARATION OF CONFLICTS OF INTEREST

The authors declare no competing interests.

DECLARATION OF PATIENT'S CONSENT

Written informed consent was obtained from the patient and his family for publication of this case, including clinical images.

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