Cardiology in the Young

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From diagnosis to postoperative challenges: a comprehensive case report on 2q37 deletion syndrome with CHD

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Brief Report

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Abstract

Chromosomal 2q37 deletion syndrome, marked by developmental delays, distinctive facial features, and a spectrum of congenital anomalies, presents significant challenges in the cardiac management of affected individuals. This paper details the case of an 8-month-old male with 2q37 deletion syndrome, manifesting atrial and ventricular septal defects, patent ductus arteriosus, and right ventricular outflow tract stenosis, leading to a demanding postoperative course. Despite an initially stable post-surgery phase, the onset of junctional ectopic tachycardia necessitated prolonged veno-arterial extracorporeal membrane oxygenation support, highlighting the syndrome's potential for intricate postoperative courses. The complexities encountered in this case, including extended renal replacement therapy and delayed thoracic closure, underscore the syndrome's multisystem impact and the critical need for tailored, multidisciplinary care approaches. This report contributes to the growing body of knowledge on the cardiac implications of 2q37 deletion syndrome, emphasising the importance of individualised surgical strategies and the ongoing exploration of genotype–phenotype correlations in this rare genetic disorder.

Introduction

Chromosomal 2q37 deletion syndrome is a rare genetic condition characterised by a spectrum of clinical manifestations including developmental delays, growth retardation, hypotonia, distinct facial features, and autism spectrum disorders.[1] The association between 2q37 deletion syndrome and CHD, such as atrial septal defect, ventricular septal defect, and patent arterial duct, has been documented in the literature.[1,2] However, little is known about the cardiac surgery and its postoperative course of 2q37 deletion cases with CHD. This paper aims to shed light on the surgical management of CHD within the context of 2q37 deletion syndrome, presenting a case that underscores the challenges and considerations unique to this patient population.

Case

The patient was an 8-month-old male infant, diagnosed prenatally with suspected tetralogy of Fallot, and was spontaneously born at 39 weeks weighing 2902 g. There is no documented family history of genetic abnormalities or CHD. Although the prenatal screening raised concerns for a CHD, chromosomal abnormalities were not initially suspected. Early signs of hypotonia and distinctive facial features following birth prompted further genetic testing, which confirmed the diagnosis of a 2q37 microdeletion. The chest radiograph demonstrated cardiac enlargement and a thoracic cavity that was smaller than usual (Figure 1). The infant's cardiac assessment revealed multiple findings: a 2-mm atrial septal defect, an 8-mm ventricular septal defect, a 2-mm patent arterial duct, and right ventricular outflow tract stenosis (Figure 2), complicating his clinical picture. Additionally, severe tracheomalacia presented shortly after birth, necessitating tracheostomy at 3 months. At 7 months of age, due to progressive heart failure, he underwent cardiac catheterisation. Cardiac catheterisation revealed the following haemodynamic parameters: mean right atrial pressure was 4 mmHg; pulmonary artery pressures were recorded at 23/12 mmHg, with a mean of 17 mmHg; right ventricular pressures were 41 mmHg with an end-diastolic pressure of 13 mmHg; and light ventricular pressures were 53 mmHg with an end-diastolic pressure of 7 mmHg. The pressure gradient between the pulmonary artery and right ventricle was measured at 20 mmHg. The Qp/Qs ratio was determined to be 5.4, and the pulmonary vascular resistance was calculated at 1.42 Wood units. The elective surgery was performed with the use of cardiopulmonary bypass. Through the median sternotomy approach, cardiopulmonary bypass was established in a usual manner. After patent arterial duct ligation,

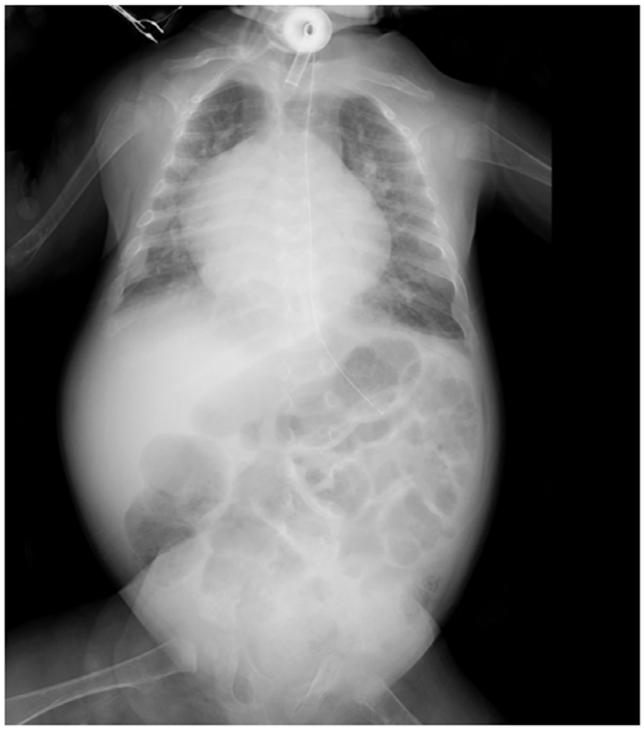

Figure 1. Chromosome test result shows that the chromosome is 46,XY,der(2)t(2;3)(q37.3:p21.3).

cardiac arrest was achieved by antegrade cardioplegia. The atrial septal defect was directly closed, and ventricular septal defect was closed with a patch through the right atrium. Additionally, right 15-mm ventriculotomy was placed to excise abnormal muscle bundles, subsequently augmented with a bovine patch. Weaning from cardiopulmonary bypass was uneventful. The durations of the cardiopulmonary bypass and cardiac ischaemic time were 233 and 109 min, respectively. The postoperative phase was initially stable with adequate urine output; however, the onset of junctional ectopic tachycardia on the third day necessitated the initiation of veno-arterial extracorporeal membrane oxygenation. The implementation of extracorporeal membrane oxygenation was prompted by persistent heart failure, which subsequently led to an anuric state. This condition necessitated continuous renal replacement therapy for 2 months. Additionally, the patient experienced delayed thoracic closure, which was successfully achieved 3 months post-surgery. This delay was due to the relatively small size of the thoracic cavity, coupled with an enlarged heart, posing significant challenges in managing the patient's haemodynamics during the closure process. Liver failure had progressed, and bilirubin was at a high of 52 mg/dL 2 months postoperatively. Regarding the management of junctional ectopic tachycardia, amiodarone at a dosage of 10 mg/kg/day was initially effective. However, due to elevated lactate dehydrogenase levels and radiographic signs of pneumonia, the treatment was discontinued after 2 days. Fortunately, the arrythmia resolved within this period and did not recur, negating the need for long-term arrhythmia prevention medication. At 2 years postoperative, the patient's condition stabilised, with normalised bilirubin levels and successful daytime weaning from ventilatory support. The summary of postoperative course and facial photographs are shown in Figure 3.

Discussion

Our case underscores the intricate nature of CHD in patients with 2q37 deletion syndrome and their potential for a complex postoperative trajectory. Approximately 16–20% of 2q37 deletion cases are reported to be complicated by CHD.[3] Congenital heart disease associated with 2q37 deletion is often simple, such as atrial septal defect and ventricular septal defect. Although there have been reports of neonatal cases of complex CHD that died shortly after surgery,[4] detailed reports on the postoperative outcomes of cardiac surgery in patients with 2q37 deletion are exceedingly rare. This gap highlights the importance of our case, providing a comprehensive view of the postoperative challenges and management strategies that can guide future clinical approaches. The present case had multiple CHDs, but each one is a simple congenital heart disease similar to existing reports. Although the surgery was not challenging and the cardiac arrest time was not prolonged, it resulted in a severe postoperative course. Postoperative junctional ectopic tachycardia is known as a complication following congenital heart surgery, with up to 6% of patients affected as reported in recent studies,[5] where the incidence ranged from 0% to 18%. Several risk factors for junctional ectopic tachycardia have been identified, including the presence of a ventricular septal defect, open sternum, and specific demographic characteristics such as Asian race. In our case, the patient, a recipient of congenital heart surgery for ventricular septal defect, was indeed at an elevated risk. The patient's severe preoperative heart failure, complex surgery involving multiple defects, and concomitant severe tracheomalacia necessitated the prolonged cardiopulmonary time, resulting in an open sternum postoperatively. These factors cumulatively heightened the risk for junctional ectopic tachycardia development. Despite the successful weaning from veno-arterial extracorporeal membrane oxygenation, the patient's course was marked by a prolonged need for continuous renal replacement therapy and delayed chest closure, reflecting the extensive multisystem involvement and fragility due to the underlying genetic condition. We consider that this rare chromosomal abnormality may potentially augment the risk of developing junctional ectopic tachycardia when combined with traditional risk factors. These challenges underscore the necessity for a multidisciplinary approach to perioperative care, with a focus on close monitoring and tailored management strategies to mitigate the risks associated with both the recognised risk factors and the specific vulnerabilities introduced by genetic abnormalities. In this particular case, the patient's severe tracheomalacia significantly contributed to respiratory instability, which complicated the process of obtaining parental consent for surgery. This delay in surgical intervention, while necessary to ensure comprehensive preparation and informed consent, may have contributed to the subsequent instability in the postoperative period. Unfortunately, the absence of such a diagnosis delayed the decision-making process for surgical intervention.

The variability in clinical presentation, even among patients with similar genetic deletions, highlights the challenge in establishing clear genotype–phenotype correlations in 2q37 deletion syndrome. Reports have indicated that CHDs with associated genetic abnormalities or extracardiac malformations are

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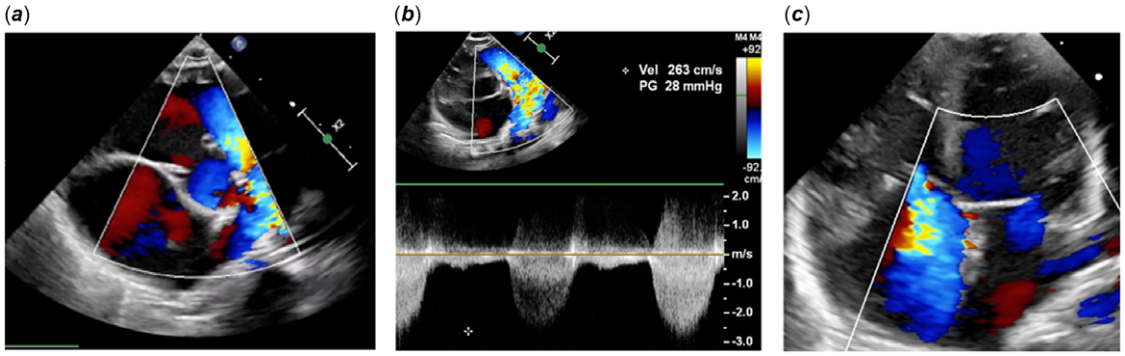

Figure 2. Echocardiogram reveals (***a***) ventricular septal defect, (***b***) right ventricular outflow tract stenosis, and (***c***) severe tricuspid regurgitation. Besides these figures, the echocardiogram also shows atrial septal defect and patent ductal arteriosus.

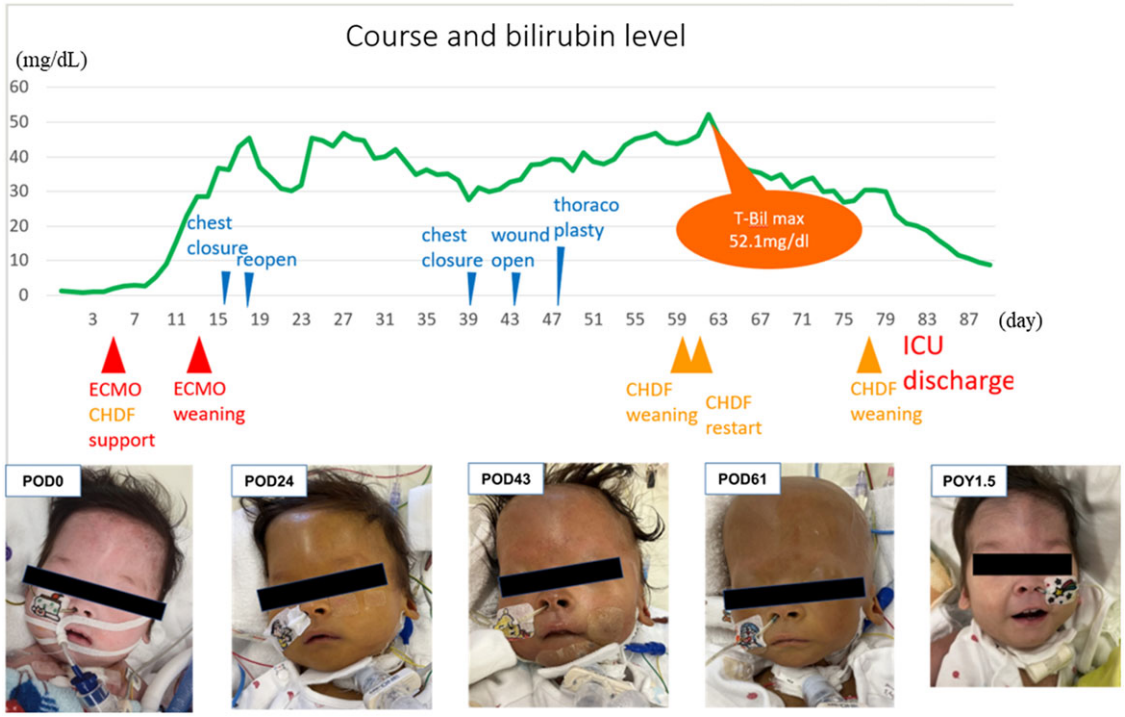

Figure 3. The summary of postoperative course and facial photographs. ECMO = extracorporeal membrane oxygenation; CHDF = continuous hemodialysis and filtration therapy; POD = postoperative day; POY = postoperative year.

associated with higher mortality rates,[6] underscoring the importance of elucidating the relationship between these genetic disorders and their cardiac and extracardiac manifestations. While certain genes within the 2q37 region, such as HDAC4, have been implicated in some of the syndrome's phenotypic features,[7] the full spectrum of clinical manifestations and their underlying genetic determinants remain to be fully elucidated. Our case highlights the necessity for ongoing research to better understand the relationship between specific deletions within the 2q37 region and the resulting phenotypic spectrum, including the full range of possible cardiac manifestations.

In conclusion, the management of patients with 2q37 deletion syndrome requires a comprehensive understanding of the potential multisystem impacts, including a wide spectrum of possible cardiac involvements. Our case contributes to the clinical awareness and knowledge base necessary for the holistic care of these patients and underscores the need for further research to unravel the complex genotype–phenotype relationships in 2q37 deletion syndrome.

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