

Nursing Care of a Child with Double-Chambered Right Ventricle (DCRV) and Perimembranous Ventricular Septal Defect Undergoing Total Surgical Correction: A Case Study

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Abstract

Congenital heart disease (CHD) is a major cause of morbidity in pediatric populations. This case study presents the comprehensive nursing management of a 3-year-7-month-old boy diagnosed with Double-Chambered Right Ventricle (DCRV), perimembranous Ventricular Septal Defect (VSD), and subinfundibular right ventricle obstruction. The patient was admitted for scheduled total correction with VSD closure. Postoperative nursing care focused on hemodynamic stabilization, prevention of low cardiac output syndrome, fluid balance control, nutritional support, infection prevention, and family-centered care. The nursing process framework was applied systematically, including assessment, nursing diagnosis, care planning, intervention, and evaluation. The case highlights the importance of holistic pediatric cardiac nursing to promote recovery and prevent complications.

Keywords: congenital heart disease; DCRV; VSD; pediatric cardiac surgery; nursing care plan

1. Introduction

Congenital heart disease (CHD) is one of the most common congenital anomalies in children. Ventricular Septal Defect (VSD) is frequently encountered and may coexist with other structural abnormalities such as Double-Chambered Right Ventricle (DCRV) (Kliegman et al., 2023). DCRV is a rare condition characterized by hypertrophied muscular bundles that divide the right ventricle into two chambers, leading to right ventricular outflow obstruction and increased intracardiac pressure (Park, 2021).

The combination of DCRV and VSD results in altered hemodynamics, increased myocardial workload, and risk of complications including heart failure, pulmonary hypertension, and impaired growth if untreated (Hockenberry & Wilson, 2021). Surgical correction, including muscle bundle resection and VSD closure, is the definitive treatment to restore normal cardiac function.

Despite successful surgery, pediatric patients remain at risk for postoperative complications such as decreased cardiac output, fluid imbalance, infection, and nutritional deficiency. These risks directly inform priority nursing diagnoses, including Risk for Decreased Cardiac Output, Excess Fluid Volume, Imbalanced



Nutrition: Less Than Body Requirements, and Risk for Infection (Herdman & Kamitsuru, 2021). Therefore, systematic nursing assessment, continuous hemodynamic monitoring, fluid management, wound care, and caregiver education are essential components of the nursing care plan.

Family-centered care is equally important, as parental anxiety and the need for discharge preparation significantly influence recovery and long-term outcomes (Hockenberry & Wilson, 2021). Integrating pathophysiological understanding with the nursing process ensures comprehensive and evidence-based care for children undergoing surgical correction of DCRV with VSD. (Thidaratana, 2023)

This case study aims to present the comprehensive nursing management of a child with DCRV and VSD undergoing total surgical correction, and to demonstrate the integration of pathophysiological knowledge with the nursing process in developing evidence-based nursing diagnoses and care plans to promote optimal recovery and long-term outcomes.

2. Case Presentation

2.1 Patient Information

A 3-year-7-month-old male child was admitted to the Pediatric Cardiology Unit for elective surgery.

Diagnosis:

- Double-Chambered Right Ventricle (DCRV)
- Perimembranous Ventricular Septal Defect (VSD)
- Subinfundibular Right Ventricular Obstruction

Medical History:

The patient had been diagnosed at 3 months of age and followed regularly every three months. Medical management included:

- Lanoxin (Digoxin)
- Lasix (Furosemide)
- Spironolactone

Current Diagnosis on Admission:

Surgical correction (DCRV total correction with VSD closure) was performed as scheduled.

2.2 Socioeconomic and Environmental Context

The patient is a 3-year-7-month-old boy living with both parents in family. The father works in the private sector, and the mother is the primary caregiver. The family's income is adequate for basic living expenses, and the child receives care under the national health coverage scheme.

The family lives in a well-ventilated single-house residence with access to electricity and clean water. There is no household tobacco exposure. The parents have consistently attended scheduled follow-up appointments since the diagnosis at 3 months of age. The mother demonstrated good understanding of

the child's condition and actively participated in hospital care. No financial or access barriers to treatment were reported.

3. Postoperative Clinical Findings

3.1 Postoperative Day 6:

- Good consciousness (GCS E4V5M6)
- Stable vital signs
- Minimal pulmonary congestion on chest X-ray
- No atelectasis
- Residual small VSD noted
- No residual DCRV
- Good left ventricular systolic function
- No pulmonary hypertension

3.2 Physical Examination

- On postoperative day 6 after DCRV total correction with VSD closure, the child was conscious (GCS E4V5M6) with full motor strength (5/5) and able to sit and play appropriately for age
- Vital signs were stable: temperature 36.5–36.7°C, heart rate 126–130 beats per minute, respiratory rate 24–26 breaths per minute, blood pressure 104/63–112/75 mmHg, and oxygen saturation 97–100%. The patient was successfully weaned to room air
- Cardiovascular examination showed regular rhythm with clear S1 and S2, capillary refill time 2 seconds, and no cyanosis or clubbing
- Lung examination revealed symmetrical expansion and normal vesicular breath sounds without wheezing or crepitation
- The median sternotomy wound was clean and dry

4. Diagnostic Assessment

4.1 Echocardiography

Postoperative echocardiography demonstrated a residual small VSD, no residual DCRV, good left ventricular systolic function, and no pulmonary hypertension

4.2 Chest X-ray

showed stable mild pulmonary congestion without atelectasis Chest radiographic findings are presented in Figure 1.

As shown in Figure 1, mild pulmonary congestion is characterized by increased perihilar vascular markings compared with normal lung fields. The comparison between normal lungs and mild pulmonary congestion is illustrated in Figure1 , highlighting early signs of fluid overload.

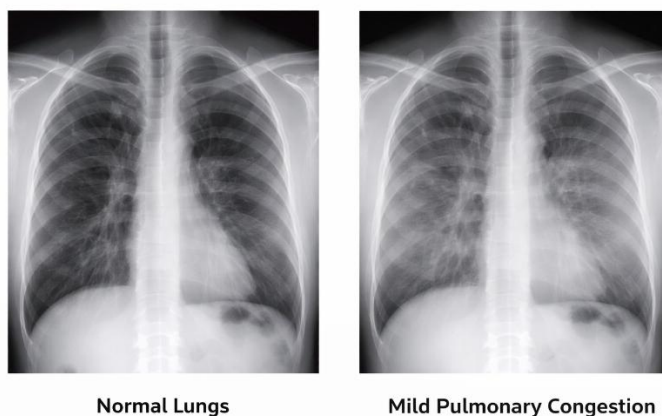


Figure 2 Comparison between normal lung fields and mild pulmonary congestion on chest radiography.

Note. The right image demonstrates increased pulmonary vascular markings and early interstitial fluid accumulation consistent with mild pulmonary congestion. Image generated using ChatGPT (OpenAI), 2026, for academic illustration purposes.

4.3 Laboratory Findings

Laboratory findings demonstrated stable electrolyte levels during monitoring.

- Hematocrit was 43%
- Serum sodium was 138 mmol/L, potassium 3.6 mmol/L, calcium 9.5 mg/dL, phosphate 4.2 mg/dL, and magnesium 2.0 mg/dL
- Subsequent monitoring showed calcium 9.3–9.5 mg/dL, phosphate 4.7–5.1 mg/dL, and magnesium 2.2 mg/dL

5. Pathophysiological Discussion

Double-Chambered Right Ventricle (DCRV) is a congenital cardiac anomaly characterized by anomalous hypertrophied muscular bundles that divide the right ventricle into a proximal high-pressure chamber and a distal low-pressure chamber. In this case, DCRV was associated with a perimembranous Ventricular Septal Defect (VSD) and subinfundibular right ventricular obstruction

The presence of VSD allows abnormal left-to-right shunting of blood, resulting in increased pulmonary blood flow and volume overload of the right ventricle. Over time, progressive muscular hypertrophy within the right ventricle can worsen the obstruction, increasing right ventricular pressure and myocardial workload. This pathophysiological process may lead to symptoms such as tachypnea, poor weight gain, exercise intolerance, and signs of congestive heart failure, which were part of the patient's clinical course prior to surgical intervention

The anatomical differences between a normal heart and double-chambered right ventricle (DCRV) associated with perimembranous ventricular septal defect (VSD) are illustrated in Figure 2. The abnormal muscular bundles divide the right ventricle into proximal and distal chambers, resulting in right ventricular outflow obstruction. The presence of VSD permits abnormal intracardiac shunting, while associated aortic regurgitation contributes to volume overload and pulmonary congestion.

As shown in Figure 2, progressive hemodynamic alterations may lead to pulmonary edema and increased cardiac workload, emphasizing the importance of early surgical correction and continuous postoperative monitoring.

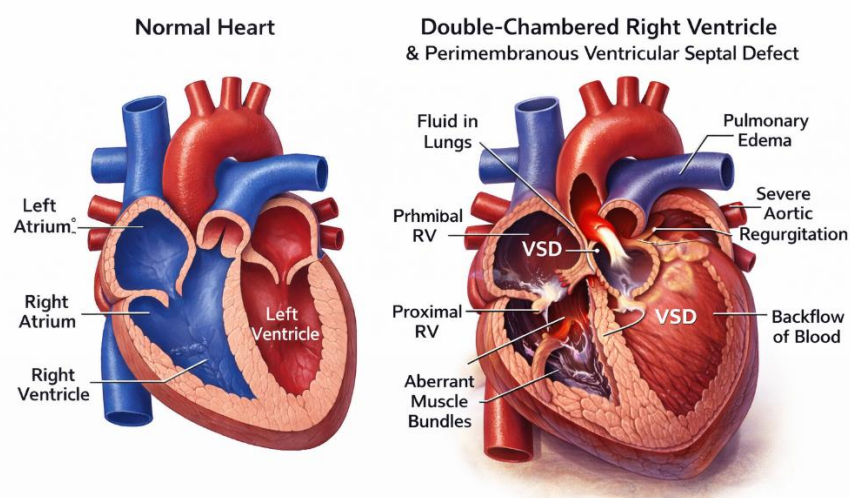


Figure 2 Comparison between a normal heart and double-chambered right ventricle (DCRV) with perimembranous ventricular septal defect (VSD).

Note. The right image demonstrates anomalous muscular bundles dividing the right ventricle into proximal and distal chambers, associated VSD, aortic regurgitation, and pulmonary congestion. Image generated using ChatGPT (OpenAI), 2026, for academic illustration purposes.

Surgical correction through DCRV total correction with VSD closure involves resection of obstructing muscle bundles and closure of the septal defect.

Following surgery, restoration of more normal intracardiac flow reduces right ventricular outflow obstruction and eliminates significant left-to-right shunting. However, early postoperative findings in this case demonstrated a residual small VSD and reduced right ventricular systolic function, while left ventricular systolic function remained good.

The reduced right ventricular systolic function may reflect postoperative myocardial stunning, previous pressure overload, or transient effects of cardiopulmonary bypass. Continued monitoring is essential, as persistent ventricular dysfunction could contribute to low cardiac output or fluid imbalance.

The absence of pulmonary hypertension and no residual DCRV indicate effective surgical relief of the primary obstruction

Overall, the pathophysiological progression in this case illustrates the hemodynamic burden imposed by combined DCRV and VSD and demonstrates the corrective impact of surgical intervention, while highlighting the importance of vigilant postoperative monitoring for ventricular function and residual defects.

The hemodynamic progression of double-chambered right ventricle (DCRV) associated with ventricular septal defect (VSD) and its surgical management are illustrated in **Figure 3**. The presurgical phase demonstrates left-to-right shunting through the VSD, resulting in increased pulmonary blood flow and progressive right ventricular hypertrophy. These hemodynamic alterations contribute to reduced cardiac efficiency and an increased risk of heart failure.

As shown in **Figure 3**, total surgical correction involves resection of obstructing muscular bundles and closure of the VSD. Postoperatively, although obstruction is relieved, some patients may exhibit transient or persistent right ventricular systolic dysfunction, necessitating close monitoring of cardiac output and fluid balance.

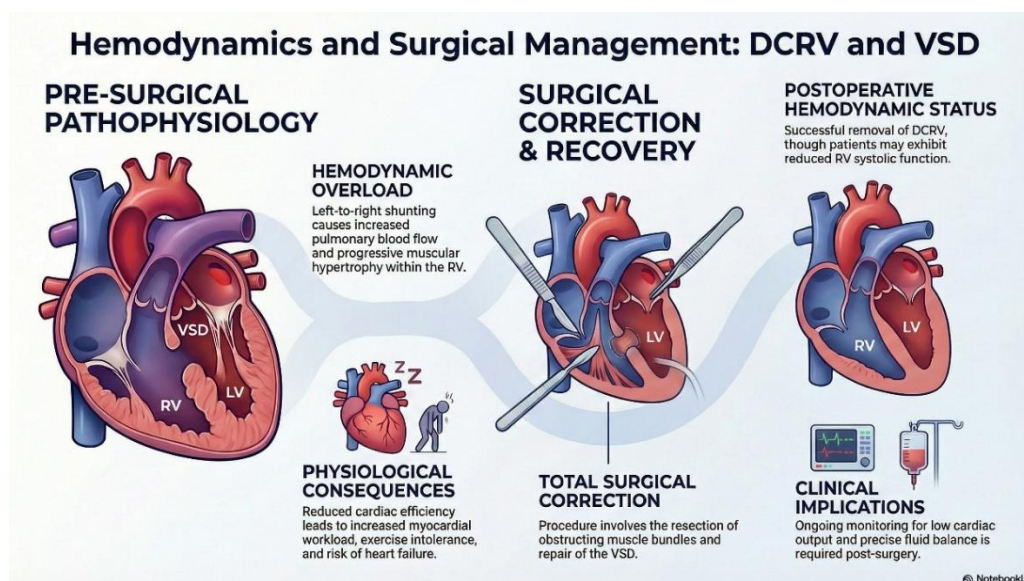


Figure 3 Hemodynamics and surgical management of double-chambered right ventricle (DCRV) with ventricular septal defect (VSD).

Note. The diagram illustrates presurgical pathophysiology (left-to-right shunt and right ventricular hypertrophy), total surgical correction (resection of aberrant muscle bundles and VSD repair), and postoperative hemodynamic status. Image generated using NotebookLM (Google AI), 2026, for academic illustration purposes.

6. Medical Management

- The patient was diagnosed with double-chambered right ventricle (DCRV) associated with perimembranous ventricular septal defect (VSD) and subinfundibular right ventricular obstruction. Definitive treatment was performed through total surgical correction under cardiopulmonary bypass, including resection of the obstructing muscular bundles and closure of the VSD.

- Postoperatively, the patient was admitted to the pediatric cardiac intensive care unit for continuous hemodynamic monitoring. Oxygen therapy was gradually weaned, and the child maintained adequate oxygen saturation (97–100%) on room air. Vital signs remained stable throughout recovery.

- Fluid balance and electrolyte levels were closely monitored. Laboratory findings demonstrated stable serum sodium, potassium, calcium, phosphate, and magnesium levels within acceptable postoperative ranges. Hematocrit was maintained at 43%.

- Postoperative echocardiography revealed no residual DCRV, a residual small VSD, good left ventricular systolic function, reduced right ventricular systolic function, and no pulmonary hypertension. These findings supported continued medical observation, optimization of cardiac function, and scheduled cardiology follow-up.

- Pharmacological Management

- The patient received standard medical therapy for heart failure and postoperative cardiac support, including:

- **Lanoxin (Digoxin):** Administered to enhance myocardial contractility and improve cardiac output, particularly in the presence of reduced right ventricular systolic function. Digoxin also helps control heart rate and supports hemodynamic stability.

- **Lasix (Furosemide):** A loop diuretic used to reduce fluid overload, relieve pulmonary congestion, and decrease preload, thereby improving symptoms of heart failure.

- **Spironolactone:** A potassium-sparing diuretic and aldosterone antagonist administered to assist in fluid management while preventing hypokalemia associated with loop diuretics. It also contributes to reducing cardiac remodeling in chronic heart failure.

- This pharmacological regimen aimed to optimize ventricular function, control fluid balance, prevent worsening congestion, and promote recovery during the postoperative period.

Overall, medical management focused on maintaining hemodynamic stability, preventing complications, supporting ventricular recovery, and preparing the patient and family for safe discharge and long-term surveillance.

7. Nursing Diagnoses and Nursing Care Plan

Nursing care for pediatric heart surgery requires systematic clinical reasoning guided by standardized nursing diagnoses. The following diagnoses are based on NANDA-I (2021–2023) classification and supported



by pediatric cardiac nursing literature (Hockenberry & Wilson, 2021; Herdman & Kamitsuru, 2021 ;Thidaratana, 2023).

7.1 Nursing Diagnosis 1: Decreased Cardiac Output

Related to altered myocardial contractility and postoperative right ventricular systolic dysfunction As evidenced by reduced RV systolic function on echocardiography

Goal: The patient will maintain adequate cardiac output as evidenced by stable vital signs, normal capillary refill time (<2 seconds), appropriate activity level, and absence of signs of low cardiac output.

Nursing Interventions:

1. Monitor heart rate, blood pressure, respiratory rate, and oxygen saturation regularly.
2. Assess for signs of low cardiac output (cool extremities, delayed capillary refill, decreased urine output).
3. Monitor response to Digoxin therapy and observe for signs of toxicity (bradycardia, vomiting).
4. Maintain strict intake and output (I&O) recording.
5. Collaborate with the medical team for ongoing echocardiographic follow-up.

Evaluation: The patient maintained stable vital signs, capillary refill time of 2 seconds, and appropriate activity for age.

7.2 Nursing Diagnosis 2: Excess Fluid Volume

Related to compromised cardiac function and postoperative fluid retention As evidenced by mild pulmonary congestion on chest X-ray

Goal: The patient will demonstrate balanced fluid status as evidenced by clear breath sounds, absence of edema, and stable weight.

Nursing Interventions:

1. Monitor respiratory status and lung sounds for crackles or increased work of breathing.
2. Record daily weight at the same time each day.
3. Monitor intake and output accurately.
4. Administer Furosemide and Spironolactone as prescribed and monitor effectiveness.
5. Monitor serum electrolytes to prevent imbalance

Evaluation: No worsening respiratory distress was observed, and electrolyte levels remained within acceptable ranges.

7.3 Nursing Diagnosis 3: Risk for Impaired Gas Exchange

Related to pulmonary congestion secondary to cardiac dysfunction

Goal: The patient will maintain adequate oxygenation with $SpO_2 \geq 95\%$ on room air.

Nursing Interventions:

1. Monitor oxygen saturation continuously.
2. Assess respiratory effort and chest expansion.
3. Position the child in semi-Fowler's position to enhance lung expansion.
4. Provide oxygen therapy if SpO₂ decreases below target level.

Evaluation: The patient maintained oxygen saturation between 97–100% on room air

7.4 Nursing Diagnosis 4: Risk for Infection

Related to postoperative surgical wound

Goal: Prevent surgical site infection.

Nursing Interventions:

1. Aseptic technique
2. Monitor wound for redness/swelling
3. Monitor temperature
4. Educate caregiver on wound care

Evaluation: No signs of infection.

7.5 Nursing Diagnosis 5: Risk for Electrolyte Imbalance

Related to diuretic therapy

Goal: Electrolyte levels will remain within normal limits.

Nursing Interventions:

1. Monitor serum sodium, potassium, calcium, magnesium, and phosphate levels regularly
2. Observe for signs of hypokalemia or hyperkalemia.
3. Ensure appropriate dietary intake as recommended.
4. Collaborate with the physician for dose adjustment if needed.

Evaluation: Electrolyte levels remained stable during hospitalization.

7.6 Caregiver Role Strain / Anxiety

Related to the child's complex congenital heart disease, postoperative recovery, and uncertainty about long-term outcomes, as evidenced by the caregiver's expressed concerns and repeated clarification regarding treatment and home management.

Goal: The caregiver will demonstrate reduced anxiety, verbalize understanding of the child's condition and treatment plan, and actively participate in caregiving with confidence.

Nursing Interventions:

1. Assess caregiver's level of anxiety and coping mechanisms.
2. Provide clear, consistent, and developmentally appropriate explanations regarding diagnosis, surgical outcome, and medication regimen (Digoxin, Furosemide, Spironolactone).
3. Encourage caregivers to ask questions and express concerns.
4. Involve caregivers in daily care activities to enhance confidence and competence.



5. Provide written discharge instructions and warning signs requiring medical attention.

Evaluation: The caregiver verbalized understanding of the disease process and medication regimen and demonstrated active participation in care without signs of significant distress.

Summary of Nursing Care Plan

The nursing management of this case focused on maintaining hemodynamic stability, optimizing cardiac output, and preventing postoperative complications. Continuous monitoring of vital signs, cardiac function, respiratory status, and fluid balance was prioritized to detect early signs of low cardiac output and pulmonary congestion.

Pharmacological management, including digoxin, furosemide, and spironolactone, was carefully monitored to ensure therapeutic effectiveness and prevent adverse effects, particularly electrolyte imbalance.

In addition, nursing care emphasized respiratory support, strict intake and output monitoring, and laboratory surveillance to maintain electrolyte stability. Family-centered care was integral to the management plan, with ongoing education, emotional support, and discharge preparation provided to reduce caregiver anxiety and promote safe long-term home care.

Overall, the comprehensive and individualized nursing care plan contributed to clinical stability, prevention of complications, and readiness for discharge with appropriate follow-up.

Comprehensive nursing assessment and early intervention were essential in preventing further cardiac decompensation and promoting recovery.

Discharge Planning (D-METHOD)

D – Diagnosis: Educate about DCRV and VSD condition.

M – Medication: Explain dosage, schedule, and side effects of Lasix and other medications.

E – Environment: Provide safe home environment, prevent infection.

T – Treatment: Follow-up appointments and echocardiogram schedule.

H – Health: Encourage balanced diet and fluid restriction compliance.

O – Outpatient: Regular follow-up every 3 months.

D – Diet: Low sodium diet, adequate calories.

8. Nursing Outcomes (NOC)

Following comprehensive surgical and nursing management, the patient demonstrated significant clinical stabilization.

8.1. Cardiac Output Status (NOC)

- Stable heart rate and blood pressure within age-appropriate range
- Capillary refill time $\leq$ 2 seconds
- Adequate urine output
- No clinical signs of low cardiac output

Postoperative echocardiography confirmed relief of right ventricular obstruction with no residual DCRV, good left ventricular systolic function, and absence of pulmonary hypertension, although a small residual VSD and reduced right ventricular systolic function were noted

8.2 Respiratory Status (NOC)

- Oxygen saturation maintained at 97–100% on room air
- No respiratory distress
- Stable chest examination findings
- Mild pulmonary congestion did not progress clinically during hospitalization

8.3 Fluid and Electrolyte Balance (NOC)

- Balanced intake and output
- Stable daily weight
- Serum electrolytes within acceptable postoperative range

Diuretic therapy (Furosemide and Spironolactone) was well tolerated without evidence of significant electrolyte imbalance.

8.4 Risk for Infection (NOC)

- Infection Severity: No signs or symptoms of infection
- Wound Healing: Primary Intention: Surgical wound remains clean, dry, and well-approximated
- Immune Status: Body temperature within normal range
- Knowledge: Infection Control (Caregiver): Caregiver demonstrates correct wound care

technique and verbalizes warning signs of infection

8.5 Caregiver Coping and Knowledge (NOC)

- Caregiver verbalized understanding of the disease process
- Demonstrated correct medication knowledge (Digoxin, Furosemide, Spironolactone)
- Identified warning signs requiring medical attention
- Participated actively in discharge preparation

Overall Outcome

The integrated medical and nursing interventions resulted in hemodynamic stability, prevention of postoperative complications, effective symptom control, and preparedness for safe discharge with structured cardiology follow-up.

9. Discussion

This case emphasizes that complex congenital heart disease (CHD), particularly double-chambered right ventricle (DCRV) associated with ventricular septal defect (VSD), can impose significant hemodynamic burden and progressive ventricular remodeling if not managed appropriately. Consistent with pediatric cardiology literature, DCRV frequently develops secondary to progressive muscular hypertrophy in



response to altered intracardiac flow dynamics, and timely surgical correction is essential to prevent long-term complications (Park, 2021; Kliegman et al., 2023).

Although definitive surgical repair effectively relieved right ventricular outflow obstruction in this patient, the presence of residual small VSD and reduced right ventricular systolic function reflects findings reported in previous studies, where postoperative ventricular dysfunction may occur due to preoperative pressure overload or transient myocardial stunning (Kliegman et al., 2023). These findings reinforce the importance of structured postoperative surveillance.

The management of mild pulmonary congestion through diuretic therapy aligns with current pediatric heart failure management principles, emphasizing preload reduction and optimization of cardiac output (American Heart Association [AHA], 2023). Close monitoring of electrolyte levels and digoxin therapy is essential to prevent arrhythmias and medication-related complications.

Importantly, this case strongly supports the holistic nursing care approach in managing children with congenital heart disease. According to Thidaratana (2023), effective nursing care for patients with CHD must integrate physical, psychological, social, and family dimensions of care. In this case, beyond physiological stabilization, nursing interventions included caregiver education, emotional support, and discharge preparation, which are consistent with holistic and family-centered care principles.

The integration of continuous clinical monitoring with holistic family engagement contributed to reduced caregiver anxiety, improved treatment adherence, and enhanced readiness for long-term follow-up. Therefore, this case illustrates that optimal outcomes in pediatric postoperative CHD patients depend not only on surgical success but also on comprehensive, multidisciplinary, and holistic nursing management (Thidaratana, 2023).

10. Conclusion

This case illustrates the complexity of double-chambered right ventricle (DCRV) associated with ventricular septal defect (VSD) and highlights the importance of timely surgical intervention to prevent progressive cardiac dysfunction. Although surgical correction successfully relieved right ventricular obstruction, careful postoperative monitoring was required due to residual defects and reduced right ventricular systolic function.

Optimal outcomes were achieved through integrated medical management and comprehensive nursing care. Continuous hemodynamic assessment, fluid and electrolyte monitoring, medication surveillance, and family-centered education were essential in maintaining stability and preventing complications.

This case reinforces that multidisciplinary collaboration and holistic nursing practice are fundamental to promoting recovery and ensuring safe long-term follow-up in children with complex congenital heart disease.

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12. Ethical Considerations

This case study was conducted in accordance with ethical principles for research involving human participants. Written informed consent was obtained from the patient's parent/legal guardian for the use of anonymized clinical data for academic publication purposes. All identifying information has been removed to ensure confidentiality and privacy protection.

The study adhered to the principles outlined in the Declaration of Helsinki and institutional ethical guidelines for case reporting. As this manuscript presents a single case without experimental intervention, formal institutional review board approval was not required according to institutional policy.

13. Author Contributions

All authors contributed substantially to the intellectual content of this manuscript.

- **Conceptualization and Case Analysis:** Primary author
- **Clinical Data Collection:** Clinical nursing team
- **Literature Review and Theoretical Integration:** Primary author
- **Manuscript Drafting:** Primary author
- **Critical Revision and Final Approval:** All authors

All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

14. Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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