

Case Study

Nursing Care in Complex Congenital Heart Disease and Respiratory Distress Syndrome for Baby in NICU

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ABSTRACT

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Background: Neonates are at high risk for health problems. Without proper treatment, those problems might lead to either disability or death. Congenital heart disease causes respiratory distress syndrome (breathing distress syndrome), with symptoms of dyspnea, cyanosis, and respiratory arrest due to pathological changes in the heart that disrupt the blood flow cycle throughout the body. This study aimed to discover nursing care for Baby MH with complex congenital heart disease and respiratory distress syndrome.

Methods: This research used a case study design—data collection from assessment to evaluation in the NICU in December 2022. The patient was observed for 4 days. Data collection techniques were carried out through interviews, observation, and documentation. Data analysis was carried out using narrative analysis.


Results: Baby MH looks dyspnea with minimal epigastria retraction and hypersecretion in the mouth with CPAP installed. The nursing diagnoses in the case of Baby MH are ineffective breathing patterns, decreased cardiac output, activity intolerance, risk of shock, risk of hypothermia, risk of developmental disorder, and risk of attachment disorders. The interventions provided are based on the Indonesian Nursing Intervention Standards, consisting of observational, therapeutic, and collaborative interventions.

Conclusion: Nursing problems in baby MH after the treatment showed that the problem of ineffective breathing patterns had not been resolved, but the decreased cardiac output was partially handled while the activity intolerance had not been resolved. However, no shock occurred, and the risk of hypothermia was partially resolved.

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Introduction

Neonates are at high risk of experiencing health problems if they do not get proper treatment, resulting in death such as disability and death. World Health Organization (WHO, 2020) reports that the

prevalence of neonatal deaths worldwide reaches 47%, which are caused by prematurity, asphyxia, respiratory failure, neonatal infections, and congenital abnormalities. According to data from the



Ministry of Health of the Republic of Indonesia ([Kemenkes, 2020](#)), neonatal deaths caused by congenital abnormalities, including congenital heart disease in the 3rd rank (11.4%) after low birth weight (35.2%) and asphyxia (27.4%).

Congenital heart disease is a disease with abnormalities in the heart structure or the function of the heart circulation that is present from birth which occurs due to disturbances or failures in the development of heart structures in the early phases of fetal development ([American Heart Association, 2022](#)). According to [Manopo et al \(2018\)](#), the results showed that as much as 88.89% of neonatal deaths were caused by congenital heart disease in the non-cyanotic group (atrial septal defect, ventricular septal defect, and persistent ductus arteriosus), while 11.11% of neonatal deaths were caused by coronary heart disease—cyanotic congenital heart (tetralogy of Fallot).

Congenital heart disease is one of the causes of respiratory distress syndrome in neonates, or called respiratory distress syndrome (RDS). A study conducted by [Maduabuchi et al \(2020\)](#) stated that 47 children with respiratory distress syndrome had congenital heart disease and most had 36.2% ventricular septal defects, followed by 23.4% tetralogy of fallout. The greater the disturbance experienced in the child's heart, the greater the symptoms experienced by the child, ultimately interfering with the child's growth process. According to [Mari et al, 2016](#), children with congenital heart disease will experience growth retardation due to disruption of the body's circulatory system, which affects neuromuscular growth and results in delays in children fulfilling developmental tasks, especially gross motor skills such as the ability to sit, stand and so on and fine motor skills. Such as the

child's ability to observe, write. Another impact is that the child's ability to speak and independence is also disturbed.

To avoid this, treatments must be carried out to help overcome these problems. The Indonesian National Nurses Association (PPNI) has issued Indonesian nursing intervention standards (SIKI), which can serve as guidelines for nursing care. In addition, nurses can also use evidence-based practice as a source to address nursing problems. This case study aims to see the application of "Nursing care for an infant with complex congenital heart disease and respiratory distress syndrome".

Method

This study uses a qualitative research design with a case study approach. A case study is understanding a case, specific people or situation in depth ([Creswell, 2018](#)). Data collection started from assessment to evaluation of nursing which was carried out in the Neonatal Intensive Care Unit (NICU) of the Hospital in Banda Aceh on December 2022. Previously, the patient was observed or treated for twelve days, and the authors observed and cared for only four days because the service schedule had been completed. Data collection techniques using interviews, observation, and documentation using narrative analysis. In conducting research, the authors apply ethical principles by maintaining the confidentiality of patient data. Research has obtained ethical clearance.

Results

Table 1. Description event

Date	Event
November 11, 2022	By. MH was born a male with a low



Date	Event
	birth weight of 2000 grams.
November 11, 2022	The village midwife recommended further treatment at Fauziah Bireun Hospital.
November 12, 2022	The baby refused to breastfeed, without shortness of breath, less active movements, and weak crying.
November 15, 2022	By. MH underwent echocardiography and was diagnosed with complex congenital heart disease (atrial septal defect, ventricular septal defect, and patent ductus arteriosus).
November 21, 2022	The patient was referred to a general hospital in Banda Aceh due to edema and decreased urine output since November 19, 2022.
Day 12 of treatment	The patient appeared weak, experienced dyspnea with minimal epigastric retraction and hypersecretion in the mouth, and received CPAP with PEEP 7 cmH ₂ O FiO ₂ 25%—RR: 47 x/m, SpO ₂ : 95% with breathing apparatus. The patient showed

Date	Event
	rapid and shallow breathing when CPAP was briefly removed. Initial diagnosis: ineffective breathing pattern (D.0005) related to respiratory obstruction based on Indonesian Nursing Standards (PPNI, 2016).
Day 12 of treatment	Echocardiography confirmed complex congenital heart disease (atrial septal defect, ventricular septal defect, and patent ductus arteriosus). The patient appeared pale, had a weak pulse, HR: 155 x/m, CRT <2 seconds, and had a history of edema for 9 days. Second diagnosis: decrease in cardiac output (D.0008) related to afterload

By. MH was born on November 11 2022, to a male with a low birth weight of 2000 grams, so the village midwife recommended further treatment at the Fauziah Bireun Hospital. On November 12, 2022, it was discovered that the baby did not want to breastfeed, without shortness of breath, less active movements and weak crying. On November 15, 2022, By. MH underwent echocardiography resulting from complex congenital heart disease consisting of atrial septal defect,



ventricular septal defect and patent ductus arteriosus. Then on 21 November 2022, the patient was referred to the general hospital in Banda Aceh with complaints that since 19 November, 2022, the patient has experienced edema and urinated a little.

The results of the examination carried out by the author (day 12 of treatment) found that the patient looked weak, dyspnea (shortness of breath) with minimal epigastric retraction, hypersecretion in the mouth, CPAP installed with PEEP 7 cmH₂O FiO₂ 25%, RR: 47 x/m, SpO₂: 95% with breathing apparatus and the patient is seen breathing fast and shallow when the CPAP is released for a moment, for the first diagnosis based on Indonesian Nursing Standards (PPNI, 2016) is an ineffective breathing pattern (D.0005) associated with respiratory obstruction.

In addition, echocardiography was performed on the patient, and the results obtained were complex congenital heart disease consisting of the atrial septal defect, ventricular septal defect and patent ductus arteriosus. The patient looks pale, has a weak pulse, HR: 155 x/m, CRT <2 seconds and has a history of edema since the chronological age of 9 days, so the second diagnosis is a decrease in cardiac output (D.0008) related to afterload changes.

The third diagnosis is activity intolerance (D.0056), associated with an imbalance between oxygen supply and demand marked by the baby looking tired and short of breath when trying to give the oral diet so that nutrition is carried out through the OGT. Furthermore, the fourth diagnosis that appears is a risk of shock (D.0039) related to hypoxaemia and sepsis, which is marked by pale skin and looks sweaty, dyspnea (shortness of breath), SPO₂: 95% with CPAP, CRT < 2 seconds, increase in leukocytes to 13.56 x 10³/mm³

on 25 November 2022 which was previously leukocytes 11.68 x 10³/mm³, decreased hematocrit levels 43%, decreased stem neutrophils 0%, decreased lymphocytes 13%, increased urea levels 69 mg/dL and increased creatinine levels 1.50 mg/d.

In addition, the fifth diagnosis is the risk of hypothermia (D.0130) associated with low birth weight, which the baby marks as a low birth weight, namely 2000 grams and the baby is placed in an incubator with a temperature of 31.7 C. Furthermore, the baby born is a full-term neonate of gestational age with low birth weight and has a congenital heart defect (complex congenital heart disease) which can cause a risk of developmental disorders (D.0107) related to congenital abnormalities for the sixth diagnosis. The seventh diagnosis is the risk of attachment disorders (D. 0127) associated with hospitalization, which shows that the baby is separated from the parents and has minimal physical contact due to being blocked by the incubator.

After nursing care for 4 days, the patient's breathing pattern had not improved, and breathing appeared shallow with minimal epigastric retraction. The patient is still given oxygen through a ventilator with A/C Peep mode 5 cmH₂O and 70% FiO₂. The RR results adjusted from the ventilator, namely 50x/minute and HR 163x/minute with SPO₂ 98-100%. The problem of ineffective breathing patterns has not been resolved, and the NICU nurse continues nursing interventions.

The problem of decreased cardiac output is known. The patient's condition is still unstable, which is characterized by slightly reduced pale skin, reduced edema, good capillary refill, which is < 2 seconds and a weak palpable pulse, namely 155-165 x/minute compared to day 3 when

providing nursing care so that nursing interventions are continued.

During the 4 days of treatment, the diet was still administered through the OGT. Besides the patient's shortness of breath and fatigue when given the oral diet, the patient was also put on a ventilator since the second day of treatment. The diet was given formula milk as much as 5cc/3 hours from the second day of treatment, which previously received 25 cc-30 cc/3 hours. During gastric decompression, 5-10 cc of gastric residue was found with a cloudy yellow colour. In addition, patients still receive Aminosteril 10% with increased doses of up to 2.5 cc/hour because the absorption of nutrients in the patient's digestive tract is not optimal. The problem of activity intolerance has not been resolved, so the intervention is continuing.

On the third day of treatment, there was an increased risk of shock, characterized by the patient's condition being very weak, the skin color looking very pale with CRT > 2 seconds, and the patient's extremities being cold. The patient has received a PRC transfusion of 1 of 20 ccs, IVFD fluid N5/Ca+Kcl 6.6 cc/hour, and the antibiotic Piperacilin tazobactam 100gr/8 hours is still being continued. On the fourth day of treatment, the patient's condition seemed to improve, as evidenced by reduced pale skin and warm extremities. Shock prevention interventions continue so that they can be treated immediately when shock occurs.

Then the problem of the risk of hypothermia was found to be partially resolved as evidenced by a change in temperature; pallor was slightly reduced, the acral was warm, and the temperature was within the normal range of 36.9 oC. The hypothermia risk intervention was continued by nurses in the NICU room.

Regarding the risk of developmental disorders, it was found that the patient's

condition looked good. Implementation for developmental care, such as handling, is only done every 3 hours when giving a diet, adjusting the patient's position in nesting, and minimizing noise and light with a cloth covering the incubator. Nurses have also implemented developmental care interventions for all babies in the NICU to prevent developmental disorders in infants.

For the problem of attachment disorder, the bottom result was that while nursing care was given, the patient was only met by the father, while the mother remained in the village because of financial problems and had to look after her first small child. This becomes an obstacle in providing intervention to the family. The family has received information about the patient's progress directly or by telephone. Interventions were continued by room nurses, such as facilitating visits and discussing the child's condition with parents.

Discussion

1. Ineffective breathing pattern

The implementation that has been carried out is monitoring breathing patterns, effort and depth of breathing, respiratory frequency, and oxygen saturation through a monitor attached to the side of the patient's incubator. Then, the monitoring results are documented in a chart (cardex). Calculation of respiratory frequency is essential because, in infants, the respiratory frequency increases significantly, which is associated with anxiety, crying, fever or illness ([Doenges et al., 2015](#))

The patient has not been able to breathe spontaneously because of the RDS he is experiencing, so the patient's breathing is assisted with CPAP. Subsequent implementations include

ensuring that the nasal prongs are correctly installed, fixing the nasal prongs properly to avoid injury to the nose, and routinely checking the condition of the bubbles and the CPAP system. According to [Asmarini \(2020\)](#), using CPAP has been shown to reduce breathing difficulties, reduce dependency on oxygen, help improve and maintain residual lung capacity, and reduce the need to be treated in intensive care units, thereby reducing treatment costs.

Furthermore, the author also performs maintenance on CPAP, ensuring CPAP works and functions properly. According to the Regulation of the Minister of Health of the Republic of Indonesia Number HK.01.07/MENKES/214/2019 ([Kemenkes, 2019](#)), the use of CPAP can maintain residual lung volume, save surfactant use and maintain the presence of surfactant in the baby's alveoli. PEEP of 2-3 cmH₂O is too low to maintain lung volumes and tends to cause a ventilation-perfusion imbalance. Likewise, a PEEP that is too high (> 8 cmH₂O) can cause pulmonary air leaks, over-distend the lungs, block a venous return to the heart, reduce pulmonary vascular resistance, and cause CO₂ resistance. Therefore the agreement in Indonesia PEEP generally starts from 7 cmH₂O. CPAP is considered failed if the baby continues to show signs of respiratory distress with a PEEP of 8 cmH₂O and a FiO₂ exceeding 40%.

On day 2 of treatment, the patient was unable to maintain his oxygen saturation using CPAP with a PEEP of 8 cmH₂O and 40% FiO₂ so the patient's breathing apparatus was replaced with a ventilator with A/C PEEP mode of 5 cmH₂O and 50% FiO₂. Mechanical ventilation (ventilator) is a tool to

support or assist patients in breathing, one of which is in infants who experience respiratory failure (apnea). Using a ventilator aims to ensure adequate oxygenation so that changing gases with sufficient ventilation can remove CO₂ from the body ([Chakkarapani et al \(2020\)](#)).

In addition, the baby's head is also raised by placing a cloth roll between the baby's head and neck to straighten the airway. In addition, the patient is also replaced with a prone position with the head tilted to prevent aspiration, increase oxygen saturation and provide comfort to the baby. Research by [Anggraeni et al \(2019\)](#) shows that giving babies a prone position effectively increases oxygen saturation. The prone position improves gas exchange by improving the ventral-dorsal transpulmonary pressure difference, reducing lung compression, and increasing lung perfusion. The prone position also exposes alveoli that have collapsed during ventilation.

2. Decreased cardiac output

The intervention is to monitor for signs of decreased cardiac output, including blood pressure, dyspnea, skin colour, and edema, and monitor fluid intake, output, and capillary refill time (CRT). CRT examination is critical where capillary refill aims to ensure circulation. Capillary refill time is required for the distal capillary base colour to return to baseline after applying sufficient pressure to cause blanching. Delayed CRT is defined as >2 seconds and indicates abnormal circulatory status. CRT is used clinically to assess peripheral circulation for signs of shock and dehydration ([Falotico et al., 2020](#)).



In addition, documenting intake and output aims to monitor fluid balance. In patients with heart problems, fluid accumulation (fluid retention) occurs in the lungs due to fluid shifts from the intravascular compartment into the alveolar cavity in connection with the increase in hydrostatic pressure generated by the heart, causing the cardiac output to decrease so that oxygen circulation is disrupted and causes the patient to experience shortness of breath and end up with respiratory failure. Other monitoring is in the form of monitoring edema, which shows fluid accumulation in the body's interstitial tissues, which is one of the possible causes of fluid shifts to the tissues. This condition is increased fluid volume in the blood vessels ([Andayani et al., 2019](#)).

Another implementation is the collaboration of giving injections of furosemide 3.5 mg/12 hours for patients. According to The Food and Drug Administration (FDA) ([Khan et al., 2022](#)), furosemide can treat conditions of excess fluid volume (fluid retention) and edema due to kidney disease, nephrotic syndrome and heart disease.

3. Activity Intolerance

In the diagnosis of activity intolerance, interventions that can be carried out according to [PPNI \(2018\)](#) are energy management by identifying impaired body functions that cause fatigue, providing a comfortable and low-stimulus environment by covering the incubator using a cloth and turning off the alarm that sounds on the device in the room. Other implementations include nutritional management, including identifying nutritional status, monitoring food intake, monitoring laboratory results, and collaborating

with nutritionists for patient diets. The implementation was done by giving 25-30 cc/3 hours of formula milk diet through the OGT on the first day of treatment before giving the writer a check for residues by aspirating the OGT tube. If there is no residue, then the diet is given.

Starting from the second day of treatment, when administering the diet, the gastric residue was checked, and there were quite a lot of gastric residues, so the patient underwent gastric decompression to determine absorption in the patient's stomach. After decompression, there was a slightly cloudy yellow gastric residue of 5-10 cc, so starting on the second day, the diet given was 5 cc/3 hours. According to [Dutta et al. \(2015\)](#), the gastric residue that is more than a threshold value (LBW babies with the normal residue of 5 ml) may indicate an intolerance to enteral feeding or a suspicion of Necrotizing Enterocolitis (NEC), which is a disease of the digestive tract that develops when the tissues are in the inner lining of the stomach. The small or large intestine is damaged / dead, causing inflammation.

Furthermore, using OGT is the right choice for babies with respiratory disorders in fulfilling their nutrition. According to [Samudro \(2012\)](#), infants with congenital heart disease show hypoxia and difficulty breathing when eating/drinking orally; this results in venous congestion in the gastrointestinal tract, which affects food malabsorption, peripheral anoxia and acidosis, causes inadequate nutrition and increases the rate of Metabolic disease indicates insufficient food intake for the growth and development of the baby.

In addition to providing enteral nutrition, patients receive parenteral

nutrition, namely Drip Aminosteril 2.5 cc/hour, because the baby's digestion cannot absorb nutrients optimally. According to [\(Liu et al \(2015\)\)](#), newborns who cannot receive enteral nutrition should be given intravenous lipid emulsions no later than the third day after birth; this aims to maintain balanced and optimal nutrition.

4. Risk of shock

Shock prevention interventions such as IV administration or blood transfusions can be carried out to overcome the risk of insufficient blood flow to body tissues. The implementation that has been carried out is IV administration, monitoring signs and symptoms of shock, monitoring serum examination results and collaboration of antibiotics.

In collaboration with the use of antibiotics, previously, the patient received Meropenem 60 mg/hour. However, there was no change for 7 days, as evidenced by the patient's leukocytes, urea and creatinine increasing on November 13, 2022, so on December 2, 2022, the patient's antibiotics were changed to Piperacillin tazobactam 100 gr /8 hours. Based on research conducted by [Oyong et al. \(2016\)](#) showed that meropenem was less effective when used on some gram-negative bacteria that cause neonatal sepsis, such as coagulate-negative staphylococci and Burkholderia cepacia. On the last day of treatment, the patient received a 20 cc PRC transfusion because the CRT was > 2 seconds and the pulse was weak.

5. Risk of hypothermia

The implementation that has been carried out is temperature regulation, including monitoring the baby's body

temperature, skin colour and temperature and symptoms of hypothermia. Based on the monitoring results, the baby's temperature is within the normal range. Another implementation is to take care of the baby in the incubator and adjust the incubator's temperature according to the baby's needs. Babies with low birth weight tend to experience unstable body temperature due to immature circulation. The baby's incubator temperature is kept within normal limits of around 33°C to 35°C. In addition, 40% to 60% of relative humidity must also be maintained to help stabilize the baby's body temperature [\(Riadinata, 2016\)](#).

To prevent heat loss in infants, the nurse implements: changing the baby's diaper if the diaper is wet due to urination or defecation, warming the hands before touching the baby and warming the milk before giving it to the baby, this implementation is carried out to prevent heat loss through the conduction process/ creep on the baby.

According to [Indrayani & Emma \(2013\)](#), newborns cannot regulate their body temperature and quickly lose heat if not prevented. One of the mechanisms of heat loss in infants is conduction through direct contact between the baby's body and objects or surfaces with a lower temperature, such as wet conditions caused by a full diaper.

6. Risk of developmental disorders

On the problem of implementation of developmental disorders, the author can provide developmental care, which includes minimizing touch (handling), adjusting pronation positions and minimizing noise; developmental care in the NICU includes positioning,



assessing and adapting sensory stimulation, kangaroo method care, non-nutritive sucking, pain control, reduction of stress factors from the environment, placement of extraordinary nurses, and family-focused care have several positive effects on neurodevelopment ([Burke, 2018](#)). Developmental care is significantly related to parental satisfaction, length of stay, care costs, and baby development ([Moody et al., 2017](#)).

7. Risk of attachment disorders

Hospitalization makes mothers and children rarely interact, as a result, will experience attachment disorders. The implementation that can be done is to facilitate families, especially mothers, during baby visiting hours. However, until the last day of treatment, the baby's mother did not come for a visit, so only the father was given implementation related to explaining the child's condition.

According to [Pineda et al \(2018\)](#), relationships are built and developed when parents are present in the NICU, hold the baby, and learn how to identify and respond to the baby's needs can increase the attachment between parents and children. Parents can also help improve the baby's ability to cope with NICU stressors and provide appropriate and meaningful sensory stimulation.

Conclusion

Based on the results of the case study, the authors conclude several things as follows: Nursing care at By. MH is accompanied by several other health problems associated with complex congenital heart disease as the main cause,

such as respiratory distress syndrome, low birth weight and neonatal sepsis. Respiratory distress syndrome cases can lead to ineffective breathing pattern nursing problems. According to SIKI, nursing care is carried out for 4 days with intervention. The nursing problem of ineffective breathing patterns has not been resolved, evidenced by shallow breathing, epigastric retraction, and patients still using ventilators with A/C PEEP mode 5cmH₂O and FiO₂ 70%.

Complex congenital heart disease cases have several nursing problems, such as decreased cardiac output, activity intolerance, risk of shock and risk of developmental disorders. For nursing problems, decreased cardiac output is partially resolved with the criteria for improved CRT results, pale skin and reduced edema. The problem of activity intolerance nursing has not been resolved because the patient has not been able to drink orally, and absorption is inadequate, with the amount of nutrition being reduced due to increased gastric residue. The nursing problem of the risk of shock is partially resolved, as evidenced by the absence of shock, while the risk of developmental disorders is partially resolved, although there is no further action for complex congenital heart disease because the patient's condition is still unstable.

The Low birth weight problem has nursing problems such as the risk of hypothermia and attachment disorders. During the provision of nursing care, showed no hypothermia in patients. Regarding the risk of attachment disorders, the authors have facilitated the baby's parents to visit.

Authors Contributions

The MDY carries out tasks from data collection, data analysis, and making discussions to making manuscripts. NF participated in the research design, data interpretation, and review of the manuscript to the author's guidelines and template. NS was involved in the review of published articles.

Conflicts of Interest

There is no conflict of interest.

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