Case Report

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Comprehensive Nursing Care in a Neonatal Asphyxia with Hypoxic Ischemic Encephalopathy and Sepsis Complications: A Case Report

Firman Sugiharto[1*], Khoirunnisa Khoirunnisa[2], Sri Hendrawati[3], Fania Putri Alya[1]

[1]Faculty of Nursing, Universitas Padjadjaran, Indonesia
[2,3]Department of Pediatrics Nursing, Faculty of Nursing, Universitas Padjadjaran, Indonesia

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Other information:
Email of Author : Firman17001@mail.unpad.ac.id

Corresponding Author:
Firman Sugiharto

Website:
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ABSTRACT

Background: Asphyxia is one of the highest causes of neonatal mortality in the world. Delayed treatment of asphyxia can have an impact on permanent organ failure and neurological disability in neonates such as cerebral palsy, hyperactivity, and epilepsy. **Aim:** This study aimed to describe nursing care for neonates with asphyxia neonatorum. **Case Description:** A boy named H (By. H), 22 day old was transferred from the neonatal intensive care unit (NICU) with a diagnosis of severe asphyxia with complications of HIE and sepsis. At the time of assessment, the level of consciousness compos mentis, general condition was weak, often restless, short of breath, there was lobed breathing, intercostal retractions, stridor, secret in the mouth, rhonchi in both lung fields. Vital signs obtained HR: 150 x/minute, RR: 50 x/minute, body temperature: 36.6^0C, SpO2: 96%. The neonatus has good nutritional status and adequate hydration status, with positive fluid balance and no signs of fluid overload. Rest and sleep status of the neonatus is enough. The patient had a history of apnea, seizures, and post cooling therapy. **Conclusion:** The interventions and implementations carried out were monitoring vital signs, monitoring signs and symptoms of hypoxia, monitoring additional breath sounds, positioning the semi-fowler $30\text{-}45^0$, changing position to prone position after breastfeeding, and nebulization with 3% NaCl 4 ml. After the intervention, the nursing problems in this case study had only been partially resolved. There is a need for further monitoring related to airway management which includes observation of vital signs and respiratory distress, continued nebulization with 4 ml of 3% NaCl, and monitor for signs of hypoxia.

Introduction

Asphyxia is one of the biggest contributors to infant mortality in the world. Asphyxia is a state of lack of blood flow or oxygen exchange just before, during, or immediately after childbirth (Gillam-Krakauer & Jr, 2021). According to World Health Organization (WHO) (2020) said that asphyxia is the third leading cause of infant death in the world in the early life period. Every year, approximately 3% (3.6 million) of the 120 million newborns experience asphyxia and nearly 1 million of these babies die (World Health Organization, 2020). Meanwhile, in Indonesia of all neonatal deaths, 5,464 people or 27% of them are caused by neonatal asphyxia (Kementrian Kesehatan Republik Indonesia, 2020). Then, based on data from Dinas Kesehatan Kota Bandung (2019) showed that asphyxia neonatorum was the second most common cause of infant mortality in Bandung, with 19 cases after low birth weight (43 cases) (Dinas Kesehatan Kota Bandung, 2019). Therefore, the neonatal mortality rate is one indicator in assessing the degree of public health so that the causative factors of asphyxia can be prevented as early as possible.

Several factors can put babies at risk for asphyxia. According to Tasew et al. (2018), parental educational status, maternal parity, antepartum bleeding, presence of meconium in amniotic fluid, infant weight, and prematurity are risk factors for infants experiencing asphyxia. In addition, according to Portiarabella et al. (2021) there are two factors that can cause asphyxia in infants, namely factors during the antepartum and intrapartum periods. Risk factors in the antepartum
period include preeclampsia, fetal growth restriction, and bleeding. Meanwhile, risk factors in the intrapartum period include prematurity, meconium aspiration syndrome, and breech presentation (Portiarabella et al., 2021). Therefore, many of these risk factors need to be optimized to improve service quality and speed in handling asphyxia (Tasew et al., 2018).

Asphyxia management quickly and appropriately is very important in reducing the impact that will arise and maintaining neonatal survival. According to Del Riesgo-Prendes et al. (2017) if health workers are slow in handling asphyxia, it can have a permanent impact on neurological disability in infants. The process of disturbance depends on the severity and duration of hypoxia and is related to the process of tissue reoxygenation after the hypoxia process takes place. (Manoe & Amir, 2016). The most serious neurological damage occurs such as cerebral palsy, epilepsy, hyperactivity and will cause disturbances in various organ functions (Del Riesgo-Prendes et al., 2017; Manoe & Amir, 2016).

One of the serious and most common complications caused by asphyxia is hypoxic-ischemic encephalopathy (HIE). HIE is a type of brain injury or damage caused by a lack of oxygen to the brain during the neonatal period (Greco et al., 2020). The incidence is about 1.5 cases by 1000 live births in developed countries. Meanwhile, in low- and middle-income countries, the incidence is much higher (10-20 by 1000 live births) (Greco et al., 2020). HIE can cause premature death or a variety of lifelong morbidities, including acute symptoms such as seizures, altered consciousness, weak breathing, poor muscle tone or metabolic disorders as well as chronic conditions such as cerebral palsy, epilepsy, intellectual disability, and behavioral disorders (Adstamongkonkul & Hess, 2017). Therefore, a multidisciplinary approach is needed to prevent the damage that has already occurred from getting worse.

Several treatments can be performed on infants who have asphyxia with HIE. Gillam-Krakauer dan Jr. (2021) hypothermia therapy is the treatment for asphyxiated infants with neonatal HIE. Based on research Abate et al. (2021) said that hypothermic therapy was shown to be effective in reducing the mortality of neonates with moderate to severe HIE. In addition, infants with respiratory disorders and pulmonary hypertension require intubation, administration of surfactant, oxygen, and inhaled nitric oxide (Gillam-Krakauer & Jr, 2021).

Management of cases of infants with HIE/asphyxia needs multidisciplinary roles, one of which is a nurse. The role of nurses in the process of caring for babies with asphyxia is

focused on ensuring the recovery of the baby's health, one of which is ensuring the patent of the baby's airway. In addition, nurses also have a fundamental role in the care of babies with asphyxia, nurses are responsible for ensuring that the care will be carried out properly and contribute to the positive development of the baby (Sanchez Couto et al., 2019). Then, assistance should also be given to parents and family members of infants who have high levels of stress and anxiety as a result of the child's hospitalization (Sanchez Couto et al., 2019). Therefore, the nursing care provided must be able to meet the physiological and psychological needs of infants and families and the nursing process must be provided with the best quality possible.

Case Presentation

A boy named H (Baby. H), 22 day old was transferred from the neonatal intensive care unit (NICU) with a diagnosis of severe asphyxia with complications of HIE and sepsis. At the time of assessment, the level of consciousness compos mentis, general condition was weak, often restless, short of breath, there was lobed breathing, intercostal retractions, stridor, secret in the mouth, rhonchi in both lung fields. Vital signs obtained HR: 150 x/minute, RR: 50 x/minute, body temperature: 36.6^{0}C, SpO2: 96%. The neonatus has good nutritional status and adequate hydration status, with positive fluid balance and no signs of fluid overload. Rest and sleep status of the neonatus is enough. The patient had a history of apnea, seizures, and post cooling therapy.

Maternal birth history was cesarean section for indications of premature rupture of membranes and a protruding umbilical cord with a gestational age of 39-40 weeks. After birth, By. H had severe asphyxia with an APGAR score of 1/3 with a saturation of 56%, so he was given positive pressure ventilation (PPV) for 20 minutes, then intubated and placed on an endotracheal tube number 3.5 with a depth of 9.5 centimeters.

Laboratory examination showed hemoglobin 14.1 g/dL (high), MCV 89 fL (low), hematocrit 38.4% (low), MCHC 36.8% (high), rod neutrophils 0% (low), Lymphocytes 51% (high), and monocytes 12% (high). This indicates that the abnormal levels of white blood cells such as stem neutrophils, lymphocytes, and monocytes indicate that the client has an infection, so in this case study the client was diagnosed with neonatal sepsis. The neonatus received therapy with meropenem 3 x 130 mg iv, amikacin 1 x 40 mg IV, and nebulization using a hypertonic solution of 3% NaCL as much as 4 ml 3 times by day.

In this case study will be discussed comprehensively on the main nursing problem in this patient, namely ineffective airway clearance.

Discussion

This case study discusses related to the main nursing problems is ineffective airway clearance in neonates with severe asphyxia with complications of HIE and sepsis.

Nursing Assessment

Based on the results of observations, the client appears to be experiencing shortness of breath and the number of respiratory rates is 51-63 times/minute. Then, this client's shortness of breath was accompanied by intercostal chest retraction, and crackles were heard throughout the lung fields. Shortness of breath is the main complaint that is often found in clients with neonatal asphyxia. This is in line with a case study conducted by Sanchez Couto et al. (2019) said that parents brought their children to the emergency department because they had shortness of breath and a slight bluish color to the client's lips. According to Seattle Children's (2022) signs in infants who experience asphyxia usually indicate shortness of breath and difficulty in breathing. Blueness of the lips is also an indication that the baby has hypoxia. Hypoxia occurs as a result of lack of blood flow or gas exchange in the body and is common in asphyxiated infants (Gillam-Krakauer & Jr, 2021). In addition, other symptoms of asphyxia neonatorum are deep breathing, decreased heart rate, decreased blood pressure, chest retractions, the child looks weak, decreased blood oxygen pressure (PaO2), increased CO2 pressure

(PaCO2), decreased pH (due to acidosis respiratory and metabolic) (Fida & Maya, 2014).

The cause of the client's shortness of breath is the increased production of mucus in the respiratory tract area. Factors that may be related to mucus production in the client are a history of intubation (Bork, 2020). This is in accordance with the historical data of this case study which showed that at birth, the client's APGAR score was 3 with poor saturation of 56% so that the client was given positive pressure ventilation (VTP) for 20 minutes and then intubated and placed an endotracheal tube number 3.5 with a depth of 9.5 centimeters. Therefore, one of the complications arising from intubation is infection due to tears in the endotracheal or other body parts. The presence of this infection can lead to an inflammatory effect and of course there can be an increase in the production of secretions in the patient (Gillam-Krakauer & Jr, 2021).

The results of this case study are in line with Gillam-Krakauer dan Jr (2021) which indicates that in this case study the client had an infection. This is evidenced by the results of the study which showed that the level of neutrophil rods was 0 (Low), lymphocytes 51% (High), and monocytes 12% (High). Therefore, it can be concluded that the sound of crackles that arise in the client is caused by an increase in mucus due to an infectious process.

Nursing Diagnosis

The main nursing diagnosis in this case study was ineffective airway clearance. In this case study, researchers used the North American Nursing Diagnosis Association (NANDA) guidelines. This is because NANDA is general which is generally used globally, not only in Indonesia. In theory, according to Nurarif and Kusuma (2016) said that babies with asphyxia can experience nursing problems related to ineffective airway clearance, impaired gas exchange, ineffective breathing patterns, impaired peripheral tissue perfusion, and the risk of body temperature imbalance. Meanwhile, in this case study, there were three main problems experienced by the client, namely ineffective airway clearance, ineffective breastfeeding patterns, and the risk of infection. This difference was caused by the condition of the patients who had HIE and sepsis.

The underlying etiology of the client experiencing problems with ineffective airway clearance is that the client has severe category of neonatal asphyxia. Factors that may cause the client to experience asphyxia occur in the intranatal phase. History of illness and childbirth, the client's mother experienced premature rupture of the membranes, the green membranes were mixed with meconium, and the umbilical cord was swollen. The presence of mixed meconium in the amniotic fluid causes the baby to have meconium aspiration syndrome (Portiarabella et al., 2021). Inhaled meconium can block the airway, interfere with surfactant function, and inhibit surfactant synthesis (Portiarabella et al., 2021). The impact of meconium aspiration syndrome on the client is an obstruction in the airway that causes the client to experience desaturation.

Nursing Intervention

The intervention given in this case study is based on *Nursing Interventions Classification* (NIC) (Bulechek, G.M., Butcher, H.K., Dochterman, J.M., & Wagner, 2016). Intervention in the form of airway management which consists of several nursing actions, namely monitoring vital signs every three hours, monitoring signs and symptoms of hypoxia, monitoring additional breath sounds, giving semi-fowler position, changing position into the prone position after drinking, and give a bronchodilator in the form of a nebulized with 3% NaCl 4 ml (Bulechek, G.M., Butcher, H.K., Dochterman, J.M., & Wagner, 2016; Gupta et al., 2016b). The rationale for using an airway management intervention is to identify and ensure the patient's airway is patent so that this will improve respiratory status and maximize gas exchange in the lungs (Bulechek, G.M., Butcher, H.K., Dochterman, J.M., & Wagner, 2016; Damanik et al., 2021).

Giving inhalation therapy has a good effectiveness to be given to children with airway clearance problems (Gupta et al., 2016a). This therapy is a way of giving medicine in the form

of steam which goes directly to the respiratory tract from the nose to the lungs using a device called a nebulizer. This inhalation therapy aims to widen the bronchial lumen and provide a bronchodilation effect so that phlegm or secretions in infants who are not able to cough effectively become watery so that they are easy to expel and reduce bronchial hyperactivity and can overcome infection (Astuti et al., 2019). In this case study, nebulization was carried out only with 4 ml of 3% NaCl and no bronchodilator drugs were added. Nebulization therapy in this case study was carried out for 15-20 minutes until the NaCl liquid was almost exhausted. During this therapy, the baby is positioned to maximize ventilation and therapy. This research study is in line with the research of Damanik et al., (2021) said that the main intervention for ineffective airway clearance problems given in cases of asphyxia is airway management. Interventions include observing breathing patterns, depth frequency, respiratory effort, additional breath sounds, giving semi-Fowler's position and giving oxygen as needed (Damanik et al., 2021).

Nursing Implementation

Based on the case, it is known that the implementation has been in accordance with the prepared plans/interventions. Researchers try as much as possible to carry out nursing actions so that the expected goals are achieved.

The first implementation given in this case study is to position the client into a semi fowler. Semi-Fowler's position is a position by elevating the head 30-45^0, this position is usually given to patients who experience shortness of breath (Chanif & Prastika, 2019). In the semi-Fowler's position, the earth's gravity will pull the diaphragm down so that it can reduce oxygen consumption and maximize lung expansion. The diaphragm muscle which is located in the 45^0 position will allow the muscle to contract by increasing the volume of the chest cavity. An enlarged chest cavity will make the pressure on the chest cavity expand and force the lungs to also expand (Chanif & Prastika, 2019).

The second and third implementations are observing and monitoring vital signs and signs of hypoxia. The purpose of these actions is to determine the hemodynamic status and peripheral circulation status of the client. Increased respiration, blood pressure, and heart rate often occur in severely asphyxiated patients with hypoxia (Manoe & Amir, 2016). In addition, monitoring for signs of hypoxia should also always be considered, such as symptoms of respiratory distress, capillary refill time, cyanosis, and coldness. The presence of signs of hypoxia must be treated immediately because hypoxia and ischemia that occur due to aphixia will cause disturbances in various organ functions (Manoe & Amir, 2016). Thus, monitoring of vital signs and signs of hypoxia in this case study was carried out every 3 hours. This is done as an effort to prevent and reduce the risk of impacts that will arise as a result of prolonged hypoxia.

The fourth and fifth implementation is nebulizing with 3% NaCl 4 ml and positioning the head head up and positioning the semi fowler when nebulizing. The purpose of nebulization is to dilate the respiratory tract (bronchi), dilute, and facilitate the discharge of secretions so that the status of oxygen demand can return to adequate. The air inhaled through the nebulizer is moist, which can help expel bronchial secretions. Then, during nebulization therapy the client's head is positioned head up and in a semi-Fowler's position. According to Chanif dan Prastika (2019) when undergoing nebulization therapy, the client can position in fowler's or semi-fowler's position, the fowler's position will relieve pressure on the diaphragm which allows greater volume exchange so as to smooth the airway and inhale the drug that will enter maximally (Chanif & Prastika, 2019). As for the semi-fowler's position, the earth's gravitational force will be withdrawn so that the lungs are free to exhale and inhaled drugs can enter the respiratory tract to the maximum.

In this case study, nebulization therapy used hypertonic saline solution, namely 4 ml of 3% NaCl. Nebulization with hypertonic saline is useful in making secretions less viscous and increasing their excretion, resulting in clinical improvement (Gupta et al., 2016b). In addition, Gupta et al., (2016) also concluded that

nebulization with 3% hypertonic saline (without additional bronchodilators) is an effective and safe treatment for non-asthmatic and moderately ill acute bronchiolitis patients. This significantly reduced clinical improvement scores and length of hospital stay compared with 0.9% saline and salbutamol in 0.9% saline. Then, supported by research Zhang et al., (2013) and Wang et al., (2019) suggested that nebulization with hypertonic fluids resulted in a shorter duration of hospitalization and better clinical severity scores, and that no side effects were associated.

After nebulization, the last implementation is auscultation of additional breath sounds before and according to nebulization. The purpose of this action is to evaluate the given nebulized therapy. Evaluation is intended to determine the effectiveness of the nebulization therapy given by looking at the client's response after being given therapy (Wang et al., 2019).

Nursing Evaluation

In this case study, the evaluation was carried out after several days of implementation. On the first day, the client still looks breathless but has reduced, rhonchi improved after nebulization, reduced stridor sound, occasional mild chest retractions, respiration rate 46-50 times per minute with oxygen saturation 96-97%. Then, on the last day the client's shortness of breath was reduced, there was flaring of the nose but occasionally, there were still crackles throughout the lung fields, often restless, respiration rate 50-53 x/minute with oxygen saturation 95-100%. Baron and El-Chaar (2016) stated that 120 minutes after nebulization using hypertonic saline there was no improvement in the sound of crackles but could increase oxygen saturation (Baron & El-Chaar, 2016). Meanwhile, in research Florin et al., (2014) said that the use of 3% hypertonic saline in the nebulization process resulted in an improvement in respiratory distress 1 hour after the intervention, as measured by the RACS including an increase in oxygen saturation and an improvement in rhonchi or wheezing. However, it is possible that rales reappear 8-12 hours after the intervention (Baron & El-Chaar, 2016).

The most significant difference in response on the first and last day can be assessed by the addition of breath sounds. On the first day, after the intervention, the rales were better. However, on the second day the rhonchi reappeared and the intervention still did not provide improvement according to the criteria. It can be concluded that the problem of airway clearance in this case study has not been fully resolved. Therefore, based on the evaluation results that have been obtained, it is necessary to continue airway management interventions, namely to perform and observe vital signs and respiratory distress, continue nebulization with 4 ml of 3% NaCl, position the patient in semi fowler or fowler position, and evaluate additional breath sounds.

Conclusion

Nursing problems that often arise in infants with asphyxia is ineffective airway clearance. The intervention given can be in the form of clearing secretions in the respiratory tract. This treatment is very important because it will improve the baby's breathing pattern. In addition, monitors monitor of vital sign every three hours, monitor signs and symptoms of hypoxia, monitor additional breath sounds, give a semi-fowler position 30-45^0, change position to the prone position after breastfed, and give nebulization with 4 ml of 3% NaCl is a very important intervention to free the client's airway. The evaluation for the problem of airway clearance related to airway hypersecretion in this case study has not been fully resolved, meaning that the problem in this case study is only partially resolved. Nurses are expected to implement airway management interventions in patients with asphyxia with complications of HIE and neonatal sepsis.

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Conflicts of Interest

The authors declare no conflict of interest.

Statement of Ethics

Written informed consent has been obtained from the patients to publish this paper.

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