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CASE REPORT

Neonatal Resuscitation in Primary Health Care Facilities

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ABSTRACT

Background : Neonatal resuscitation is an action that must be done in the first minute when a newborn with severe asphyxia is born.

Case Illustration : The case was infant whom born spontaneously from 41 years old woman, G7P6A0 in primary health care facilities at Kokoda Utara District, with a condition did not cry or breathe, the skin color was bluish, there was no muscle tone, APGAR score was 0. Infant did not show any response, so we gave positive pressure ventilation using a bagging mask and chest compression with compression techniques by using both thumbs and other fingers around the chest supporting from the back, with a ratio of 3 compressions per 1 breath. After 60 minutes of resuscitation, the baby can cry loudly and the APGAR score is 10, heart rate was 140 beats per minute, breathing is 35 times per minute, SpO2 98%, blood glucose is 46 mg/Dl, body weight 2300 grams, body length 40 cm, head circumference 33 cm, chest circumference 32 cm, which indicates that the baby is no longer in asphyxia.

Conclusion : Rapid initial assessment of the newborn and appropriate implementation of neonatal resuscitation determines success and reduces mortality.

Keywords: Neonatal; Resuscitation; Asphyxia

INTRODUCTION

A few newborn are not capable of having good neonatal adaptation after birth, they tend to require special treatment with stabilization or resuscitation. From the previous study, 85% of newborns were able to breathe spontaneously without any int ervention, about 10% of newborns were able to respond after being given initial measures through warming, providing stimulation and performing airway clearance. In addition, PPV (Positive Pressure Ventilation) assistance was provided in about 5% of newborns. 0.4% and 2 percent of newborns received rescue breaths using intubation. Moreover, chest compressions were administered in 0.3% newborns, and 0.05%, newborns received medication. [1-3]

Studies indicated that the risk of death has increased by 16% for every 30 seconds of delay in initiating ventilation for up to 6 minutes, and increased by 6% for every 1 minute of delay. Ventilation should be provided immediately in the first minute after birth to reduce neonatal mortality. There should be a minimum of 1 person who is proficient in resuscitation of newborns in every delivery process. Rapid assessment of gestational time, respiration/crying, and muscle tone are highly needed in identifying infants requiring resuscitation. Resuscitation is frequently required in newborns with indications of fetal distress[2]. Rapid and appropriate neonatal resuscitation procedures can reduce neonatal mortality by approximately 30% [2,3].

Resuscitation neonatus in primary health facilities which is in very remote areas with many limited tools and medicines, should still be carried out to help reduce morbidity and mortality in cases of cardiac arrest and respiratory arrest in neonates**.**

CASE ILLUSTRATION

A 41-year-old woman with the initials E, G7P6A0 attended to the primary health care facilities, Kokoda Utara District on July 01, 2020, at 21.00 WITA with complaints of consistent abdominal pain and leaking of fluid from the birth canal since 30 minutes before, with no internal examination or Vaginal Touche (VT) due to the family refused. In this pregnancy, the patient was recorded to have had an Antenatal Care (ANC) pregnancy examination at the

Health Center of 2 times. Moreover, the patient had a previous delivery at home, assisted by the patient's husband and family.

At 23.00 WITA, the infant of Mrs. E, P7A0, was born spontaneously. The delivery was led by a general practitioner and assisted by 3 nurses. The gestational age was considered to be more than the expected date, amniotic fluid was found to be green and thick, there were 2 twists of the umbilical cord around the infant's neck. After birth, the doctor immediately assessed the infant's condition. In addition, the infant did not cry or breathe, the skin color was bluish, there was no muscle tone, the infant's umbilical cord was cut and the infant was moved to the same place as the mother and immediately wrapped in cloth for further treatment. Within 60 seconds after the APGAR score was assessed, and the result was found to be 0. Consequently, the first step was immediately taken, specifically warming the infant using a cloth, positioning the infant and cleaning the airway using manual suction by the nurse, then drying the infant while being stimulated on the feet. However, the infant did not show any response, so the nurse gave positive pressure ventilation using a bagging mask. Moreover, there was no infant heart rate, and chest expansion had not been found to be adequate. Therefore, chest compressions were performed by doctors with compression techniques using both thumbs and other fingers around the chest supporting from the back, with a ratio of 3 compressions per 1 breath.

At 5 to 25 minutes after birth, the APGAR score of 2 was obtained, and the infant's skin had started to turn red at 30 minutes, heart rate < 100 beats/minute, minimum stimulus was found, infant respiration is 6 time per minutes, it was weak and irregular, SpO2 88%, muscle tone was found with the APGAR score of 6. Moreover, when chest compressions and ventilation were stopped, the infant's APGAR score returned to 0, thus chest compressions and ventilation were administered again in a ratio of 3:1, until the 60^{th} minute after the infant was be able to cry loudly, breathing was found to be good, heart rate > 100 beats per minute, flexion muscle tone was good, the infant's skin color was pink and the APGAR score is 10.

The infant body's weight 2300 gram, body length 40 cm, head circumference 33 cm and chest circumference 32 cm, temperature 36.7°C, heart rate 140 beats per minute SpO2 98%, blood glucose is 46mg/Dl, respiration 35 times per minute. the infant has been wrapped in cloth and placed in mother's arm due to keep the infant warm as mother temperature. They were hospitalized for a night and allowed to recovery at home after that.

Moreover, after observation for 1 hour the infant could be breastfed properly and the suction was strong, and the result is SpO2 99%, temperature 36.7°C, heart rate 142 beats per minute, respiration about 36 times per minute. In addition, the infant was able to defecate and urinate and was within normal limits.

DISCUSSION

Neonatal resuscitation is essential, and should be performed within the first 60 seconds after birth. Resuscitation with the correct technique is very important for the prevention and management of the incidence of meconium aspiration syndrome so as to improve the quality of neonatal resuscitation. Delay in initiating resuscitation is capable of exacerbating hypoxia, leading to increased morbidity and mortality in neonates[1,3,4].

According to Weldearegay's study conducted at all health facilities in Ethiopia regarding the quality of neonatal resuscitation in Ethiopia, about two thirds (n = 364, 65.6%) of asphyxiated infants were resuscitated using bag and mask, and 9 (1.6%) infants were resuscitated with stimulation only. The results indicated that most of the neonates (n= 463,83.4%) were born safely[4].

In this case, fetal distress and neonatal asphyxia as manifestation of green amniotic fluid. That was impact to delivery and APGAR score of 0. The infant had no heart rate, no breathing, weak muscle tone, no response to reflexes, and had the bluish and pale skin. Limited equipment and distance of access to health centers in very remote areas, so that they were constrained by some medical equipment that was not available, such as the incomplete preparation of parturition kits, the unavailability of easier suction devices to use so that suctioning to open the infant's airway can be even better. In addition, emergency drugs such as epinephrine

cannot be found with ease. Infant radiant warmers and more adequate patient beds were also not available.

APGAR score is method for assess general condition of new born, 30 seconds after birth that could determine asphyxia or non asphyxia. The calculated APGAR score can be used to differentiate between infants requiring immediate resuscitation or infants requiring routine care only. There are 5 assessment parameters on the APGAR score that can be assessed during the first minute of birth and 5 minutes after, further assessment can be done at 5 or 10 minute intervals if a low APGAR score is found.

Parameters that can be assessed are heart rate, respiratory effort, muscle tone, skin color, and reaction to stimuli. The parameters that are used as a reference for assessing the condition of the infant at birth are shown in table 1 and table 2 is the interpretation of the APGAR Score result[4].

Table 1. APGAR Score Criteria[4]

	Score of 0	Score of 1	Score of 2	Acronym
Skin Color	The whole body is blue and pale	The skin color of the body is normal and pink, but the color of the hands and feet is bluish.	The skin color of the body and legs is normal and pink, and no cyanosis is found	Appearance
Heart Rate	None	< 100 times or minutes	>100 times or minutes	Pulse
Reflex Response	There is not any respond to stimulation	Grimace or cry weakly when stimulated	Grimace or sneece or cough when the airway stimulation is carried out	Grimace
Muscle Tone	Weak or non-existent	Slightly move	Actively move	Activity
Respiration	None	Weak or irregular	Cry loudly, and the respiration is good and regular	Respiration

Table 2. Interpretation of APGAR Score Results[4]

Score	Interpretation	Notes
7 – 10	Good Adjustment	
4 – 6	Mild Asphyxia	Rarely needs resuscitation, airway clearance: suction, dry immediately, ventilate until stable, careful observation
0 – 3	Severe Asphyxia	Intensive resuscitation: CPR, intubation, ventilate with 100% O2, maintain body temperature, parental support

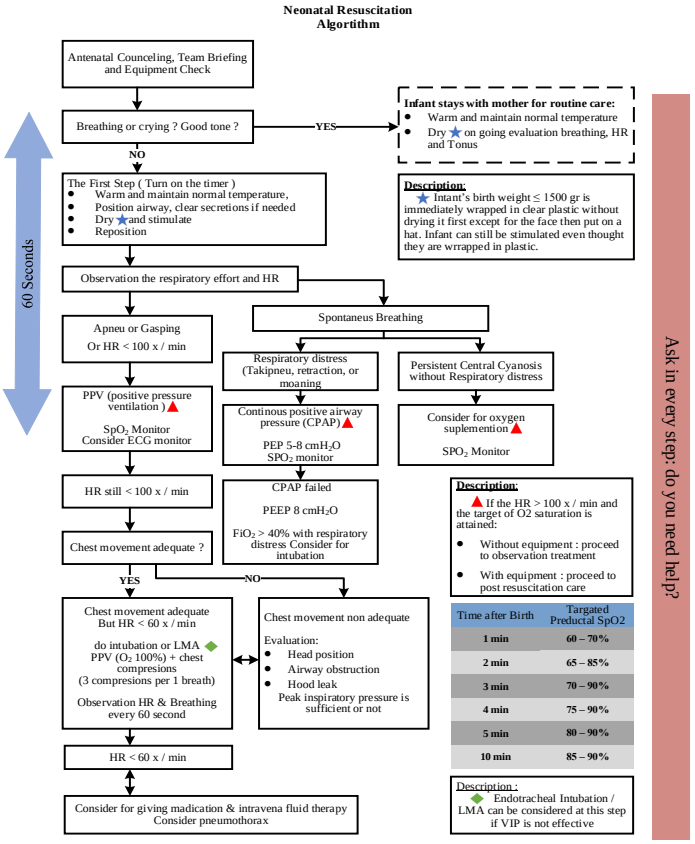

Figure 1. Neonatal Resuscitation Algorithm of IDAI (Indonesian Pediatrician Association) of 2015[5]

The initial stabilization step should be performed to keep the infant warm by placing the infant under a radiant warmer. However, due to the unavailability of the bed and radiant infant warmer, the infant was still placed in 1 bed with the infant's mother, the infant was only given a warm cloth. Airway cleaning was done using manual suction, specifically a hose that was manually suctioned, and suction administered through the mouth by a rescuer, thus it was very difficult to clear the airway, which was still covered by amniotic fluid and meconium. The steps that should be carried out according to the neonatal resuscitation algorithm of IDAI 2015 in figure 1, the pathway are described as follows:

As stated in Neonatal Resuscitation Algorithm

First step Initial stabilization steps. Keeping the newborn warm by placing the infant under a warmer to maintain a normal temperature, Opening the airway with a sniffing position and clearing the airway using a suction bulb syringe or suction catheter, Drying the infant with a cloth, Stimulating the infant to breathing[1].

Temperature control in newborns needs to be done to obtain normothermia to prevent iatrogenic hyperthermia. Preterm infants with very low birth weight (less than 1500 g) are likely to be hypothermic even though usual heat loss prevention techniques have been administered, particularly using warmed linen, drying the infant, placing the infant directly on the mother's skin, and covering the infant. Some additional recommended techniques are warming the delivery room before the infant is born (26°C); covering the infant with heat-resistant plastic (polyethylene); Placing the infant on an exothermic mat; Placing the infant under radiant warmer.

The newborn's temperature should be monitored consistently, because the combination of these warming techniques is able to increase the risk of hyperthermia. All resuscitation procedures, including endotracheal intubation, chest compressions, and intravenous cannulation can be performed simultaneously with this temperature control intervention[6].

Second step clearing the Airway. Suctioning is performed immediately after delivery of the infant by utilizing a

bulb syringe or suction catheter if airway obstruction is found or positive pressure ventilation is required when the amniotic fluid is clear. This avoids unnecessary suctioning and helps prevent bradycardia caused by suctioning in the nasopharynx. Amniotic fluid mixed with meconium indicates fetal distress, which will increase the risk of the infant requiring resuscitation after birth. If the infant is found to have good respiratory effort, good muscle tone, the infant can be close to the mother for initial steps. Clearance of meconium from the mouth and nose with a bulb syringe can be performed if necessary.

If the infant is born with amnion mixed with meconium with poor muscle tone, inadequate respiration, the initial steps of resuscitation should be performed under warm-up. Furthermore, PPV should be performed if the infant is not breathing or the heart rate is less than 100 beats/minute after the initial steps are completed.

Use of pulse oximetry during resuscitation while administering PPV is highly recommended to assess oxygen demand and heart rate without impeding resuscitation. However, in this case, no pulse oximetry device was available, so the device was not installed[1,4,6].

Third step Providing Positive Pressure Ventilation (PPV). PPV should be provided for newborns with respiratory arrest or gasping for breath or when the heart rate is less than 100 beats per minute after the initial steps are performed. Inflated early breaths after birth, either spontaneous or assisted, are capable of producing functional residual capacity. Animal studies have widely shown that premature lungs are susceptible to injury if large volumes of inflation are administered immediately after birth. Assisted ventilation of 40-60 breaths per minute has been widely practiced, but data on its efficacy at various respiratory rates have not been available[1,4,6].

The primary measure of adequate initial ventilation is related to a rapid increase in heart rate. Chest wall movement will be assessed if the heart rate is not increasing. The inflation pressure required varies unpredictably and is highly individualized to achieve an increase in heart rate or chest wall movement with each breath. Inflation pressure should be monitored, an initial

inflation pressure of 20 cmH2O may be effective, but 30-40 cmH2O may be required in some apneic term infants[3].

If monitoring of inflation pressure is not feasible, then the minimum inflation needed to achieve an increase in heart rate can be given. Sufficient research evidence for the optimal time to carry out inflation has not been much found. Consequently, assisted ventilation could be performed at 40–60 beats per minute to achieve or maintain a heart rate > 100 beats/min in preterm or term infants who have apnea. PPV for preterm infants is highly recommended to be performed using Positive End Expiratory Pressure (PEEP) of 5cm H2O[1,6].

Ventilation aids can be most effectively administered with a flow inflating or self-inflating bag or T-piece resuscitator. A device that can only be used when a pressurized gas source is not available is a self-inflating bag, but this device is not able to provide Continuous Positive Airway Pressure (CPAP) and also cannot provide PEEP during PPV. In terms of ease of use, the T-piece resuscitator can consistently deliver inflationary pressure and provide a longer inspiratory time in mechanical mode[1,6].

The ventilation that should be administered in neonates with a birth weight of more than 2000 grams or born at gestational age ≥ 34 weeks which is considered to be effective for laryngeal entry is the Laryngeal Mask airway (LMA). The number of data supporting the use of the LMA in small preterm neonates is likely to be the least, such as birth weight less than 2000 grams or gestational age less than 34 weeks. The LMA may be considered as an alternative to tracheal intubation if facemask ventilation has not been successfully utilized for effective ventilation. There has been no evaluation of the use of the LMA during chest compressions in an emergency. Endotracheal intubation is used when bag-mask ventilation is ineffective. The intubation is performed by performing chest compressions, and is also used for specific conditions such as congenital diaphragmatic hernia[1].

The best indicator for assessing the success of endotracheal intubation with successful inflation and aeration in the lungs is an increase in heart rate. CPAP can be used to reduce the need for

intubation in the delivery room. Moreover, it is also capable of decreasing the duration of mechanical ventilation by decreasing the incidence of bronchopulmonary dysplasia. CPAP can be given to spontaneously breathing preterm infants with fetal distress[1].

Furthermore, rescue breathing can also be performed using bag and mask ventilation only.

Fourth step Chest Compression. Chest compressions are only performed in 0.03% of deliveries. Chest compressions should be performed if the heart rate is less than 60 per minute despite adequate ventilation with supplemental oxygen for 30 seconds or if breathing is inadequate after adequate ventilation (with tracheal intubation). Chest compressions are performed on the lower third of the sternum to a depth of one third of the anteroposterior diameter of the chest wall. There are two techniques for performing chest compressions. The first technique, compression with the other two thumbs and fingers around the chest supporting from the back. The technique is shown in the figure 2. Second technique, compression with two fingers while the other hand supports from the back. The technique is shown in the figure 3.

Compression with the thumbs and other finger wrapped around is preferred because it produces a higher systolic pressure and coronary perfusion pressure and does not tire the rescuer quickly [1,4].

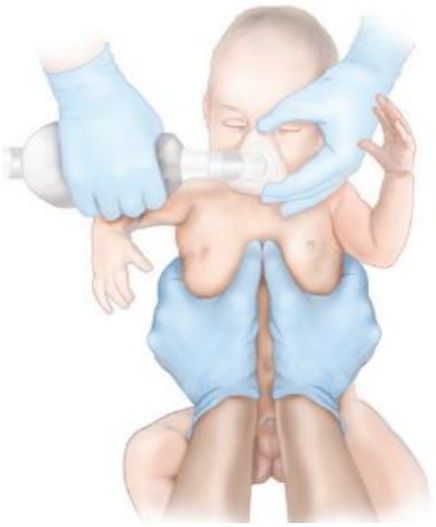

Figure 2. Chest compression with both thumbs and other fingers wrapped around [6]

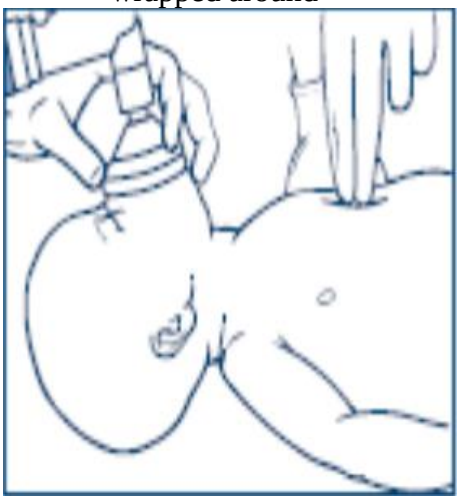

Figure 3. Chest compression with two fingers [6]

In this case report, chest compressions were carried out using the thumb and other finger techniques around the chest supporting from the back by giving positive pressure ventilation using a bag and mask, which was carried out until the 30th minute, where the infant seemed to be starting to blush, the heart rate was less than 100 times per minute, the stimulus energy was minimum, respiration was weak, irregular and the limb muscle tone was slightly flexed with an APGAR score of 6. Consequently, there was an increase in the change in the infant's condition to mild asphyxia. Moreover, when assisted chest compressions and ventilation were stopped, and the infant's APGAR score returned to 0, the chest compressions and ventilation should be re-administered in a ratio of 3: 1. Compressions were then continued until the 60th minute, with a infant's heart rate > 100 beats per minute, good cry breathing, good flexion muscle tone, loud crying reflex, pink skin color all over the body with an APGAR score of 10. Moreover, resuscitation was successful at 60 minutes.

Compression and ventilation should be well coordinated. The compression time required is slightly shorter than the release time, particularly to increase blood flow in the preterm newborn. The chest wall should be able to fully expand during relaxation, but the rescuer's thumb should remain pressed against the chest wall. To achieve 120 compressions and ventilations per minute, a compression ratio of 3 to 1 ventilation was performed, with 90 compressions and 30 ventilations to maximize ventilation. In addition, a compression and ventilation ratio of 3 to 1 are highly recommended if the cause is compromised ventilation, but if the cause is cardiac, a compression and ventilation ratio of 15 to 2 is used. Reassessment of respiration, heart rate, and oxygenation should be performed periodically, along with the coordination of compressions and ventilations that are continued until the spontaneous heart rate is 60 beats per minute. Frequent interruptions of compressions should be avoided because they impair systemic perfusion and coronary blood flow[1,4].

Drug use is rarely required during neonatal resuscitation. Neonatal bradycardia is usually caused by inadequate lung expansion or severe

hypoxemia, and adequate ventilation is the most important step in treating it, because many neonates requiring resuscitation respond well to adequate ventilation. However, various emergency medicines should still be available in the delivery room. If the heart rate remains less than 60 beats per minute despite adequate ventilation (by ET intubation) with 100% oxygen and chest compressions, the use of epinephrine may be re-considered[1,3]. In this case, no epinephrine or intravenous fluids were given due to the unavailability of drugs and equipment at the North Kokoda Health Center.

Administration of drugs through intravenous (through the umbilical vein) is highly recommended at a dose of 0.01 - 0.03 mg/kgBW. If difficult intravenous access is found, administration via an endotracheal tube is considered. Despite the safety and efficacy have not been widely studied, the dose required is greater than the intravenous route, i.e. 0.05 – 1 mg/kgBW. Animal and pediatric studies of larger-than-recommended doses of epinephrine have shown excessive elevation of blood pressure, myocardial depression, and decreased neurologic function. Furthermore, epinephrine concentrations for both routes of administration are 1:10.000 (0.1 mg/mL)[1,4,6].

Fluids should be administered to the infant if the cause of blood loss is known or suspected (pale skin, poor perfusion, weak pulse) and the infant's heart rate does not respond to resuscitation. Isotonic crystalloid fluid or blood is recommended in the delivery room at a recommended dose of 10 ml/kg body weight, which can be repeated. In resuscitation of premature infants, repeated fluid administration should be avoided, because rapid infusion of large volumes is associated with intraventricular hemorrhage[6].

Post-resuscitation care for newborns requiring resuscitation is at risk of worsening after vital signs return to normal. Adequate circulation and ventilation should be maintained, and the infant should be transferred to the intensive care unit. In this case, the intensive care room was not available when the infant was in a stable condition, and based on regular pulse checks, it was found that the heart rate was 120 beats per minute and breathing was good at 35

breaths per minute. Thus, the infant was immediately given to the mother's arms so that the infant remained in warm conditions[6]. According to the European Resuscitation Council, resuscitation can be delayed or discontinued if an APGAR score of 0 at 10 minutes becomes a strong predictor of mortality and morbidity in preterm and term infants. Referring to that matter, if the APGAR score constant in 0, and the heart rate is not detected, the resuscitation can be stopped[1]. In this case, resuscitation keep going up to 60 minutes until the infants giving respond. The output of the infants resuscitation APGAR score 10. Infant crying with heart rate >100 times per minute, good crying breath, good flexion muscle tone, and loud cry reflex whole body pink.

CONCLUSION

Rapid initial assessment of the newborn and appropriate implementation of neonatal resuscitation determines success and reduces mortality. Moreover, every health facility in every remote area is highly expected to provide adequate tools and the presence of trained medical personnel who can assist in any delivery assistance.

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