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Factors Contributing to Neonatal Asphyxia

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ABSTRACT

Background: Neonatal asphyxia is the failure of spontaneous breathing, and in some cases, an APGAR score of <7 is observed in the first minute. According to the WHO, asphyxia is one of the leading causes of neonatal death. ***Objective:*** To identify the factors that cause asphyxia in newborns based on previous studies. ***Methods:*** For the literature review, we gathered a range of journals from PubMed, ScienceDirect, and Google Scholar. The research involved reviewing literature by using keywords like "neonatal asphyxia, "APGAR score" and "low APGAR score" with 30 articles. ***Results:*** Factors contributing to asphyxia (Apgar score <7) in newborns include maternal factors, fetal factors, delivery factors, and external factors.

Keywords: asphyxia neonatal; low APGAR score.

INTRODUCTION

Newborn asphyxia (neonatal asphyxia) is a condition where there is a lack of oxygen entering the respiratory tract so the newborn experiences spontaneous respiratory failure [1]. According to global data from the WHO in 2022, 2.3 million neonates died due to prematurity, pregnancy complications such as asphyxia and trauma, infections, and congenital anomalies [2]. The APGAR score is the gold standard for evaluating the clinical condition and determining the need for resuscitation in newborns. The APGAR evaluation includes appearance (skin color), pulse (heart rate), grimace (reflex response), activity (muscle tone), and respiration (breathing) [3]. An APGAR score of <7 indicates asphyxia [4].

METHODS

For the literature review, we collected various journals from PubMed, ScienceDirect, and Google Scholar. The research was conducted by searching for literature using keywords such as "neonatal asphyxia", "APGAR score", and "low APGAR score." The thematic search terms used included "causes of asphyxia in neonates" and "factors influencing the decrease in APGAR scores".

RESULTS AND DISCUSSION

Meconium-Stained Amniotic Fluid (MSAF)

Meconium-stained amniotic fluid (MSAF) is caused by the breakdown products of heme from the fetus's meconium, bleeding within the amniotic sac, or both. [5].

The frequency of green amniotic fluid increases with the gestational age, reflecting the maturation of the fetal digestive system. In post-term pregnancies, the incidence of MSAF occurs in about 27% of cases [5]. One of the negative effects on neonates related to meconium-stained amniotic fluid (MSAF) is a low Apgar score [5].

Newborns born to mothers with MSAF are prone to aspirating meconium, which can obstruct the airways and alveoli, this leads to airway blockage and limited lung movement, as a result, with suboptimal gas exchange, birth asphyxia, indicated by a low Apgar score, may occur [6]. Meconium-stained amniotic fluid is significantly associated with a 3.07 times higher likelihood of a low Apgar score [6]. A study in Sub-Saharan Africa states that MSAF is a variable that significantly impacts the condition of neonatal asphyxia [7]. A study in Northwest Ethiopia found that babies born with a history of MSAF are 4.25 times more likely to experience asphyxia [8]. Another study also found that the condition of MSAF is correlated with the occurrence of neonatal asphyxia [9], [10], [11], [12], [13], [14].

Low Birth Weight

Low birth weight, refers to an infant weighing less than 2500g (5 lbs., 8 oz.) at birth [15]. Low birth weight can lead to a low APGAR score, likely due to the extreme immaturity of the organ and nervous systems, which makes the newborn baby struggle to adapt to the new environment [16].

In addition, many cases of low birth weight occur in preterm infants who do not have adequate surfactant, making it difficult for them to breathe and ultimately leading to asphyxia [8]. Statistically, a decrease in Apgar scores is significantly correlated with low birth weight and can occur in both female and male infants [17]. Neonates with low birth weight are 8.17 times more likely to have a low Apgar score compared to neonates with normal birth weight [6]. A study conducted in Southern Ethiopia presented data showing that neonates with low birth weight are 3.2 times more likely to have a low Apgar score compared to neonates with normal birth weight [18]. According to a systematic review and meta-analysis conducted in Sub-Saharan Africa, the risk of asphyxia is 2.58 times higher in neonates with low birth weight [7]. Another study mentioned that low birth weight is a determining factor in the occurrence of asphyxia at birth [11], [19].

Fetal Malpresentation

Fetal malpresentation refers to the part of the baby that is closest to the upper pelvic inlet, which is not the anterior occiput position relative to the mother's pelvis. Instead, it involves abnormal cephalic presentations such as those with non-flexed vertex positions, longitudinal presentations (face, brow, or breech), and oblique presentations (shoulder, arm, or placenta) [20]. Detection of fetal position, fetal presentation, and estimated fetal weight can be performed using Leopold's maneuvers during pregnancy to determine the appropriate course of action [21]. The most common fetal presentation is breech presentation [21]. In a face presentation, the fetal head has more difficulty entering the mother's pelvic inlet, which results in a longer labor duration, this can cause swelling of the skull, face, and airway, leading to respiratory distress [22]. There is another theory that suggests fetal malpresentation increases the risk of umbilical cord compression, which can lead to asphyxia in the newborn [23]. Fetuses with malpresentation have a 5.6 times higher risk of experiencing asphyxia compared to babies with a normal/vertex presentation [11]. Other studies have also suggested that statistically, fetal malpresentation is significantly associated with low APGAR scores or asphyxia [17] [8], [24], [14].

Prolonged Labor

Prolonged labor (dystocia) is a condition where the mother experiences a labor process that lasts longer than the normal duration. This can be observed clinically, such as cervical dilation of less than 1 cm per hour [25]. Mothers who experience prolonged labor (>12 hours) have a 2.69 times higher risk of delivering a newborn with asphyxia compared to mothers without prolonged labor [8]. Other studies have shown that babies born after prolonged labor have a 2.78 times higher risk of experiencing asphyxia compared to babies born without prolonged labor [9]. Prolonged labor has a significant correlation with the occurrence of newborn asphyxia [26], [11].

Instrumental Labor

Instrumental delivery is the process of childbirth that involves the use of external tools, typically forceps or a vacuum (ventouse) [27]. Neonates delivered by instrumental methods had a 6 times increased risk of birth asphyxia compared to those born through spontaneous vaginal delivery [14]. A potential explanation for this is that instrumental deliveries are typically carried out in cases of prolonged obstructed labor or abnormal fetal heart rates, where the newborn may not receive sufficient oxygen [14]. Furthermore, instrumental vaginal delivery may cause cranial bleeding, such as cephalohematoma or hemorrhage, which could eventually lead to birth asphyxia [14]. A cesarean section is carried out during the second stage of labor without prior attempt at an instrumental vaginal delivery [28].

Induced Labor

Induced labor is a procedure that involves the administration of hormones or medications to stimulate uterine contractions and accelerate labor [29]. Neonates delivered through induced labor were 3.6 times more likely to experience asphyxia than those born via spontaneous labor [9]. There is a theory that explains that medication-induced labor can increase uterine contractions, leading to changes in the fetal heart rate. When contractions are too strong, the placenta struggles to distribute oxygenated blood to the fetus, causing the newborn to experience asphyxia [11]. Induced labor is associated with the birth of a baby in a state of asphyxia [24].

Type of Labor

Newborns born to mothers who underwent an emergency cesarean section were about 2.17 times more likely to have a low Apgar score than those delivered by mothers who had an elective cesarean section [6]. A statistically significant correlation was found between the type of delivery and the likelihood of a low Apgar score at birth [26], This could be due to most mothers experiencing complications, or the decision to perform a cesarean section being delayed until after complications arise [30].

Others Factors

In addition to the factors previously explained, many studies have identified other factors that can trigger low Apgar scores or asphyxia in newborns, including gestational age [17], [7], [8], [11]; cord prolapsed [17], [14], [19]; maternal hypertension [6], [11]; preeclampsia [10], [11], [13]; antepartum hemorrhage [6], [26], [10], [11]; type of anesthesia [6], [18]; membrane status [26], [10], [11], [12]; fetal distress [8], [14], [10]; maternal anemia [24], [14]; maternal age [24]; and infections [24].

CONCLUSIONS

The conclusion drawn from previous studies regarding the factors contributing to asphyxia (Apgar score <7) in newborns includes maternal factors, fetal factors, delivery factors, and external factors (such as equipment, medications, and infections).

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