

The Role of Mode of Delivery on Neonatal APGAR Scores: A Literature Review

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ABSTRACT

After the delivery of a newborn, a comprehensive initial assessment is immediately conducted to evaluate the infant's overall health status. This critical initial evaluation serves as the foundational step in identifying any pressing medical issues, determining the need for urgent medical interventions, and closely monitoring the newborn's adaptation to extrauterine life. APGAR Score is a standardized test performed on a newborn baby after birth to assess the clinical status. APGAR Score assessment uses a rapid method and also requires intervention for resuscitation. In addition to the immediate post-birth assessment, there are several key factors that contribute to the APGAR score outcome, which serves as an indicator of the newborn's immediate health and physiological status at birth. These factors include the mode of delivery. Whether the birth is vaginal or cesarean can have a profound impact on neonatal outcomes. This literature review will explore the relationship between the mode of delivery and APGAR scores, providing valuable insights for healthcare providers to optimize newborn care and decision-making.

Keywords: APGAR score; mode of delivery; newborn; evaluation.

INTRODUCTION

The birth of a newborn initiates a crucial period where immediate assessment is essential to gauge their overall health and well-being. This initial evaluation is the cornerstone of identifying potential medical concerns, determining the necessity of interventions, and monitoring the newborn's transition to life outside the womb. The APGAR score, a standardized test immediately after birth, provides a rapid assessment of the newborn's clinical status and guides resuscitation efforts if needed. Several factors can influence the APGAR score, such as gestational age, type of drugs, and anesthesia given. Among the factors influencing APGAR scores, and thus reflecting the newborn's immediate health and physiological condition, the mode of delivery stands out as particularly significant.

The mode of delivery, whether vaginal or cesarean, is a crucial factor that can impact the health outcomes of newborns. One important measure of neonatal well-being is the APGAR score, which evaluates the infant's physical condition at birth.

Understanding the relationship between the mode of delivery and APGAR scores is essential for healthcare providers to make informed decisions and provide optimal care for newborns. Understanding the potential influence of the delivery mode on APGAR scores is paramount for healthcare providers. This knowledge enables informed decisions regarding necessary interventions and facilitates the provision of optimal care tailored to the specific needs of each newborn. A lower APGAR score may indicate the need for prompt medical attention, while a higher score generally signifies a healthy transition to extrauterine life. This literature review examines the effect of the mode of delivery on APGAR score outcomes, providing valuable insights for healthcare providers to optimize newborn care and decision-making.

DISCUSSION

APGAR Score

APGAR Score is a standardized test performed on a newborn baby after birth to assess the clinical status.

It was first initiated by an obstetrical anesthesiologist from Columbia University, Dr. Virginia APGAR, in 1952. APGAR Score assessment uses a rapid method and also requires intervention for resuscitation. There are five components that are assessed including color, heart rate, reflexes, muscle tone, and respiration. Each component is scored on a scale from 0 to 2. The score is recorded at the first minute and five minutes for all infants, with extended recording at 5-minute intervals for infants scoring seven or less at 5 minutes and those needing resuscitation as a method for monitoring the response. Scores ranging from 7 to 10 are considered reassuring [1].

The APGAR Score is applied to determine the clinical conditions of newborns, identifying signs of depression such as cyanotic skin color, bradycardia, inhibited reflex responses when given stimulation, hypotonia, and apnea [2]. Evaluation and assessment of babies are conducted at the first and fifth minutes after birth. If the score is less than seven, the fifth-minute assessment is followed up. Resuscitation should be done immediately even before the first-minute APGAR Score is determined. The tenth-minute APGAR Score is used as an indicator for ongoing resuscitation in newborns [3].

TABLE 1: Criteria for APGAR Scoring [4].

Sign	Score		
	0	1	2
Heart Rate	Absent	Slow (<100 beats/min)	>100 beats/min
Respiration	Absent	Weak cry, hypoventilation	Good, strong cry
Muscle tone	Limp	Some flexion	Active motion
Reflex irritability	No response	Grimace	Cry or active withdrawal
Skin Color	Blue or pale	Body pink, extremities blue	Completely pink

There are five categories in the APGAR scoring system. Each category is weighted equally and assigned a score of 0, 1, or 2. These scores are then summed to produce a total score, which is recorded at 1 and 5 minutes after birth. Scores of 7 to 10 are generally considered reassuring, scores of 4 to 6 indicate moderate deviations, and scores of 0 to 3 are considered low for full-term and late preterm babies. If the score is less than 7 at the fifth minute, the Neonatal Resuscitation Program guidelines recommend additional scoring at intervals of 5 to 20 minutes. It's important to note that the evaluation during resuscitation is not equivalent to the assessment of babies who are not undergoing resuscitation, as the resuscitation process can alter some score elements. The APGAR Score criteria are calculated with the following provisions:

(1) Appearance (Skin Color)

Peripheral cyanosis, or a bluish color in the extremities, is common in healthy newborns. For this criterion, a score of 0 is assigned if the skin is pale or blue, a score of 1 if the body is pink but the extremities are blue, and a score of 2 if the entire body is pink.

(2) Pulse (Heartbeat)

The newborn's heartbeat is assessed with a stethoscope, as the heart rate is a key indicator of the need for resuscitation. A score of 0 is given if there is no detectable heartbeat, 1 if the heart rate is less than 100 beats per minute and 2 if the heart rate is greater than 100 beats per minute.

(3) Grimace (Reflex in Response to Stimuli)

This measures the newborn's response to stimulation. A score of 0 is assigned if there is no response to stimulation, 1 if a grimace is observed in response to a stimulus, and 2 if the newborn exhibits a cry, cough, or sneeze in response to stimulation.

(4) Activity (Muscle Tone)

Muscle tone and movement are assessed to determine neuromuscular status. A score of 0 is given if the muscles are flaccid with no activity, 1 if some muscle tone and flexion are present, and 2 if there is active movement with good muscle tone and resistance to extension.

(5) Respiration (Breathing Effort)

This evaluates the newborn's breathing strength and effort. A score of 0 is assigned if there is no breathing, 1 if the breathing is slow, irregular, or weak, and 2 if the newborn has a strong, robust cry [1].

The instrument used to listen to the heartbeat, a stethoscope, is superior to pulse palpation in assessing heart rate. Auscultation provides a more accurate calculation of the pulse than palpation of the umbilical or brachial pulse. A pulse oximeter can also be used. Ideally, a heater should be available in the delivery room to provide necessary warmth for neonates suffering from hypothermia. If a heater is not available, warm blankets can be used as an alternative [1].

Mode of Delivery

• **Vaginal Delivery**

A vaginal delivery or spontaneous labor is defined as the process of expelling a full-term fetus from a mother's womb through the vagina using the mother's own strength without the help of induction or other assistance [5].

The process of labor begins with a series of distinct and definitive signs, each marking a step in the progression toward childbirth. The first sign is the onset of uterine contractions, often referred to as the first stage of labor or the opening stage. These contractions are unmistakable, presenting as circular waves of pain that typically start in the back and radiate toward the front of the abdomen.

Mothers may experience persistent back pain that spreads forward, accompanied by regular contractions that gradually become more frequent and intense over time. This is often accompanied by changes in the cervix, as it begins to efface thin and dilate, signaling that the body is preparing for delivery. Interestingly, increased activity from the mother, such as walking or moving, can heighten the intensity of these contractions. These rhythmic uterine contractions are key drivers of cervical change, with at least two contractions occurring within a 10-minute window. They are vital in causing the cervix to thin and open, a process that indicates labor is advancing [6].

Following the onset of contractions comes the effacement and dilation of the cervix, a process that serves as a physical indicator of labor's progression. As the cervix thins out and begins to open, mothers may notice certain physical signs, including the release of mucus and a small amount of blood both of which signal the body's readiness for delivery. This marks a pivotal moment, as these changes are directly tied to the labor process itself [6].

Another sign to watch for is the bloody show, which occurs as the cervix continues to efface and dilate. This phenomenon involves the expulsion of mucus from the cervical canal, often accompanied by a small amount of blood. The blood is the result of tiny blood vessels breaking as the fetal membranes detach in the lower part of the uterus. While this can be alarming, it is a natural part of the labor process and indicates that labor is drawing nearer [6].

Additionally, some mothers may experience the premature rupture of membranes, a sudden and unmistakable release of a large amount of fluid from the birth canal. This occurs due to the rupture of the amniotic sac or fetal membranes. The timing of this event can vary—it typically happens when the cervix is fully or nearly fully dilated, signaling that labor is imminent. However, it can also occur with only a small amount of dilation or even before labor has officially begun. When this happens, labor will usually begin within 24 hours after the amniotic fluid is released. This event serves as another key sign that labor is well on its way [6].

The process of vaginal delivery unfolds through four distinct stages, each marked by significant physiological changes and experiences for the mother.

(1) *Stage I: Opening Stage*

The first stage of vaginal delivery, known as the Opening Stage, is crucial as it involves the maturation and dilation of the cervix, allowing the fetus to transition from the uterus to the outside world. This stage is divided into two phases: the latent phase and the active phase. Latent Phase: During this initial phase, the cervix dilates up to 3 cm over approximately eight hours. Contractions begin but are generally mild. Active Phase: As labor progresses into the active phase, the cervix continues to open, reaching full dilation at 10 cm within about six hours.

Contractions become more intense, occurring every ten minutes for durations of 20-30 seconds, with a frequency of 2-4 times lasting 60-90 seconds each [7].

(2) *Stage II: The Expulsion of the Baby*

The second stage begins once the cervix is fully dilated at 10 cm and lasts until the baby is born. This stage is characterized by intense contractions and a strong urge to push. As the lower part of the fetus exerts pressure on the perineum and anus, abdominal wall muscles and diaphragm contract to facilitate delivery. This stage can vary in duration but typically lasts from a few minutes to several hours [7].

(3) *Stage III: Delivery of the Placenta*

In this third stage, following the birth of the baby, both the placenta and any remaining membranes are expelled from the uterus. This process usually occurs within 30 minutes post-delivery and may involve mild contractions as the uterus continues to contract to help detach and expel the placenta [7].

(4) *Stage IV: Recovery Phase*

Stage IV represents a critical recovery period occurring approximately two hours after delivery. During this time, healthcare providers monitor for any excessive bleeding or complications from delivery. It is essential for mothers to receive appropriate care to ensure healing and address any potential issues that may arise [7].

The mechanism of vaginal delivery involves a series of well-defined phases that facilitate the safe passage of the fetus through the birth canal. Each phase is critical in ensuring that the delivery proceeds smoothly. The process begins with engagement, which occurs when the biparietal diameter (the distance between the left and right temples of the fetus) passes through the upper pelvic inlet. This marks the entry of the fetal head into the pelvic cavity, positioning it for descent. Following the engagement, the next phase is descent. During this stage, the fetal head moves downward through the pelvis. Factors influencing this descent include the size of the fetus's head, the dimensions of the pelvis, fundal pressure from uterine contractions, amniotic fluid pressure, and maternal efforts during pushing. As the fetal head descends further, it encounters resistance from various structures such as the cervix, pelvic walls, and pelvic floor. This resistance causes flexion, where the fetus's neck bends, reducing the angle between its head and neck. This position helps facilitate easier passage through the birth canal. After flexion, the fetal head undergoes internal rotation. In this phase, as it descends, the crown of the head turns forward to navigate through the narrowest part of the pelvis known as the interspinous distance. This rotation is essential for aligning the fetal head with the pelvic outlet. Once the internal rotation is complete, an extension occurs. The fetal head extends backward to pass through the pelvic floor. This movement allows for a smooth transition from inside the pelvis to outside.

After delivery of the head, external rotation takes place. The head rotates towards the mother's back to align with her shoulders for delivery. This alignment is crucial to prevent any twisting of the neck and ensures that both shoulders can emerge smoothly. Finally, in the expulsion phase, both shoulders are delivered sequentially the posterior shoulder is followed by the anterior shoulder and then the rest of the baby's body follows. This completes the vaginal delivery process [8].

Spontaneous vaginal delivery is a preferred method of childbirth, but it is contraindicated in several conditions due to potential health risks for the mother and child. The following are key contraindications:

- (1) *Complete Placenta Previa*: This condition occurs when the placenta is positioned at the lower part of the uterus, completely obstructing the cervix, making vaginal delivery impossible [9].
- (2) *Infections*: Active infections, such as herpes simplex virus with active lesions or untreated HIV, pose significant risks as they can be transmitted to the baby during vaginal birth [9].
- (3) *Multiple Previous Cesarean Deliveries or Uterine Surgeries*: A history of multiple cesarean sections or extensive uterine surgeries increases the risk of uterine rupture during labor [9].
- (4) *Multiple Pregnancy*: Conditions such as twin gestations where the presenting twin is in a non-vertex position, conjoined twins, and mono-amniotic twins complicate vaginal delivery [9].
- (5) *Abnormal Placenta (Known Placenta Accreta) or History of Uterine Rupture*: These conditions can lead to severe bleeding during labor, making vaginal delivery risky [9].
- (6) *Certain Fetal Presentations*: Presentations such as footling breech, frank breech, complete breech, and cord prolapse may necessitate an emergency cesarean section due to complications associated with these positions [9].
- (7) *Vasa Previa or Placenta Previa*: Similar to complete placenta previa, these conditions involve abnormal placental attachment that can cause severe bleeding during labor [10].
- (8) *Transverse Fetal Presentation*: When the baby is positioned horizontally in the uterus, it complicates the delivery process and typically requires a cesarean section [10].
- (9) *Umbilical Cord Prolapse*: This occurs when the umbilical cord slips ahead of the baby in the birth canal, which can lead to serious complications for the fetus [10].
- (10) *History of a Prior Classical Cesarean Section*: A classical cesarean involves a vertical incision in

the upper part of the uterus, which increases the risk of uterine rupture in subsequent deliveries [10].

• Cesarean Delivery

A Cesarean delivery, also known as a cesarean section, is a surgical procedure where an incision is made in the abdominal and uterine walls to facilitate the removal of the baby [11]. Cesarean delivery can be performed using various techniques, each with its own indications and implications. Here are the primary varieties of cesarean delivery:

- (1) *Deep Transperitoneal Cesarean Delivery (Ismica)*: This method involves making both transverse and longitudinal incisions in the lower part of the uterus. It is the most commonly used technique, accounting for about 99% of cesarean sections. The deep transperitoneal approach is favored for its benefits, including efficient wound healing, minimal bleeding, reduced risk of uterine rupture, and fewer adhesions. However, it can pose challenges in delivering the fetus effectively, potentially leading to an expansion of the incision wound and bladder complaints post-surgery [12].
- (2) *Classic (Corporal) Cesarean Section*: In this procedure, an incision is made in the uterine corpus or upper part of the uterus. This method is selected when lower uterine surgery is unsafe such as in cases where the bladder is tightly adhered, there is a uterine mass or myoma, cervical malignancy, or if membranes have ruptured prior to delivery. Benefits include a quicker delivery process and no adhesions to the bladder; however, it has downsides such as more complicated wound healing, higher infection risk, potential for uterine rupture in future pregnancies, and possible adhesion to the abdominal wall [12].
- (3) *Cesarean Section with Uterus Removal*: Also known as a hysterectomy, this procedure involves removing the uterus after a cesarean delivery. It is indicated for conditions such as abnormal tissue growth in the uterus, uterine myoma, or uterine rupture that does not respond to suturing [12].
- (4) *Extraperitoneal Cesarean Section*: This technique involves making an incision in the abdominal wall and fascia while separating the abdomen and rectus muscles. The peritoneal folds are then pushed upwards while the bladder is retracted downwards to expose the bottom of the uterus. Although this method can be beneficial in certain cases, it is technically challenging and may lead to adverse effects on bladder function [12].
- (5) *Vaginal Cesarean Section*: This outdated procedure involved tearing the front vaginal wall into the uterine cavity to facilitate delivery but has since been discontinued due to safety concerns [12].

According to the Association of Scientific Medical Societies in Germany [AWMF] guideline, indications for cesarean delivery can be categorized into absolute and relative indications, with absolute indications representing situations where vaginal delivery poses significant risks to the mother or fetus. Firstly, absolute disproportion occurs when the mother's pelvis is too small to allow for a safe vaginal delivery. The mismatch between the size of the fetal head and the maternal pelvis makes it impossible for the baby to pass through the birth canal safely. Secondly, chorioamnionitis, also known as amniotic infection syndrome, is a serious infection of the placenta and amniotic fluid that can pose immediate risks to both the mother and fetus, necessitating urgent delivery to prevent further complications. Thirdly, maternal pelvic abnormalities refer to anatomical deformities in the mother's pelvis that obstruct normal birth, making cesarean delivery the safest option. Fourthly, eclampsia and HELLP syndrome are severe pregnancy complications that can endanger the life of the mother. These conditions typically require prompt cesarean delivery to protect both maternal and fetal health. Additionally, fetal asphyxia or fetal acidosis are conditions that threaten the fetus's oxygen supply and can lead to life-threatening situations. Immediate cesarean delivery may be required to prevent irreversible damage. Furthermore, umbilical cord prolapse occurs when the umbilical cord slips ahead of the fetal head in the birth canal, risking compression and asphyxia for the fetus. A cesarean section is often necessary in such cases [13].

The relative indications for cesarean delivery are situations where vaginal delivery may still be possible but could pose risks to the mother or fetus. Abnormal cardiotocography (CTG) is one of the key relative indications, as this condition may indicate immediate hypoxia or fetal asphyxia. If the fetus shows signs of acidosis, it becomes essential to expedite delivery, which can be accomplished through instrumental methods such as suction or forceps, or by performing a cesarean section. Additionally, stalled labor, which can manifest as extended labor or secondary cardiac arrest, is another significant relative indication. A delay or halt in the labor process can lead to adverse outcomes for the fetus or newborn, making timely intervention critical. Moreover, a history of cesarean section is often perceived as a relative indication against vaginal delivery in future pregnancies. While many women can successfully attempt vaginal birth after cesarean (VBAC), the common belief persists that a previous cesarean delivery may limit options for subsequent births [13].

There are certain clinical situations that may advise against the choice of cesarean delivery. However, there are more dangers involved with cesarean sections for both the mother and the kid. For instance, cesarean delivery may not be suitable for patients with severe anemia due to the potential risk of bleeding. Similarly, a history of abdominal surgery, significant fetal abnormalities, or even fetal

death could make cesarean delivery less advisable. From an ethical standpoint, it is also important to consider the patient's wishes. If a patient declines a cesarean delivery, it would be ethically inappropriate to proceed with it [15].

• *Difference between Vaginal and Cesarean delivery*
Vaginal delivery and cesarean section are distinct approaches to childbirth. Vaginal delivery involves the natural onset of labor, where the cervix dilates and effaces, leading to the baby's birth through the birth canal. A study found that induced labor is linked to a higher rate of cesarean section [15]. Women who underwent induced labor were more likely to have a cesarean section than those who went into labor spontaneously. The reasons for labor induction played a role in the increased risk of cesarean section after induced labor. The American College of Obstetricians and Gynecologists (ACOG) states that for certain clinical conditions, such as placenta previa or uterine rupture, cesarean delivery is the safest option. However, for most low-risk pregnancies, cesarean section appears to pose a greater risk of maternal morbidity and mortality than vaginal delivery [16].

The Role of Mode of Delivery on APGAR Score outcomes

The relationship between mode of delivery and APGAR scores has been the subject of extensive research, revealing a complex interplay of factors that influence neonatal outcomes. Numerous studies have shown that vaginal delivery is generally associated with higher APGAR scores compared to cesarean deliveries. For instance, some studies report that neonates born via vaginal delivery tend to exhibit better APGAR scores than those delivered by cesarean section [17]. However, it is important to note that some studies have found no significant relationship between APGAR scores and delivery modes, indicating a need for further investigation into this area [17].

The mode of cesarean delivery also plays a significant role in determining APGAR scores. Research indicates that elective cesarean sections are associated with better neonatal outcomes compared to emergency cesarean sections. This study highlights that elective cesarean deliveries often yield higher APGAR scores than their emergency counterparts, suggesting that the timing and indication for cesarean delivery are crucial factors influencing neonatal health [17]. Furthermore, a study by Kulkarni et al. (2021) supports this notion by demonstrating that the median APGAR scores at one minute were consistently higher in elective cesarean sections compared to emergency cesarean sections [18].

Additionally, the presentation of the fetus during delivery is another critical factor impacting APGAR scores. Non-cephalic presentations, such as breech, are linked to lower APGAR scores compared to cephalic presentations [19]. Recent studies corroborate this by showing that the mode of delivery, particularly in cases of non-cephalic presentations, significantly influences neonatal outcomes [20].

This relationship underscores the importance of fetal positioning in determining the success of the delivery method and subsequent APGAR scores.

Moreover, the influence of maternal factors, such as age and health conditions, cannot be overlooked. Studies have indicated that maternal age and pre-existing medical conditions can affect both the mode of delivery and the resulting APGAR scores [21]. For instance, older maternal age has been associated with increased risks of complications during delivery, which may subsequently lead to lower APGAR scores in neonates [22].

CONCLUSION

In conclusion, the evidence suggests that the mode of delivery has a significant impact on neonatal APGAR scores, with vaginal deliveries generally associated with better outcomes compared to cesarean deliveries. The type of cesarean delivery, fetal presentation, and maternal health factors all contribute to this complex relationship, indicating a need for further research to explore these dynamics and improve neonatal health outcomes.

ACKNOWLEDGMENT

The authors express their gratitude to the supervisors who guided them throughout the process of writing this literature review, as well as to all the studies that contributed to enhancing and broadening the knowledge required for this review.

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