بسم الله الرحمن الرحيم
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GAR SCORE & UNCERTAINITIES

THE APGAR SCORE

- The **Apgar score** is a method to quickly summarize the health of newborn against infant mortality.
- Virginia Apgar, an anesthesiologist at New York–Presbyterian Hospital, developed the score in 1952 to quantify the effects of obstetric anesthesia on babies.

APGAR SCORING SYSTEM

	0 Points	1 Point	2 Points	Points totaled
Activity (muscle tone)	Absent	Arms and legs flexed	Active movement	
Pulse	Absent	Below 100 bpm	Over 100 bpm	
Grimace (reflex irritability)	Flaccid	Some flexion of Extremities	Active motion (sneeze, cough, pull away)	
Appearance (skin color)	Blue, pale	Body pink, Extremities blue	Completely pink	
Respiration	Absent	Slow, irregular	Vigorous cry	

Severely depressed	0-3
Moderately depressed	4-6
Excellent condition	7-10

APGAR SCORE

- The test is generally done at 1 and 5 minutes after birth and may be repeated later if the score is and remains low till 20 minutes.
- Scores of 7 and above are generally normal; 4 to 6, fairly low; and 3 and below are generally regarded as critically low.

- A low score on the 1-minute mark may show that the neonate requires medical attention, but does not necessarily indicate a long-term problem, particularly if the score improves at the 5-minute mark.
- An Apgar score that remains below 3 at later times, such as 10, 15, or 20 minutes, may indicate longer-term neurological damage, including hypoxic ischemic encephalopathy and seizure.
- However, the Apgar test's purpose is to determine quickly whether or not a newborn needs immediate medical care. It is *not* designed to predict long-term health issues.
- *Casey BM, McIntire DD, Leveno KJ . "The continuing value of the Apgar score for the assessment of newborn infants". The New Eng J of Med 2001*

- A score of 10 is uncommon, due to the prevalence of transient cyanosis, and does not substantially differ from a score of 9.
- Transient cyanosis is common and as it is shown by pulse oximetry the first minute oxygen saturation is about 60-65%.

CONTINUOUS APGAR SCORE

- In cases where a newborn needs resuscitation, it should be initiated before the Apgar score is assigned at the 1-minute mark.
- Therefore, the Apgar score is not used to determine if initial resuscitation is needed, rather it is used to determine if resuscitation efforts should be continued.
- Variation between the 1-minute and 5-minute Apgar scores can be used to assess an infant's response to resuscitation.
- If the score is below 7 at the 5-minute mark, the NRP guidelines specify that the infant's Apgar score should be reassessed at 5-minute intervals for up to 20 minutes.

- An Apgar score that remains 0 beyond 10 minutes of age may, however, be useful in determining whether continued resuscitative efforts are indicated because very few infants with an Apgar score of 0 at 10 minutes have been reported to survive with a normal neurologic outcome.
- In line with this outcome, the 2018 Neonatal Resuscitation Program guidelines state that "if you can confirm that no heart rate has been detectable for at least 10 minutes, discontinuation of resuscitative efforts may be appropriate

APGAR SCORE &UMBILICAL CORD PH

- The relationship between umbilical cord pH and neonatal outcomes studies found that low cord pH is strongly correlated with mortality, morbidity and cerebral palsy in childhood.
- To reduce the risk of negative outcomes, it is recommended to obtain a sample of the umbilical artery blood gas when a newborn has an Apgar score of 5 or less at the 5-minute mark.
- *Malin GL, Morris RK, Khan KS . "Strength of association between umbilical cord pH and perinatal and long term outcomes: systematic review and meta-analysis". BMJ. 2010*

PREDICTIONS

- A 1-minute Apgar score of 0 to 3 does not predict any individual infant's outcome.
- A 5-minute Apgar score of 0 to 3 correlates with neonatal mortality in large populations but does not predict individual future neurologic dysfunction. Population studies have uniformly reassured us that most infants with low Apgar scores will not develop cerebral palsy.
- However, a low 5-minute Apgar score clearly confers an increased relative risk of cerebral palsy, reported to be as high as 20- to 100-fold over that of infants with a 5-minute Apgar score of 7 to 10.
- Although individual risk varies, the population risk of poor neurologic outcomes also increases when the Apgar score is 3 or less at 10 minutes, 15 minutes, and 20 minutes.
- When a newborn infant has an Apgar score of 5 or less at 5 minutes, umbilical arterial blood gas samples from a clamped section of the umbilical cord should be obtained, if possible.
- Submitting the placenta for pathologic examination may be valuable.

LIMITATIONS

- There are numerous factors that contribute to the Apgar Score, several of which are subjective.
- Examples of subjective factors include but are not limited to color, tone, and reflex irritability.
- Preterm infants may receive a lower score in these categories due to lack of maturity rather than asphyxia.
- Other factors that may contribute to variability among infants are birth defects, sedation of the mother during labor, gestational age or trauma. Inappropriately using the Apgar Score has led to errors in diagnosing asphyxia.
- *Montgomery, Kristen S. (2000). "Apgar Scores: Examining the Long-term Significance". The Journal of Perinatal Education.*

LIMITATIONS

- Various studies have shown that the Apgar score has variability between individual medical providers.
- A study was done in which health care providers were assigned to give Apgar scores to a group of infants.
- Results showed that health care provider had a consistency of 55% to 82% when it came to assigning scores when compared with one another.
- *Livingston, Jacquelynn (1990). "Interrater reliability of the apgar score in term and premature infants". Applied Nursing Research*

LIMITATIONS

- Skyes et al. in a study of 1210 newborn stated that because the Apgar score doesn't usually reflect the degree of acidosis at delivery, its value in asphyxial assessment must be questioned.
- Sykes GS, Molloy PM, Johnson P, Gu W, Ashworth F, Stirrat GM, et al. Do Apgar scores indicate asphyxia? Lancet. 1982

APGAR SCORE AND RESUSCITATION

- The present poor reliability of the Apgar score is attributable to changes in the care of newborn infants during the past 60 years.
- Very immature infants who might previously have died now survive and their condition is assessed by the Apgar score.
- However, approaches to score immature muscle tone and reflex responses of infants differ in and between single centres. Furthermore, many infants now receive medical interventions during the first minutes of life, but how to score an infant receiving medical support is not standardized.
- Apgar score assigned during resuscitation is not equivalent to a score assigned to a spontaneously breathing infant.

THE SPECIFIED-APGAR, THE EXPANDED APGAR

- To overcome this problem, we previously suggested specifying the Apgar score to describe an infant's condition irrespective of gestational age or interventions received.
- Furthermore, the American Academy of Pediatrics suggested an expansion of the score to describe the interventions an infant received.
- This Combined-Apgar (specified and expanded) describes both an infant's condition and the interventions needed.
- In the Combined-Apgar, a maximum of 17 points describes an infant who received no intervention and had undisturbed vital parameters, whereas an infant with a score of zero received all necessary interventions, but did not respond to them.
- Mario Rüdiger.**Apgar score and risk of cause-specific infant mortality. Lancet 2015**

THE SPECIFIED-APGAR, THE EXPANDED APGAR

- The **Specified-Apgar** describes the condition without interrupting intervention and the Expanded-**Apgar** adds the required information concerning the interventions. Thus, the Combined-**Apgar** evaluates both, infant's condition and resuscitative efforts and can be used to guide postnatal interventions

EXPANDED APGAR SCORE

- It has the same 5 signs as the original Apgar score but includes reporting a score also at 10, 15, and 20 minutes (10-, 15-, and 20-minute assessment is recommended by the American Heart Association [AHA] if the 5-minute Apgar score is <7) with added room to record (by a checkmark) if any of the following are used: oxygen, positive-pressure ventilation/nasal continuous positive airway pressure, endotracheal tube, chest compressions, and epinephrine.
- This new score accounts for resuscitative interventions.

Apgar Score

Gestational age_____weeks

Sign	0	1	2	1 minute	5 minute	10 minute	15 minute	20 minute
Color	Blue or Pale	Acrocyanotic	Completely Pink					
Heart rate	Absent	<100 minute	>100 minute					
Reflex irritability	No Response	Grimace	Cry or Active Withdrawal					
Muscle tone	Limp	Some Flexion	Active Motion					
Respiration	Absent	Weak Cry; Hypoventilation	Good, Crying					
			Total					

Comments:

Resuscitation

Minutes	1	5	10	15	20
Oxygen					
PPV/NCPAP					
ETT					
Chest Compressions					
Epinephrine					

		Minutes		
		1	5	10
C	Continuous Positive Airway Pressure [a]			
O	Oxygen			
M-B	Mask and Bag Ventilation [b]			
I	Intubation and Ventilation			
N	Neonatal Chest Compression			
E	Exogenous Surfactant			
D	Drugs			
	Sum of Expanded Apgar			
	Scoring Each Item: 0 = Intervention was performed ; 1 = No intervention was performed			
	a : score 0 if "Mask and Bag" or "Intubation and Ventilation" is score 0 b : score 0 if "Intubation and Ventilation" is scored 0			
A	Appearance (Skin Color) 2 = Completely pink 1 = Centrally pink with acrocyanosis 0 = Centrally blue or pale			
P	Pulse (HR) 2 = > 100 beats per minute 1 = < 100 beats per minute 0 = No heart beat			
G	Grimacing (Reflex) 2 = Appropriate for gestational age 1 = Reduced for gestational age 0 = No reflex response			
A	Activity (Muscle Tone) 2 = Appropriate for gestational age 1 = Reduced for gestational age 0 = No reflex response			
R	Respiration (Chest Movement) 2 = Regular chest movement 1 = Small of irregular chest movement 0 = No chest movement			
	Sum of Specified Apgar			
Total (Sum of Expanded + Specified)				

COMBINED APGAR

- C=Continuous Positive Airway Pressure (a)
- O=Oxygen
- M-B=Mask and Bag Ventilation (b)
- I=Intubation
- N=Neonatal chest Compression
- E=Exogenous Surfactant
- D=drugs
- Scoring of Each item
- 0=Intervention was performed
- 1=No intervention was performed
- **The Combined-Apgar scoring system, that consists of the Expanded and Specified Apgar scoring systems as introduced by Rudiger et al in 2012**

- Appearance (Color)

2= Completely pink

1 = Centrally pink with acrocyanosis

0 = Centrally blue or pale

- P Pulse (HR)

2 = > 100 beats per minute

1 = < 100 beats per minute

0 = No heart beat

- G Grimacing (Reflex)

1 = Reduced for gestational age

2 = Appropriate for gestational age

0 = No reflex response

- A Activity (Muscle Tone)

2 = Appropriate for gestational age

1 = Reduced for gestational age

0 = No reflex response

- R Respiration (Chest Movement)

2 = Regular chest movement

1 = Small of irregular chest movement

0 = No chest movement

- Sum of Specified Apgar
- Total (Sum of Expanded + Specified)

COMPARING COMBINED &CONVENTIONAL APGAR

- The Combined-Apgar score had the highest sensitivity (97%) and specificity (99%) in predicting birth asphyxia, followed by the Specified-Apgar score that was also highly sensitive (95%) and specific (97%).
- The Expanded-Apgar score was highly specific (95%) but not sensitive (67%) and the Conventional-Apgar score had the lowest sensitivity (81%) and low specificity (81%) in predicting birth asphyxia.
- When adjusted for gestational age, only the low 5-minute Combined-Apgar score was independently associated with the occurrence of HIE and IVH.

THE PROPOSED SCORES IN PREDICTING ADVERSE EARLY NEUROLOGIC OUTCOME

- In the asphyxiated neonates, among the proposed scores, the low 5- minute Combined-Apgar score (less than 10) (P = 0.01) and low 5- minute Expanded-Apgar score (less than 4) (P = 0.02) were the only scores associated with the occurrence of HIE, however neither could predict the severity of HIE.
- The low 5- minute Combined- Apgar score (P = 0.001) and low 5- minute Expanded-Apgar score (less than 4) (P = 0.01) were the only scores associated with the occurrence of IVH, however neither could predict the severity of IVH.
- None of the low 5- minute scores was associated with the occurrence of neonatal seizure.

THE PROPOSED SCORES IN PREDICTING ADVERSE EARLY NEUROLOGIC OUTCOME

- When adjusted for gestational age by using logistic regression model, only low 5-minute Combined-Apgar score remained significantly associated with HIE (B = 1.61, P = 0.02) and IVH (B = 2.8, P = 0.01).
- Dalili H, Nili F, Sheikh M, Hardani AK, Shariat M, Nayeri F. Comparison of the four proposed Apgar scoring systems in the assessment of birth asphyxia and adverse early neurologic outcomes. *PLoS One*. 2015;10(3):e0122116. Published 2015

RECOMMENDATIONS

- The Apgar score does not predict individual neonatal mortality or neurologic outcome and should not be used for that purpose.
- It is inappropriate to use the Apgar score alone to establish the diagnosis of asphyxia. The term asphyxia, which describes a process of varying severity and duration rather than an end point, should not be applied to birth events unless specific evidence of markedly impaired intrapartum or immediate postnatal gas exchange can be documented.
- When a newborn infant has an Apgar score of 5 or less at 5 minutes, umbilical arterial blood gas samples from a clamped section of the umbilical cord should be obtained. Submitting the placenta for pathologic examination may be valuable.
- Perinatal health care professionals should be consistent in assigning an Apgar score during resuscitation; therefore, the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists encourage use of an expanded Apgar score reporting form that accounts for concurrent resuscitative interventions.
- The Apgar Score.AAP2015

APGAR SCORE

Influencive factors

MEDICATION

- Anti epileptic drugs
- Anti depression drugs
- Magnesium Sulfate
- Betamethasone
- Oxytocin
- Analgesic drugs
- Anesthetic drugs

MATERNAL CONDITIONS

- DKA
- Maternal acidosis
- Respiratory failure
- Eclampsia
- Hypotension

Sepsis

FETAL CONDITION

Nuchal cord and knot

Meconium

Malpresention

Dystocia

Research Article

Factors Associated with Apgar Score among Newborns Delivered by Cesarean Sections at Gandhi Memorial Hospital, Addis Ababa

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Variables	Category	Frequency	Percentage
Age (in years)	20-24	116	33.72
	25-29	132	38.37
	30-34	54	15.70
	35-39	42	12.21
Pregnancy state	Gravida I	128	37.20
	Gravida II	168	48.84
	Gravida III	44	12.80
	Missing	4	1.16
Types of gestation	Single	324	94.2
	Multiple gestation	20	5.8
Maternal medical condition	Hypertension	24	6.97
	Gestational diabetes mellitus	4	1.16
	Normal	316	91.87
Type of C/S	Emergency	250	72.67
	Elective	94	24.33
Type of anesthesia	Spinal	298	86.82
	General	46	13.38

Variables	Category	Frequency	Percentage
Sex of the newborn baby	Male	210	58.14
	Female	144	41.86
Birth weight	1.5 to 2.5 kg	96	27.12
	2.5 to 4 kg	248	70.06
	Greater than 4 kg	10	2.82
Gestational age in terms	Preterm for GA	18	5.08
	Term for GA	310	87.57
	Postterm for GA	26	7.35
Skin incision to delivery time	≤3 minutes	132	38.37
	>3minutes	212	61.63

Variable	Category		Sig.	COR 95% C.I.	AOR 95% C.I.
	High score	Low score			
Type of anesthesia					
General	24	22	.021	2.244 (1.375-10.183)	3.668 (.276-10.145)
Spinal	216	82	*	*	*
Skin incision to delivery time					
<3 minutes	114	18	*	*	*
>3 minutes	128	84	.032	3.225 (.035-6.218)	3.645 (0.116-26.421)
Birth weight					
1.5-2.5 kg	24	72	.112	2.182 (0.024-17.415)	3.418 (2.126-12.099)
2.5-4 kg	216	32	*	*	*
Blood pressure					
Normotension	226	94	*	*	*
Hypertension	14	10	.456	.223 (.004-46.839)	1.229 (.012-37.277)

The result of the study indicated that newborn baby who delivered under general anesthesia has relatively low Apgar score when compared to those who delivered under spinal anesthesia.

Skin incisions to delivery time and type of anesthesia were strongly associated with a low Apgar score at one minute while kin incision to delivery time, gestational age, and blood pressure were found to be associated with low Apgar score at five minutes.

Review article

Association between maternal antenatal depression and neonatal Apgar score: A systematic review and meta-analysis of prospective cohort studies

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- Antenatal depression increased the risk of a low 5 min Apgar score; however, we did not find a difference in the mean and distribution of neonatal Apgar scores of mothers with depression and mothers without depression.

- Afr Health Sci. 2017 Mar; 17(1): 1–6.
- **Proportion and factors associated with low fifth minute Apgar score among singleton newborn babies in Gondar University referral hospital; North West Ethiopia**

- The proportion of low 5th minute Apgar score in this study was 13.8%. Factors that were significantly associated with low 5th minute Apgar score were: non-vertex fetal presentation, prolonged labor, presence of meconium stained liquor, induced/augmented labor and low birth weight.

Rasooli S., Moslemi F., ***J Anal Res Clin Med,*** 2014, 2(1), 11-6.
doi: 10.5681/jarcm.2014.002

Original Article

Apgar scores and cord blood gas values on neonates from cesarean with general anesthesia and spinal anesthesia

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- Apgar score of neonates(GA)
- fetal acidosis(SA)

BMJ Open

Apgar-score in children prenatally exposed to antiepileptic drugs: a population-based cohort study

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Strengths and limitations of this study

- The register study includes singletons with information on Apgar score (N=677 021) born in Denmark from 1997 to 2008.
- The Apgar score from the Medical Birth Register was linked with information on women's prescriptions for antiepileptic drugs (AEDs) during pregnancy from the Danish Register of Medicinal Product Statistics.
- AED exposure was associated with a 41% increased risk of having a low Apgar score (≤ 7) (adjusted relative risk (aRR)=1.41 (95% CI 1.07 to 1.85)).
- The absolute risk following AED exposure in pregnancy was low (<2%).
- AED exposure was based on information from registers and residual confounding may explain part of the increased risk.

Thank
you!