ASSESSMENT OF HYPOXEMIA USING DOWNES SCORE IN NEONATES WITH RESPIRATORY DISTRESS

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ABSTRACT

Respiratory distress in newborn is a common problem leading to hypoxemia. Pulse oximetry is the tool for measuring oxygen saturation noninvasively and blood gas analysis is the gold standard for oxygen monitoring. Downes score can be used as an alternative to assess respiratory distress clinically and determine the need of oxygen supplementation when these facilities are not available. This study was done to evaluate the validity of Downes score to assess hypoxemia in newborn with respiratory distress. This is a cross sectional descriptive study conducted from June 2020 to February 2021 in Neonatal Intensive Care Unit of Nepal Medical College Teaching Hospital. Oxygen saturation of newborn with respiratory distress was measured by pulse oximetry. At the same time the neonate was assessed for respiratory distress clinically using Downes score. Downes score and oxygen saturation measured by pulse oximetry were compared. Hypoxemia was defined as oxygen saturation less than 90% in term/ post term newborn and less than 88% in preterm baby. Similarly, neonate was considered to be hypoxic when Downes score was ≥5. The accuracy of Downes score was assessed by its sensitivity and specificity in detecting hypoxemia. Altogether 121 neonates were included in the study. Sensitivity and specificity of Downes score of 5 was 94.12% and 93.10% respectively. In conclusion, Downes score can be used as a clinical diagnostic means for assessing hypoxemia in neonates with respiratory distress

KEYWORDS

Downes score, hypoxemia, newborn, respiratory distress

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INTRODUCTION

Respiratory disorders are the most frequent cause of admission in neonatal intensive care unit in both term and preterm infants. Signs of respiratory distress are the indication for physical examination and diagnostic evaluation including determination of ventilation by arterial blood gases and oxygenation by pulse oximetry.[1] Pulse oximetry is the primary tool for noninvasive oxygen monitoring in neonates. Pulse oximeter provides continuous measurement of hemoglobin oxygen saturation with high level of accuracy.[2] In a study, Hay found oxygen saturatio (SpO_2) measured by pulse oximeter was highly correlated with arterial blood oxygen saturation (r=0.99).[3] Pulse oximetry can give inaccurate result in the conditions like inappropriate sensor placement, presence of high intensity light (phototherapy devices), fetal hemoglobin values >50% and presence of carboxyhemoglobin or methemoglobin.[2] Low peripheral perfusion and motion artifact are the two most common causes of inaccurate SpO_2 reading.[4] Arterial oxygen tension (PaO_2), measured under steady state conditions from an indwelling catheter, is the gold standard for oxygen monitoring.[2] However these facilities may not be available everywhere in our country.

Respiratory distress when prolonged and unattended leads to hypoxemia, hypercarbia and acidosis leading to pulmonary vasoconstriction and persistence of fetal circulation, thereby aggravating hypoxemia, worsening prognosis.[5] Therefore, a clinical evaluation to determine the presence of hypoxemia at early stage without supporting tools is very important. The severity of respiratory distress clinically can be assessed by Silverman- Anderson Score and Downes Score. While the Silverman Anderson Retraction Score is more suited for pretrems, Downes Score is more comprehensive and can be applied to any gestational age and condition.[6] Downes score can be used as a clinical diagnostic means for assessing hypoxia in clinical respiratory distressed neonates.[7] This study was done to determine the validity of Downes score for assessing hypoxemia in neonates with respiratory distress.

MATERIALS AND METHODS

This is a cross sectional descriptive study conducted from June 2020 to February 2021 in Neonatal Intensive Care Unit (NICU) of Nepal Medical College Teaching Hospital, Attarkhel, Kathmandu, Nepal. Sample size was calculated using the formula $n= z^2p(100-p)/d^2$ with expected prevalence of respiratory distress of 28% and the margin of error, d of 8%. All the term, post term and preterm newborns with respiratory distress who fulfilled the inclusion criteria were included in the study. The Informed consent was taken from all the parents. The newborn was considered to have respiratory distress when there is presence of at least two of the following criteria: respiratory rate of more than 60 per minute in quiet and resting baby, chest retraction and grunting.[8]

Detail maternal and neonatal history was taken. Complete physical examination of all the newborn including head to toe examination was done. Gestational age was assessed using Modified Ballard Score. All the newborn were evaluated with pulse oximetery and Downes score at the same time. Hypoxemia was considered if SpO_2 is <90% in full term and <88% in pre term babies.[7] Based on Downes score new born has clinical respiratory distress when the score is >4 and >7 indicate impending respiratory failure. Presence of hypoxemia was considered when the score was ≥5.[9] Oxygen saturation was measured by pulse oximeter by placing it on the right or left foot for 30 seconds, when it detected a good pulse and the value on the monitor did not changed for 10 second. Babies were managed according to the severity of the illness and outcome was observed. Data of the patient was collected in a preformed Proforma and analyzed using SPSS 16 software. Ethical clearance was obtained from Nepal Medical College Institutional Review Committee.

RESULTS

There were 121 neonates included in the study. The characteristic of the subjects are shown

Table 1: Demographic Characteristics of neonates

Characteristics	No	%
Gender		
Male	92	76
Female	29	24
Weight at birth		
<2500 gm	16	13.2
>=2500 gm	105	86.8
Gestational age		
<37weeks	16	13.2
>=37weeks	105	86.8
Mode of delivery		
Normal vaginal	30	24.8
Cesearean	89	73.6
Vacuum	2	1.6

Table 2. Prediction of hypoxemia using cut-off point from Downes score

Downes Score	Sensitivity	Specificity
≥1	100.0%	0.0%
≥2	100.0%	4.6%
≥3	100.0%	33.3%
≥4	100.0%	55.2%
≥5	94.1%	93.1%
≥6	44.1%	97.7%
≥7	29.4%	100.0%
≥8	20.6%	77.7%

Table 3: Sensitivity and Specificity of Downes score parameter to assess hypoxemia

Parameter	Sensitivity	Specificity
Respiratory rate	100.0%	45.0%
Cynosis	41.0%	86.0%
Retraction	97.0%	10.0%
Grunting	97.0%	54.0%
Air entry	11.0%	100.0%

in Table 1. Out of 121 newborn 34 (28.1%) were hypoxic detected by pulse oximetry. Cut off point of hypoxemia determined by Receiver Operator Curve (ROC) curve was at Downes score of 5. Area under the ROC curve was 0.96 which is highly significant (Fig. 1). Sensitivity and specificity of Downes Score of 5 in detecting hypoxia is 94.1% and 93.1% respectively. Prediction of hyoxemia using comparative cut off point from Downes Score is shown in Table-2. On analyzing the different parameters of Downes score, sensitivity of respiratory rate in detecting hypoxemia was 100% and specificity was 45% respectively (Table-3). Outcome of the newborn was poor when Downes score is 7 or more (Table-4).

DISCUSSION

During the study period neonatal admission due to respiratory distress in NICU was 26.0% whereas the incidence was 34.3% in the previous study done in the same institute with most common cause being meconium aspiration syndrome (21.1%).[10] Similar study showed 34.0% cases admitted in NICU with respiratory distress where the most common cause was transient tachypnea of newborn (44.0%).[11] Incidence of hypoxemia in our study was 28.1% which is slightly lower compared to another study where the incidence is 36%.[7]

Table 4: Correlation of Downes score with Outcome

Outcome	Downe Score								Total
	1	2	3	4	5	6	7	8	
Improved	4	23	16	33	21	5	1	4	107
Expired							2	3	5
DOR		2	3	2					7
LAMA						2			2
Total	4	25	19	35	21	7	3	7	121

DOR: discharged on request; LAMA: Left against medical advice

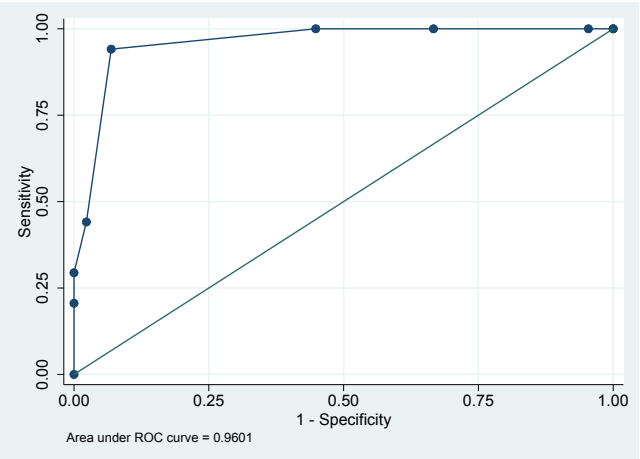

Fig. 1. ROC Curve

Our study showed the sensitivity and specificity of Downes score with cut off value at 5 as 94.1% and 93.1% respectively which is similar to another study where the sensitivity was 88% and the specificity was 81%.[7] One of the study showed parameters like birth weight, gestational age, APGAR score, oxygen saturation, and Downes score could be used together to predict mortality and requirement of respiratory support in the resource limited setting.[12]

Evaluation of individual clinical signs of

respiratory distress in neonatal hypoxemia showed different results. Duke *et al*[13] found that cyanosis had good sensitivity and specificity. Retraction and grunting has less sensitivity. In another study, on analysis of each Downes score parameter; respiratory rate, chest retraction and air entry possessed high sensitivity with low specificity, where as cyanosis and grunting resulted in low sensitivity with high specificity.[7] Our study had mixed result with respiratory rate, grunting and chest retraction had high sensitivity and low specificity where as cyanosis and air entry has low sensitivity and high specificity.

Outcome of our study showed all the newborns who expired had Downes score of 7 or more. Similar result was seen in another study where all the deaths (100%) in term babies due to respiratory distress was significantly associated with Downes score of >7.[14] Downes score of >6, extreme low birth weight, preterm delivery and cesarean delivery were found to be the independent risk factors for infant death.[15]

Downes score >6 at 15-20 minutes of starting continuous positive airway pressure (CPAP) in sepsis and pneumonia were associated with CPAP failure and was also an independent predictors of outcome. Downes score can be used at periphery to monitor response and to decide about referral in absence of sophisticated test.[16]

In conclusion Downes score can be used to assess hypoxemia in newborn with respiratory distress with 94.1% sensitivity and 93.1% specificity.

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