Comparison of Downe Score Between CPAP Success and CPAP Failure in Neonates with Respiratory Distress

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ABSTRACT

Objective: To determine the difference of Downe score between CPAP success and CPAP failure in neonates with respiratory distress.

Study Design: Cross sectional study

Place and Duration of Study: This study was conducted at the Neonatal Intensive Care Unit of Recep Tayyip Erdogan Hospital, Muzaffar Garh, Punjab, Pakistan for three months from March 2022 to 31 May, 2022.

Materials and Methods: Two groups, each of 30 patients presented with respiratory distress within 24 hours of birth, were made. One group include patients which were successfully treated with CPAP, 2nd group include CPAP failure patients.

Results: The Downe score of patients with CPAP failure group was higher compared to those with CPAP failure. Most of the patients with initial Downe score of 5 was successfully treated with CPAP, while those with 7and 8 score failed to improve with CPAP. Downe score more than 6 significantly effects the outcome of CPAP.

Conclusion: Initial Downe score is independent predictor of outcome of CPAP treatment in neonates with respiratory distress syndrome. Higher the value increases the risk of failure of CPAP treatment

Key Words: Downe score, Respiratory distress syndrome, neonates

INTRODUCTION

Respiratory difficulty is one of the most common presenting complaints in the first few days after birth, with overall prevalence of respiratory distress is 4%-7% in all live births[1] and in Pakistan, its prevalence is 4.24%.[2] It is one of the most frequent reasons of hospital admission in Neonatal Intensive Care Unit (NICU).[3] There is 2-4 time increase risk of death in neonates with respiratory distress than those without it.[4] The leading cause of respiratory distress can be respiratory disorders include Hyaline Membrane Disease (HMD), Transient Tachypnea of the Newborn (TTN), Persistent Pulmonary Hypertension (PPHN), Meconium Aspiration Syndrome (MAS), pneumonia and other causes like structural heart disease, renal

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disturbance, gastrointestinal anomalies, neurological diseases and skeletal anomalies.[5] Risk of respiratory disorder in neonates increased with prematurity, meconium aspiration, gestational diabetes, maternal chorio-amnionitis, C-section delivery and structural lung disorders. Gestational age is inversely related to the incidence of respiratory distress. There are three times more chances of developing respiratory distress at 37 weeks of gestation than at 39–40 weeks.[1]

Respiratory distress is recognized by signs of tachypnea, nasal flaring, grunting, cyanosis and chest retractions. [6] Initial investigations for severe respiratory distress include of complete blood count with differential, pulse-oximetry, blood culture, blood gases and chest radiography.

Irrespective of the cause, if respiratory distress is not timely managed, it can quickly progress to respiratory failure and cardiopulmonary arrest, which is the most common cause of neonatal morbidity and mortality. Among these patients, one third become more sick and require assisted ventilation.[7]

Respiratory support of the critically ill neonate comprises of noninvasive and invasive forms. Nasal continuous positive airway pressure (NCPAP) is the most commonly used noninvasive techniques of respiratory support, in NICUs.[8] Early application of nasal CPAP has multiple benefits in supporting neonates with respiratory distress. It maintains the ability of spontaneous breathing, prevents endotracheal intubation, and protects from lung injury as compared

to mechanical ventilation and decreases long term complications such as incidence of bronchopulmonary dysplasia (BPD).[9]

Although an experienced neonatologist can assess respiratory distress in newborn, there is great inter observer variability. It is hence, important to have a uniform clinical visual assessment criteria which can be applied instantly at bed side to predict the type of initial respiratory support needed. This will protect newborn from invasive mechanical ventilation as well as wastage of medical resources. Several physical score systems have been proposed to allow bed side assessment of neonatal respiratory distress, among these one is Downe score system.[10]

Continuous positive airway pressure is preferentially used as an initial means of respiratory support for neonates during early life and its early use is associated with successful outcome. A significant proportion of patients, however fail CPAP therapy and need invasive ventilation. Risk factors for CPAP failure include immature gestation, lower birth weight and male gender.[11] CPAP failure can be predicted by certain clinical indices of respiratory function. Among these, CPAP level (in cm H_2O), FiO2 requirement, Alveolar-Arterial Oxygen Tension (A-aDO2) gradient and arterial blood gas (ABG) are a few parameters.[12,13] Unfortunately, these tests are not feasible everywhere in resource limited set up. In such situation, Downe score is a clinical bedside tool to assess severity and response to respiratory support. The Downe score parameters include tachypnea, cyanosis, air entry, grunting and chest retractions each of which scores from minimum to maximum as 0 to 2 respectively. (Annexture-1) As a clinical diagnostic tool, Downe score has a sensitivity of 72.3% and specificity of 95.3%.[14] It can be used effectively for both term and pretem babies. The score is reliable and easy to use even by primary health personnel.[15]

Healthcare providers in settings where advanced respiratory support is not available are faced with the difficult decision regarding the timely referral of a sick neonate to a higher level facility. Such a transfer is both risky and drains the family's resources, especially in low income countries. Also, in tertiary care hospitals of Pakistan, where limited advanced respiratory support is available, decisions regarding to whom such support should be given, is crucial. In such circumstances, Downe score can be used as a simple bedside means to predict the success of CPAP in neonates with respiratory distress and hence aid in early triage of these critically ill patients.

MATERIALS AND METHODS

It was a retrospective cross sectional study, conducted at Neonatal intensive care unit of Recep Tayyip Erdogan Hospital, Muzaffar Garh, Punjab, Pakistan after taking approval from ethical review committee.

We included 60 patients and divided into two groups. All these patients presented with respiratory distress within first 24 hours after birth. Respiratory distress was defined by presence of two of the three characteristics: 1-Tachypnea (respiratory rate>60/min), 2-Intercostal/Subcostal retractions/Nasal flaring and 3-Grunting. Patients with Hypoxic ischemic encephalopathy, nasopharyngeal pathology, congenital heart disease, dysmorphism, renal failure or those newborns requiring intubation right after birth were not included in the study

Group one include 30 patients who were successfully treat with CPAP, defined by clinical improvement in the patient while group 2 included those in which CPAP was not successful. CPAP failure was defined as patient not maintaining saturation (spo2 < 89%) on Fio2 requirement ≥30 % with CPAP ≥ 8 cm H2O.

History including gestational age in weeks, use of antenatal steroid in mothers, mode of delivery (c–section / spontaneous vaginal delivery), and gender (boy/girl) were taken from attendants or from hospital record. Downe score of all these patients on admission day was noted. The diagnosis of the patients was noted. Duration of CPAP used and duration of hospital stay was noted from hospital record.

Data was analysed with SPSS version 22. Quantitative variables like age, gestational age, total hospital stay (days) and CPAP treatment duration were analysed in mean (±SD). Qualitative variables like antenatal steroid use, mode of delivery, gender, outcome of CPAP (success /failure) were analyzed in frequency and percentages and chi square was be applied for significance. P value ≤ 0.05 was considered as significant.

RESULTS

Our study included 60 neonates, divided into two groups on the basis of CPAP outcome. Among these, 44 were boys and 16 were girls. Mean age of patients at the time of presentation was 5.85 ± 7.2 hours, ranging from 0.5 hours to 20 hours. Mean age of male patients was 6.7 ± 7.4, while mean age of female patients was 3.4 ± 6.4.

Mean gestational age of the neonates in our study was 33.9 ± 2.9 weeks, ranging from 27 to 39 weeks. 10 neonates were born by SVD while 50 patients were born by Cesarean surgery. Mean gestational age of babies born by SVD was 33.8±2.1 and those by C-section were 33.9 ± 3.0. There was history of steroid use in antenatal period by mother in 14 (23.3%) neonates among them 2 were girls and 12 were boys.

Most of the babies were diagnosed to have respiratory distress syndrome RDS (48 (80%), only 2 (3.3%) had transient tachypnea of newborn and 10 (16.7%) had persistant pulmonary hypertension

CPAP failure was observed in only 5 (15.6%) newborns with Downe score of 5, while 16(80%) newborns with

initial Downe score of 6 had CPAP failure. CPAP was unsuccessful in all those patients with Downe score of 7 and 8. Mean duration of CPAP in our study was 27.99±36.5 days and mean hospital stay of the studied patients was 11.27±10.3 days.

Table No.1: Comparison of general features in both groups (Chi-square test applied to determine significance)

Characteristics		CPAP successful	CPAP failure	p-value
Gestational age (weeks)	≤32	10	16	0.118
	>32	20	14	
Post natal age (hours)	≤6	22	16	0.108
	>6	8	14	
Gender	Boy	21	23	0.559
	Girl	9	7	
Mode of delivery	SVD	4	6	0.488
	C-section	26	24	
Use of antenatal steroid	Yes	9	5	0.222
	No	21	25	
Diagnosis	TTN	2	0	0.353
	RDS	23	25	
	PPHN	5	5	
Downe score	≤6	26	6	0.000
	>6	4	24	

Table No.2: Downe score at the time of presentation

Downe Score	CPAP Success	CPAP Failure	Percentage
5	26	6	53.3
6	4	16	33.3
7	0	4	6.7
8	0	4	6.7

DISCUSSION

CPAP is commonly used respiratory support in neonates with respiratory distress. Different factors which can predict the outcome of CPAP had been studied. The relationship between the initial Downe score and outcome of CPAP is significant (0.002). Higher the value predict poor outcome of CPAP treatment. The effect of gender, gestational age, post natal age, use of steroid during antenatal period, mode of delivery, primary cause of respiratory distress and duration of CPAP use did not significantly effects the outcome of CPAP treatment in our study.

In a study in India, Pankaj M Buch and his colleagues studied 75 newborns presented with respiratory distress. In his study mean gestational age of newborns which treated successfully with CPAP was 31.97±1.6 weeks while those with CPAP failure was 31.07±1.8. in our study mean gestational age in CPAP success was 34.33±2.91 and with CPAP failure was 33.47±2.89. Although gestational age of newborns was smaller in Pankaj study, but the impact of gestational age was insignificant on CPAP outcome, similar to our study. Effect of gender on CPAP outcome in his study was also insignificant as in our study. Use of antenatal steroid was observed in 14.7%, while in our study it was 23.33%. In Indian study, use of antenatal steroid predicts better outcome of CPAP treatment, while this relationship was insignificant in our study. Impact of initial Downe score on CPAP outcome was significant, i.e. score >6 was associated with poor outcome, same as in our study[13].

In an Indonesian study, enrolled 150 neonates, the results shows that gestational age, gender, primary cause of respiratory distress and use of antenatal steroid had no significant relation to CPAP outcome, while initial Downe score was strongly associated with outcome of newborns with respiratory distress treated with CPAP. These result were similar to our study results[12]

In Koti study, relationship between gestational age, gender and mode of delivery and outcome of CPAP was insignificant as in our study, while the use of steroid during antenatal period significantly affects the outcome of CPAP contrary to our study. Initial Downe score >7 predicts poor outcome of CPAP treatment similar to our study[16].In his study, Pradeev found that lower gestational age and lack of antenatal steroid significantly increase CPAP failure risk in neonates[17]. In Indian study, low gestational age and cause of respiratory distress was significantly associated with poor outcome of CPAP in neonates, contradictory to our study, while gender and antenatal use of steroid had insignificant effect, as in our study.[18]

CONCLUSION

CPAP is commonly used non-invasive respiratory support and initial Downe score is a strong predictor of the outcome of CPAP treatment in newborns with respiratory distress, Downe score is useful in detecting hypoxia and can be used for deciding for early respiratory intervention in neonates.

Author's Contribution:

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Conflict of Interest: The study has no conflict of interest to declare by any author.

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