Original Article

Comparison of Mask versus Prong for Delivery of Continuous Airway Pressure in Premature Neonates with Tachypnea in Terms of Continuous Positive Airway Pressure Failure

Shaukat Hussain, Muhammad Tayyab and Muhammad Arslan Farooq

ABSTRACT

Objective: To compare mask and prong for delivery of CPAP in management of premature neonates with tachypnea in terms of frequency of CPAP failure.

Study Design: Randomized controlled trial study.

Place and Duration of Study: This study was conducted at the Department of Pediatrics, Holy Family Hospital Rawalpindi from September 2018 to February 2019.

Materials and Methods: One hundred and twenty pre-term infants with gestational age from 27-34 weeks of any gender were included. They were divided in two groups; randomized to receive either mask (Group 1) and prong (Group 2) as a mode of NCAP delivery interface.

Results: Comparison of mask versus prong for delivery of CPAP in management of premature neonates with tachypnea in terms of frequency of CPAP failure shows 5% (n=3) in Group 1 and 11.67% (n=7) in Group 2 with p value was 0.18.

Conclusion: Mask for delivery of continuous airway pressure in management of premature neonates with tachypnea in terms of frequency of CPAP failurehas less frequency as compared to prong.

Key Words: Preterm, Tachypnea, Failure of CPAP, Nasal mask, Nasal prong

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INTRODUCTION

Continuous increased airway pressure is used for management of pre- term neonates who have respiratory distress.[1] It is simple, non invasive, easy to use and low cost method of ventilation in a child born with respiratory distress.[1] Approximately 15 million babies are born preterm annually with mortality rate of almost 35 percent due to complications of preterm birth.[2] Lack of pulmonary surfactant is the cause of respiratory distress in preterm babies causing immature pulmonary development and alveolar collapse. Clinically pre term babies present with progressive dyspnea and respiratory failure shortly after birth. Combination of pulmonary surfactant along with nasal positive airway pressure can maintain alveoli open to improve oxygenation and decrease respiratory distress.[3]

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Mechanical positive airway pressure ventilation using tracheal intubation has been used but it is associated with complications like pneumothorax, respiratory infections and trauma.[4] There have been improvements in management of new born with respiratory distress, however controversies exist in most effective method of mechanical ventilation with least complications. Less invasive continuous increased pressure in nasal cavities is an approved method of ventilation support in neonates.[4] Continuous increased pressure in nasal cavities can be given either via nasal prongs or nasal mask. Limitations to deliver continuous positive airway pressure via nasal prongs include difficult positioning of neonate, nasal injuries, difficulty in maintaining nasal prongs and poor tolerance.[5] Other method of giving positive nasal airway pressure is by using nasal masks. Advantages of using nasal masks instead of nasal prongs are ease of application, better tolerance and less nasal trauma.[6] Nasal continuous positive airway pressure use has been increased recently and it is replacing conventional mechanical ventilation using endotracheal tube.[7,8]

Different studies show different results regarding CPAP failure when comparing nasal mask vs nasal prongs. In a study by Goel et al[1] that CPAP failure occurred in 13 % of patients in mask group and 25% in nasal prongs group. In another study by Chandrasekaran et al[9] there was no difference in the incidence of CPAP failure in

both groups. In another study by Say et al[10] the failure rate of prong technique was higher vs mask modality 8% vs 2%.

Rationale of my study is to compare the mask vs prong and to promote the use of mask for delivery of air way pressure in management of premature neonates with tachypnea because it has less failure rate, is easy to apply, more tolerable and less traumatic as compared to nasal prongs.

MATERIALS AND METHODS

This randomized controlled trial was conducted at Department of Pediatrics, Holy Family Hospital Rawalpindi from 1st September 2018 28th to February 2019. A total of 120 pre term infants with gestational age from 27-34 weeks of any gender were included. They were divided in two groups; mask (Group 1) and prong (Group 2) as a mode of NCAP delivery interface. Randomization was done using a computer generated randomization chart. Informed consent was taken from the child's parents/guardian. Infants in the Mask group were delivered NCPAP using Infant Nasal Mask. Infants in the Prong group were delivered NCPAP using appropriate size Infant Nasal Prong CPAP cannula system (size 0 and 1). Babies in both the groups were administered natural bovine surfactant (Survanta) at a dose of 100mg/Kg in 4 equal aliquots by INSURE. All infants enrolled in the study received a loading dose of 10 mg/kg caffeine base and then 2.5 mg/kg 24 hours after the loading dose and daily thereafter. Both the groups were observed for 24 hours for CPAP failure and recorded. The data was entered and analyzed through SPSS-20.

RESULTS

Gender distribution of the patients was done, it shows that 33 (55%) in Group 1 and 37 (61.67%) in Group 2 were male whereas 27 (45%) in Group 1 and 23 (38.33%) in Group 2 were females. The gestational age shows 31 (51.67%) in Group-1 and 29 (48.33%) in Group 2 were between 27-30 weeks whereas 29 (48.33%) in Group 1 and 31 (51.67%) in Group 2 were between 31-34 weeks with mean gestational ages were 30.52±1.86 weeks in Group 1 and 30.57±1.62 weeks (Table 1).

Table No.1: Frequency of gender and gestational age (n=120)

Variable	Group 1	Group 2
Gender		
Male	33 (55%)	37 (61.67%))
Female	27 (45%)	23 (38.33%
Gestational age (weeks)		
27-30	31 (51.67%)	29 (48.33%)
31-34	29 (48.33%)	31 (51.67%)
Mean±SD	30.52±1.86	30.57±1.62

Comparison of mask vs prong for delivery of continuous airway pressure in management of premature neonates with tachypnea in terms of frequency of CPAP failure shows 3 (5%) in Group 1 and 7 (11.67%) in Group 2 with P value was 0.18. Effect modifiers like gender were controlled by stratification. P-value taken statistically significant was <0.05 (Table 2).

Table No.2: Stratification of CPAP failure according to gender and gestational age (n=120)

Variables	CPAP failure	Group 1 (n=60)	Group 2 (n=60)	P-value
Gender				
Male	Yes	1	4	0.20
	No	32	33	
Female	Yes	2	3	0.51
	No	25	20	
Gestational age (weeks)				
27-30	Yes	2	1	0.59
	No	29	28	
31-34	Yes	1	6	0.05
	No	28	25	
27-34	Yes	3	7	0.18
	No	57	53	

DISCUSSION

Standard mode of therapy for premature neonates with tachypnea is nasal CPAP. Safety and comfort associated with nasal CPAP is highlighted with increased use of this non invasive mode of ventilation. Injuries associated with this modality range from 20-60% and consist of nasal tip blanching, necrosis of nasal septum and septal drop but major factors associated with these injuries are gestational age, lower birth weight and prolonged duration of treatment on this mode. In addition to this, type of nasal interface has also major contribution in injury. This study was to compare the mask vs prong and to promote the use of mask for delivery of continuous air way pressure in premature neonates with tachypnea because it has less failure rate, is easy to apply, more tolerable and less traumatic as compared to nasal prongs.

In this study 33 (55%) in Group 1 and 37 (61.67%) in Group 2 were male whereas 27 (45%) in Group 1 and 23 (38.33%) in Group 2 were females, 31 (51.67%) in Group 1 and 29 (48.33%) in Group 2 were between 27-30 weeks whereas 29 (48.33%) in Group 1 and 31 (51.67%) in Group 2 were between 31-34 weeks with mean age was 30.52±1.86 weeks in Group 1 and 30.57±1.62 weeks in Group 2, comparison of mask and prong for delivery of continuous airway pressure in management of premature neonates with tachypnea in terms of frequency of CPAP failure shows 3 (5%) in Group 1 and 7 (11.67%) in Group 2 with p value was 0.18.

Different studies show different results regarding CPAP failure when comparing nasal mask vs nasal prongs. In a study by Goel et al[1] reported that CPAP failure occurred in 13 % of patients in mask group and 25% in nasal prongs group.

In another study by chandrasekaran A et al there was no difference in the incidence of CPAP failure in both groups.[9] In another study by Say B et al the failure rate of prong technique was higher vs mask modality 8% vs 2%.[10]

A recently conducted meta-analysis concluded that rate of CPAP failure is much lower with mask technique as well as chances of nasal injury and stress are also negligibly low, but it needs a well powered RCT to strengthen their views.

Another meta-analysis[11] that compared mask vs prong technique in terms of efficacy and nasal injury in premature neonates on CPAP; total five trials were included but effectiveness was judged in only four trials (n=459 neonates), while nasal injury was assessed in three trials (n=275 neonates). They concluded that rate of CPAP failure with mask is significantly lower, [RR 0.63 (CI 0.45 to 0.88)] as well as nasal injury [RR 0.41 (CI 0.24 to 0.72)]. Moderate to severe nasal injury was observed in 36 out of 137 neonates (26%) in prong group and 14 out of 138 neonates in mask group (10%) respectively, but few limitations were seen in this meta-analysis like inadequate sample size, ethnicity of participants, inequality in interventions and inappropriate standard to measure nasal injury. Contrary to this meta-analysis our study has large sample size with no ambiguity in patient inclusion criteria, inclusion of neonates with equal chances of CPAP failure and nasal injury, usage of similar equipment i.e. dragger baby flow mask and Hudson prongs.

In another study of Newnam et al[12] who compared mask vs prong and alternate mask / prong techniques in post extubated neonates who were assigned CPAP by either mask (n=35) or prong (n=21) or alternating technique (22), chances of skin injury erythema or excoriation P-values ($P<0.001$, $P<0.007$) respectively were less in alternating group as compared to mask or prong groups. Few limitations were also present in this trial i.e. small sample size, considering only post extubated neonates, non-randomization, differential birth weight among groups and subjective assessment for nasal injury.

Despite of all measures to counter different effect modifiers like medications, interventions, subjective assessment and carefully selecting inclusion / exclusion criteria our study showed decreased chances of CPAP failure in mask vs prong group.

CONCLUSION

Mask technique for delivery of continuous airway pressure in management of premature neonates with tachypnea in terms of frequency of CPAP failure has less frequency as compared to prong.

Author's Contribution:

Concept & Design of Study:	Shaukat Hussain
Drafting:	Muhammad Tayyab
Data Analysis:	Muhammad Arslan Farooq
Revisiting Critically:	Shaukat Hussain, Muhammad Tayyab
Final Approval of version:	Shaukat Hussain

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

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