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Outcome of bubble CPAP for the management of preterm neonates with RDS and associated factors at NICU, TASH, Addis Ababa; Hospital based cross-sectional study

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I, the undersigned Pediatric and Child Health Resident, declare that I have submitted my original work titled "Outcome of bubble CPAP for the management of preterm neonates with RDS and associated Factors at NICU, Tikur Anbessa Specialized Hospital: A Hospital-Based Cross-Sectional Study" in Addis Ababa, Ethiopia.

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Acronym

APGAR....Appearance, Pulse rate, Grimace, activity and Respiratory rate

APHAntepartum hemorrhage

CPAP...Continuous positive airway pressure

GA.....Gestational age

GDM...Gestational diabetes mellitus

IVH...Intraventricular hemorrhage

LOS.....Length of hospital stay

LSCS.....Lower segment cesarean section

NICU.....Neonatal intensive care unit

PIH...pregnancy induced hypertension

PROMPremature rupture of membrane

RDS...Respiratory distress syndrome

ROP.....Retinopathy of prematurity

SGA...Small for gestational age

SVD.....Spontaneous vaginal delivery

TASH..... Tikur Anbessa specialized hospital

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Executive summary

Background: Respiratory distress syndrome is among the major complications of preterm birth. In developed countries the infant mortality rate from RDS has significantly reduced. But in resource restricted setting RDS is still among the commonest cause of mortality among preterm neonates(1)

Continuous positive airway pressure (CPAP) has become a useful modality in management of respiratory distress in preterm babies. It is found to be safe and effective means of treating mild and moderate RDS and apnoea of prematurity(2). CPAP started at birth is as effective as prophylactic or early surfactant and is associated with a reduction in BPD(3). Bubble CPAP , when used appropriately , is more cost effective , less intensive , requires less training and has lower risk of complications(4)

Method: A hospital based cross- sectional study was conducted on preterm neonates with RDS on bubble CPAP admitted at TASH ,NICU . Participants were selected using a simple random sampling technique.Data was collected through chart review . Data was entered into the statistical package for social sciences version 25 (SPSS) for subsequent descriptive and analytical statistics where applicable . Statistically significant association was taken for p value of < 0.05 .

Result: Among the 186 neonates included in the study, the occurrence of death as an outcome of bubble CPAP was 33 (17.7 %) . And being very preterm (28-31+6 weeks) and having sepsis as a concomitant illness were identified as a statistically significant association with having death as an outcome of bubble CPAP.

Conclusion: This study revealed a relatively higher level of death as an outcome of bubble CPAP and the factors associated were being very preterm (28 - 31 +6 weeks) and having sepsis as a concomitant illness.

1 Introduction

1.1 Background of the study

Respiratory distress syndrome is among the major complications of preterm birth. The risk of RDS is related to production of surfactant in the lungs(1). RDS increases with degree of prematurity and its frequency decreases significantly after 37 weeks of gestation. The clinical signs of RDS manifest within the first minutes and hours after birth and progress over the first 48 to 72 hours thereafter, begins to resolve. The diagnosis of RDS is based on clinical findings of a preterm infant with onset of progressive respiratory distress shortly after birth and a characteristic chest radiograph, which demonstrates low lung volume and diffuse reticulogranular ground glass appearance with air bronchogram.

In developed countries the infant mortality rate from RDS has significantly reduced but in resource restricted settings RDS is still among the commonest cause of mortality among preterm neonates(1)

Continuous positive airway pressure (CPAP) has become a useful modality in management of respiratory distress in preterm babies. CPAP, when applied to premature infants with RDS, re expands collapsed alveoli, splints the airway, reduces work of breathing and improves the respiration. It is found to be safe and effective means of treating mild and moderate RDS and apnoea of prematurity(2). CPAP started at birth is as effective as prophylactic or early surfactant and is associated with a reduction in BPD. Nasal CPAP is therefore the approach of choice for the delivery room management of a preterm neonate at risk for RDS(3). Bubble CPAP, when used appropriately, is more cost effective, less intensive, requires less training and has lower risk of complications(4)

1.2 Statement of the Problem

Respiratory Distress Syndrome (RDS) is a significant cause of morbidity and mortality among preterm neonates due to their underdeveloped lungs. Continuous Positive Airway Pressure (CPAP), particularly bubble CPAP, has emerged as a common and effective intervention to manage RDS by providing consistent respiratory support and improving oxygenation. Despite its widespread use, the specific outcomes of bubble CPAP for preterm neonates with RDS at Tikur Anbessa Specialized Hospital (TASH) remain under-evaluated in local context. There is a need to critically assess the effectiveness of bubble CPAP in this setting, including its impact on the duration of respiratory support, incidence of complications, and overall neonatal outcomes. Understanding these outcomes is essential for optimizing treatment protocols and improving the quality of care for preterm infants with RDS at TASH. Therefore, this research aims to evaluate the outcomes of bubble CPAP in the management of preterm neonates with RDS at TASH, to provide evidence-based recommendations for clinical practice.

1.3 Rationale/Significance of the Study

Respiratory Distress Syndrome (RDS) remains a major challenge in neonatal care, particularly among preterm infants whose lungs are underdeveloped and less capable of functioning independently. Continuous Positive Airway Pressure (CPAP) is a critical intervention in managing RDS, with bubble CPAP emerging as a preferred method due to its simplicity, cost-effectiveness, and potential benefits over other CPAP modalities (ventilator or CPAP machine, BiPAP).

Despite the theoretical benefits and increasing adoption of bubble CPAP in neonatal units worldwide, there is a paucity of specific data on its effectiveness and outcomes in the context of Tikur Anbessa Specialized Hospital (TASH). This gap in local evidence limits the ability to tailor and optimize treatment protocols based on actual outcomes and clinical experience within this particular setting.

The significance of this study lies in its potential to provide valuable insights into the practical effectiveness of bubble CPAP for preterm neonates with RDS at TASH. By evaluating key outcomes such as the duration of respiratory support, the incidence of related complications, and overall neonatal health, this research aims to enhance clinical protocols, inform policy and practice, support evidence-based medicine and optimize resource allocation.

In summary, this study is significant as it aims to bridge the gap between clinical practice and evidence by providing a detailed analysis of bubble CPAP outcomes, ultimately contributing to better management strategies and improved health outcomes for preterm neonates with RDS at TASH.

2. Literature Review

In a study conducted in India involving 170 neonates, it was observed that 30.5% of the infants experienced failure of Continuous Positive Airway Pressure (CPAP), and 8% of the infants died during their hospital stay. The median age at which CPAP was initiated was 1.6 hours of life, and the median duration of CPAP was 26 hours, with a range from 6 to 144 hours. For those who survived to discharge, the median hospital stay was 11 days, ranging from 3 to 37 days.

Factors linked to CPAP failure included insufficient or no exposure to antenatal steroids, a need for FiO₂ greater than 40% after 15 to 20 minutes of CPAP, and extreme prematurity. The study also noted a higher incidence of pneumothorax associated with CPAP, but mortality rates were notably higher among those who required ventilation. Additionally, infants who failed CPAP had significantly higher mortality rates and longer durations of oxygen requirement compared to those who did not fail CPAP.(4)

A study conducted at KIMS Hospital in Bangalore, Southern India, included 77 eligible neonates to evaluate the effectiveness of Nasal CPAP. The results demonstrated that Nasal CPAP was effective in 77.9% of the cases. The incidence of CPAP failure requiring mechanical ventilation was 22.1%. Additionally, 16.9% of the neonates required surfactant therapy, and 6.5% of the infants succumbed during the hospital stay. Mechanical ventilation was necessary for 22.1% of the study population. The study found that 64.9% of the participants were male. Notably, the treatment was most successful in preterm infants born between 33 and 36 weeks of gestation and those with a birth weight ranging from 1500 to 2500 grams. The most common predisposing factors for Respiratory Distress Syndrome (RDS) identified were Premature Rupture of Membranes (PROM) in 37.7% of cases, Pregnancy-Induced Hypertension (PIH) in 14.3%, and oligohydramnios in 13%. Other contributing factors included Gestational Diabetes Mellitus (GDM) and abnormal fetal Doppler findings(2)

A prospective observational study was conducted in the neonatal care unit of a tertiary teaching hospital in Kochi, Kerala, India (5) The study included 70 eligible neonates, with 91.4% delivered via cesarean section and 31.4% classified as small for gestational age (SGA). The most common predisposing factors for Respiratory Distress Syndrome (RDS) in this population were antenatal steroid use (74.3%), Premature Rupture of Membranes (PROM) (44.3%), and Pregnancy-Induced Hypertension (PIH) (34.3%). Other contributing factors included chorioamnionitis, Gestational Diabetes Mellitus (GDM), foul-smelling amniotic fluid, oligohydramnios, and abnormal fetal Doppler with absent diastolic flow. RDS developed soon after birth in 84.3% of the neonates, while the onset was delayed in the remaining infants. Bag and mask ventilation was required for only 10% of the neonates. Nasal CPAP was administered to 85.7% of the participants, while the remaining 10 neonates received bubble CPAP. CPAP failure occurred in 30% of the study population.

The study found that 18.6% of the neonates required surfactant therapy, and 7.1% of the infants died. The most common complications associated with CPAP were nasal trauma (80%), hypotension (11.4%), intraventricular hemorrhage (IVH) (10%), and CPAP belly (10%)(5)

A prospective analytical study in India evaluated the use of Bubble CPAP for managing Respiratory Distress Syndrome (RDS) in preterm infants. The study included 56 neonates, of whom 25% (14 infants) experienced CPAP failure. Key predictors of CPAP failure included insufficient or partial exposure to antenatal steroids, patent ductus arteriosus, sepsis or pneumonia, and a Downe's score greater than 7 or FiO₂ levels of 50% or higher after 15 to 20 minutes of CPAP. The study found that infants who failed CPAP had significantly higher rates of mortality and longer durations of oxygen requirement. Only two infants developed pneumothorax, and no cases of chronic lung disease were observed(6)

A prospective observational study was conducted over the first 72 hours of life on 174 preterm newborns with Respiratory Distress Syndrome (RDS) who received Continuous Positive Airway Pressure (CPAP) at Muhimbili National Hospital (MNH). Of the newborns enrolled, 48% were male and 91.4% were delivered at the hospital. The mean gestational age was 29 weeks (with a range from 24 to 34 weeks), and the mean birth weight was 1157.7 grams (ranging from 800 to 1500 grams). Only 25% of the mothers received antenatal corticosteroids. CPAP failure occurred in 37.4% of the newborns, with a higher failure rate of 44.1% among those with a birth weight of 1200 grams or less. Most cases of CPAP failure happened within the first 24 hours of life. No specific factors were identified as independently associated with CPAP failure. Mortality rates were significantly higher among those who experienced CPAP failure, with 33.8% of these infants dying compared to 12.8% of those who did not fail CPAP(7)

This retrospective observational study was carried out in the neonatal intensive care unit (NICU) of a tertiary care center, including 150 neonates with respiratory distress. The average birth weight of the neonates was 1.937 ± 1.34 kilograms, and the average gestational age was 34.64 ± 6.6 weeks. Among the neonates, 71.33% showed improvement with Bubble CPAP and were successfully weaned from respiratory support. In contrast, 28.67% of the neonates required mechanical ventilation(8)

A prospective observational study was conducted in the NICU of a tertiary care hospital in Raipur, Chhattisgarh, Central India. Among the 50 neonates receiving CPAP, 38 showed improvement, yielding a success rate of 76%. The remaining 12 infants (24%) experienced CPAP failure and required a higher level of ventilation. The success rate of CPAP was notably higher in females, with an 88.0% success rate. Additionally, CPAP was particularly effective in neonates with moderate grade Respiratory Distress Syndrome (RDS), achieving a success rate of 83.3%(9)

A study at AIC Kijabe Hospital analyzed the impact of introducing Bubble CPAP (BCPAP) by comparing two 18-month periods: before the introduction of BCPAP (1 November 2007 to 30

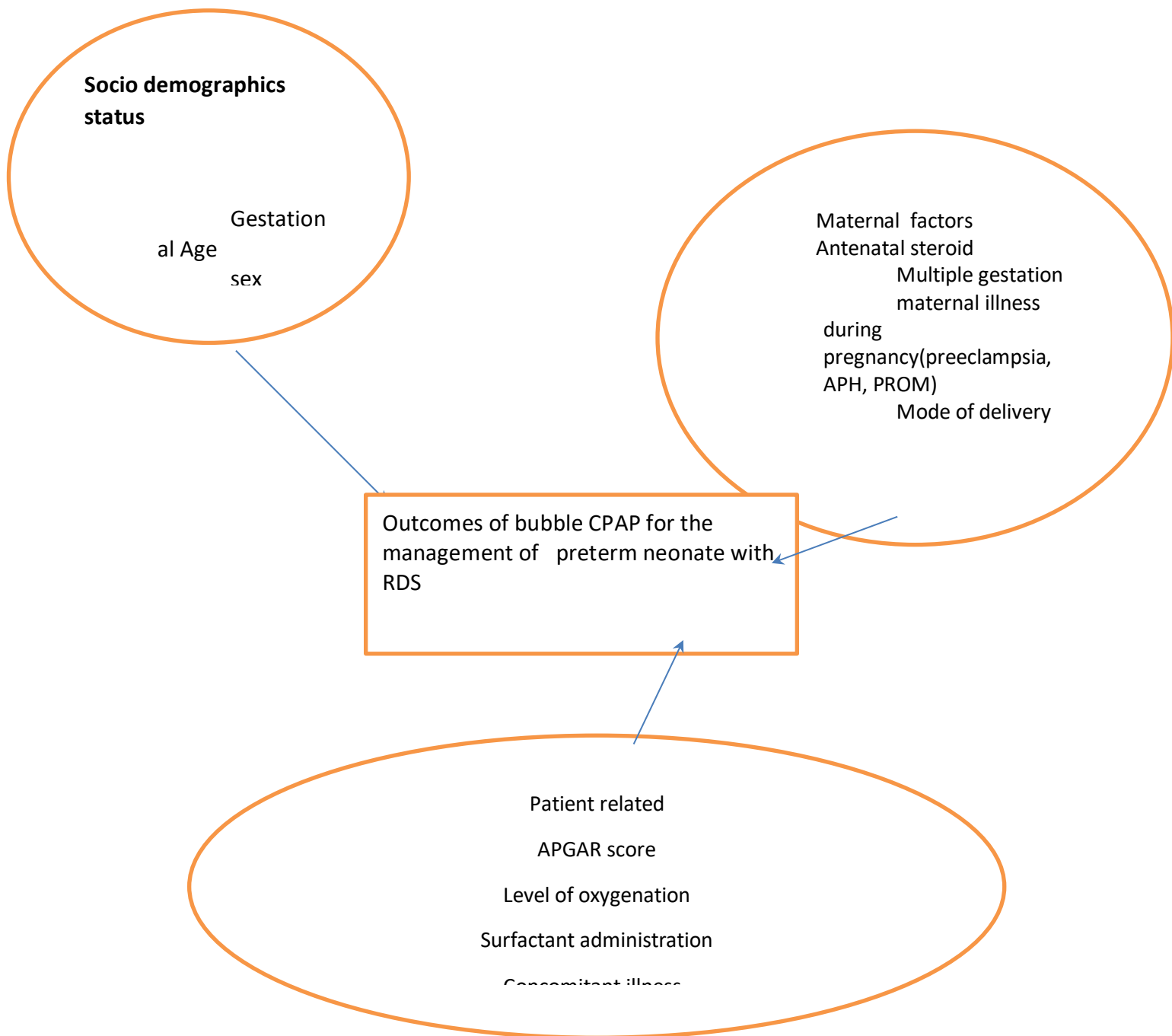
April 2009) and after its introduction (1 November 2009 to 30 April 2011). The survival-to-discharge rate significantly improved after the introduction of BCPAP, with a rate of 85% compared to 61% before its implementation. Additionally, the referral rate of preterm infants with Respiratory Distress Syndrome (RDS) decreased from 17% in the period before BCPAP to 4% after its introduction(10)

An analytic cross-sectional study was conducted over seven months involving preterm neonates with Respiratory Distress Syndrome (RDS) admitted to the Newborn Unit at AIC Kijabe Hospital. The study included 61 preterm neonates, with 54.1% male and 45.9% female. The median duration of BCPAP treatment was 5 days and was significantly associated with birth weight, while the median duration of oxygen therapy was 6 days and was significantly associated with gestational age. Twenty percent of the neonates required oxygen administration at 36 weeks. The median age for achieving full enteral feeds was 18 days. No major complications related to BCPAP, such as pneumothorax, CPAP belly, or nasal trauma, were reported. The mortality rate among preterm neonates treated with BCPAP was 13.1%(11)

This descriptive cross-sectional study was conducted in the neonatal ward of a hospital in Pakistan from December 2020 to June 2021. Out of 87 neonates, 51.7% were male, and 73.6% were younger than 14 days. The mean birth weight was 1948 ± 425 grams, with the majority (37.9%) weighing between 1500 and 2000 grams. Nasal flaring was observed in all neonates, and 85.1% had an SpO₂ saturation below 90%. CPAP was successful in 81.6% of the cases(12)

A randomized control trial was conducted at a tertiary hospital in Tanzania from December 2016 to May 2017, involving 824 babies admitted to the neonatal care unit. Out of these, 187 were preterm, and 48 were recruited and randomized (25 to bCPAP and 23 to oxygen therapy). The overall survival rate to discharge for all eligible participants was 58.2%, with a higher survival rate for those adhering to the treatment protocol. Babies in the bCPAP group had a survival rate of 77.3%, compared to 47.8% in the oxygen therapy group. The bCPAP-treated babies had a 52% lower risk of death compared to those receiving oxygen therapy. The median duration of treatment was 2 days for both groups, with a range of 0–16 days for oxygen therapy and 0–5 days for bCPAP. The median hospital stay was 14 days for the bCPAP group. Nasal bleeding was more common in the bCPAP group compared to the oxygen therapy group(13)

FIGURE 1, Conceptual Framework



4 Objectives

4.1 General

To assess the outcome of bubble CPAP for the management of preterm neonates with RDS and associated factors at NICU , TASH , Addis Ababa

4.2 Specific

- To determine outcomes of bubble CPAP for the management of preterm neonate with RDS
- To assess associated factors which determine the outcome of preterm neonates with RDS treated with bubble CPAP

5 Methods and Material

5.1 Study setting

The study was conducted at Tikur Anbessa Specialized Hospital , in NICU , Addis Ababa , Ethiopia . TASH , established in 1974 , is the largest tertiary hospital in the country . The hospital is administered by Addis Ababa university and is the largest and oldest teaching hospital . Under the department of pediatrics and child health the NICU provides care for sick neonates all over the country with a total of 60 beds available and approximately 150 neonates seen every month.

5.2 Study design and period

The study was conducted using a hospital based cross sectional study design, data was collected retrospectively from January 2024 to January 2025 G.C from chart review.

5.3 Source Population

- ☒ all preterm neonate with GA b/n 28 to 36 6/7 weeks admitted to NICU , TASH

5.4 Study population

- ☒ all preterm neonate with GA b/n 28 to 36 6/7 wk with RDS on CPAP admitted to NICU , TASH during the study period

5.5 Sample size and Sampling methods

- ☒ The sample size is determined using single population proportion formula

Sample size calculation formula: $n = \frac{(Z \alpha/2)^2 P (1-P)}{d^2}$

Where:

- n is sample size,
- z is the probability of the error going to estimate(1.96),
- d is precision required (5%), and
- p is 50 %

Sample size = 384

Sample size Correction formula For finite population (<10,000)

$$n = \frac{n^{\circ}}{1 + ((n^{\circ} - 1) / N)}$$

n= Corrected sample size

n°= sample size calculated early

N= Total number of population in the study area

Final corrected sample size = 186

5.6 Sampling Method

A simple random sampling where neonates with RDS managed on CPAP was included and data was collected retrospectively from chart review.

5.7 Inclusion and exclusion criteria

5.7.1 Inclusion criteria:

- All preterm neonate with GA b/n 28 to 36 6/7 wk with RDS

5.7.2 Exclusion criteria:

- ☒ Preterm neonates with severe respiratory distress who require immediate invasive respiratory support

- ☒ Preterm neonate with lethal congenital malformation and syndromic babies

5.8 Data collection and measurements

All relevant data was collected from the medical records by trained data collectors with questionnaires at NICU . Data was collected retrospectively from chart review.

5.9 Data handling

The primary investigator checked for data cleanliness and completeness .The hard copies were converted into soft copies stored on hard drive and ready for analysis and back up copy was stored on separate drive

5.10 Study variables

5.10.1 Dependent variables

- ❖ Outcomes of bubble CPAP for the management of preterm neonate with RDS

5.10.2 Independent variables

- ❖ Socio demographics status (Gestational Age,Sex ,Birth weight)
 - ❖ Maternal factors (Antenatal steroid,Multiple gestation, maternal illness during pregnancy(preeclampsia, APH, PROM, Mode of delivery)
 - ❖ Patient related (down score, APGAR score, Level of oxygenation, Surfactant administration,Concomitant illness)

5.11 Data Quality Assurance

Primary investigator checked collected data completeness and it was coded. Then converted to soft copy and was again cross checked with the hard copy for neatness, Completeness and its consistency before carrying out any statistical analysis.

6. Data analysis

After thorough cleaning and checking for its completeness data was entered into Statistical Package for Social Sciences ver. 25 (SPSS) for subsequent descriptive analysis such as Mean frequencies and percentage as appropriate. Chi square test and multiple logistic Regression analysis was used to analyze the association between variables where Applicable. Statistical significance will be taken for p values of <0.05 for all statistical tests.

7 Ethical consideration

Ethical clearance to conduct this study was obtained from the Pediatrics and Child Health Department's Research and Publications Committee of the School of Medicine, College of Health Sciences, Addis Ababa University. Confidentiality was fully maintained during Data Collection and further analysis and dissemination of results.

8 Dissemination of finding

The finding of the study was presented on the research defense day and a formal report will be submitted to the Department of Pediatrics and Child Health with both soft and hard copy. For the publication purpose, the abstract of this thesis will be submitted to national or international Peer reviewed publishers.

9 Operational definitions

Bubble CPAP= is a non-invasive respiratory support method which involves delivering a continuous flow of air or oxygen through a nasal cannula, with the air passing through a water column in a small container. This "bubbles" the air, helping to maintain a consistent positive pressure in the baby's airways, which helps keep the lungs open and improve oxygenation.

Very preterm = GA b/n 28 - 31+6 weeks

Moderate preterm = GA b/n 32 - 33+6 weeks

Late preterm = GA b/n 34 - 36+6 weeks

RDS = Preterm neonates presenting with respiratory distress due to surfactant deficiency.

Early CPAP initiation=with in 15 minutes of birth (9)

10 Result

Socio-demographic characteristics of the mother

In this study, the majority of mothers, 92 (49.4%), were aged between 26 and 34 years, with 63 (33.9%) receiving antenatal steroids. In terms of delivery mode, 70 (37.6%) of the mothers gave birth vaginally. Pregnancy-induced hypertension was observed in 38 (20.4%) of the mothers, followed by premature rupture of membranes (PROM) in 17.7% and antepartum hemorrhage (APH) in 12.4%. Other conditions included abnormal fetal Doppler findings (4.3%), cardiac illness (0.5%), and diabetes mellitus (1%). Singleton deliveries were recorded in 122 (65.6%) of the cases.

Table 1. Socio-demographic characteristics among mothers of preterm neonates with RDS at NICU, TASH, Addis Ababa; Hospital, 2024.

Variables	Frequency(n=186)	Percentage (%)
Age group		
<=25 years	77	41.3
26-34 years	92	49.4
>=35 years	17	9.3
Mode of Delivery		
Cesarean delivery	116	62.4
Vaginal delivery	70	37.6
Antenatal Steroid		
Given	63	33.9
Not Given	123	66.1
Maternal Illness During Pregnancy		
None	49	26.3
Pregnancy Induced HTN	38	20.4
PROM	33	17.7
APH	23	12.4
All Others (15 conditions)	43	23.1
Number of Gestation		
Singleton	122	65.6
Twin	53	28.5
Triplet or more	11	5.9

Socio-demographic characteristics of the neonate

The study also found that 93 (50%) of the neonates were male, while 86 (46.2%) were classified as late preterm (34 to 36+6 weeks). In terms of birth weight, 116 (62.3%) neonates had weights ranging from 1500 g to 2499 g and 162 (87.1%) were classified as appropriate for gestational age (AGA). Additionally, 18 (9.6 %) neonates had first and fifth-minute APGAR scores of less than seven. Nearly all, 185 (99.5%), did not receive surfactant therapy. Concerning concomitant illnesses, 131 (70.4%) neonates developed sepsis and 11 (5.9%) experienced nasal trauma, and 4 (2.2%) developed pneumothorax as a complication of CPAP. Furthermore, 10 (5.4%) neonates required mechanical ventilation. The study also revealed that 72(38.7%) of the neonates required CPAP for 48-72 hours while CPAP was initiated in the first 15 minutes in 143 (76.9 %) of the neonates . 143 (76.9%) had a mild down score, and 92 (49.5%) stayed in the hospital for more than seven days.

Table 2. Socio-demographic characteristics of preterm neonate with RDS at NICU, TASH, Addis Ababa; Hospital, 2024.

Variables	Frequency(n=186)	Percentage (%)
Concomitant Illness		
Sepsis	131	70.4
Sepsis, NEC	21	11.3
Sepsis, Pulmonary hemorrhage	9	4.8
Sepsis, NEC, Pulmonary hemorrhage	5	2.7
Others	20	10.8
Complications of CPAP		
Nasal trauma	11	5.9
Pneumothorax	4	2.1
None	171	91.9
Is a mechanical ventilator required?		
No	176	94.6
Yes	10	5.4
Duration of CPAP		
Less than 48 hours	68	36.6

48-72 hours	72	38.7
Greater than or equal to 72 hours	46	24.7
Time of initiation of CPAP		
Less than 15 minutes	143	76.9
Greater than 15 minutes	43	23.1
Down Score		
<4	143	76.9
4-7	40	21.5
Greater or equal to 8	1	.5
Length of Hospital Stay		
<=7days	94	50.5
>7days	92	49.5
Gestational Age		
Late preterm (34wk-÷6+6wk)	86	46.2
Moderate preterm (32wk-33+6wk)	69	37.1
Very preterm (GA 28 wk- 31+6 wk)	31	16.7
Weight for Gestational Age		
AGA	162	87.1
LGA	3	1.6
SGA	21	11.3
Birth Weight		
Less than 1000 gm	9	4.8
1000gm-1499gm	56	30.1
1500gm-2499gm	116	62.3
Greater than or equal to 2500 gm	5	2.7
Surfactant Given?		
Yes	1	0.5
No	185	99.5
APGAR Score		
<7	18	9.6
>=7	151	90.4

Outcome of bubble CPAP

In this study, Death was apparent among 33 (17.7%), 95 % CI (13.3, 23.8). (See figure 2).

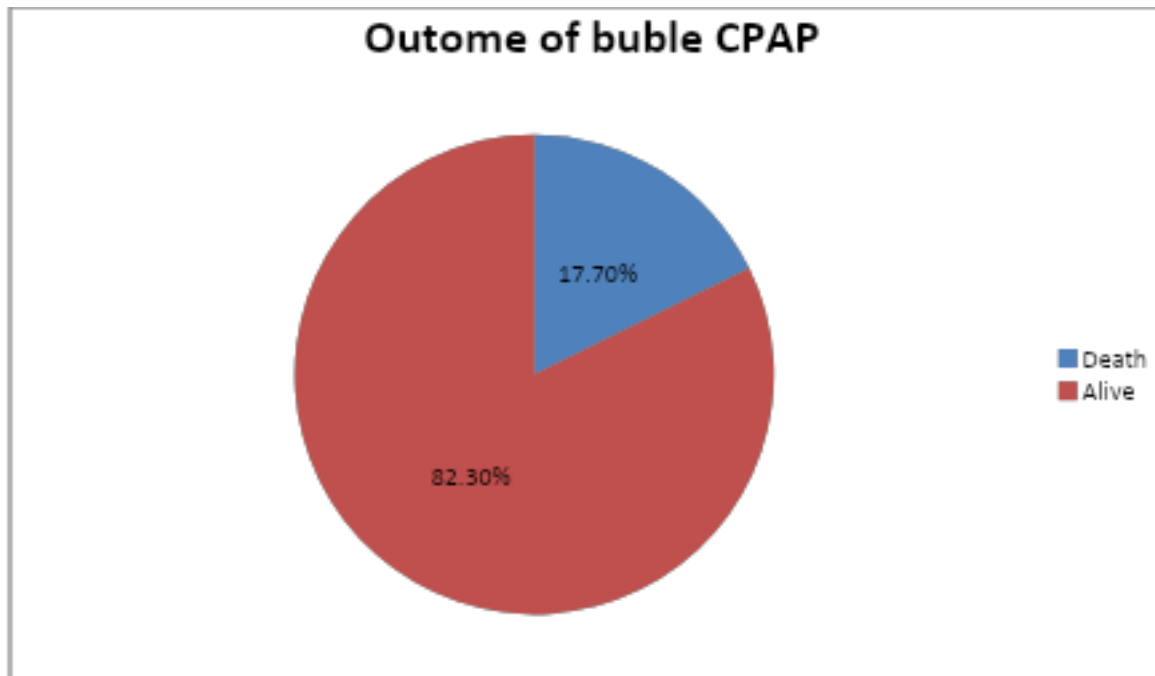


Figure 2. Outcome of bubble CPAP among preterm neonate with RDS at NICU, TASH, Addis Ababa; Hospital, 2024

Factors Associated with Outcome of bubble CPAP

To identify factors associated with outcome of bubble CPAP , both Bivariable and multivariable logistic regression analysis was done. Accordingly, eight variables were checked if they are candidates for the multivariable model. The candidate variables were selected based on the p-value and those having $p < 0.25$ were taken to the multivariable logistic regression mode .Then, four

variables having p-value of less than 0.25 were taken to the multivariable model. Model fitness was checked by Hosmer-Lemeshow test of goodness of fit and revealed ($P>0.66$).

Finally, two variables (being very preterm and having sepsis as a concomitant illness) were found to be statistically significantly associated with death as an outcome of CPAP.

Accordingly, very preterm (GA 28 wk- 31+6 wk) neonates have 2.1 times increased chance of encountering death as an outcome of CPAP. (AOR=2.10, 95%CI (1.331, 155.342))). Likewise, preterm neonates who had sepsis as a concomitant illness had a 2.19 times higher odds of developing death as an outcome of CPAP (AOR=2.059, 95% CI, (2.059, 67.62) (See table 3).

Table 3. Bivariable and Multivariable Logistic Regression analyses of factors associated with Outcome of bubble CPAP among preterm neonates with RDS at NICU, TASH, Addis Ababa; Hospital, 2024.

Variables	Outcome of bubble CPAP		COR(95%CI)	P-value	AOR(95%CI)
	Survived (0)	Death (1)			
Gestational Age					
Late preterm (34wk- ÷6+6wk)	80	4	1	1	1
Moderate preterm (32wk- 33+6wk)	59	8	0.821(.011,0 .93)	0.001*	1.06(0.213, 88.31)
Very preterm (GA 28 wk- 31+6 wk)	11	19	.027(.008, .093)	0.001*	2.10(1.331,155.342)**
Birth Weight			.083(.030, 2 .228)	0.31	
1000gm-1499gm	37	16	.013(.0013, 1.073)	0.43	
1500gm-2499gm	108	6	.037(.0032, 1.023)	0.27	
Greater than or equal to 2500 gm	4	0	1	1	
Less than 1000 gm	0	9			

Maternal Illness During Pregnancy					
None			1	1	
Pregnancy Induced HTN			1.02(0.932,11.654)	0.33	
PROM			1.77(0.741,18.95)	0.28	
APH			2.02(0.472,22.31)	0.26	
Others			1.11(0.541,13.12)	0.42	
Down Score					
<4	130	12	1	1	
4-7	20	18	2.06(0.231,22.12)	0.29	
Greater or equal to 8	0	1	1.95(0.7811,19.961)	0.27	
Duration of CPAP					
Less than 48 hours	53	15	1	1	1
48-72 hours	58	14	2.972(0.918,9.622)	0.069	
Greater or equal to 72 hours	42	4	2.534(0.779, 8.248)	0.122	
Time of initiation of CPAP					
Less than 15 minutes	121	22	1	1	1
greater or equal to 15 minutes	32	11	0.529(0.232,1.203)	0.129	
Concomitant Illness					
Sepsis			.044(.010, .0544)	0.001*	2.19(2.059, 67.62)**
Sepsis, NEC					
Sepsis, Pulmonary hemorrhage					
Sepsis, NEC, Pulmonary hemorrhage					
Others					
none			1	1	1

Antenatal Steroid					
Given	106	17	1	1	1
Not Given	47	16	.471(.219, 1.012)	0.054*	1.781(.554, 5.723)
Surfactant Given?					
Yes	1	0	1	1	
No	153	33	1.126(.331, 89.94)	0.45	

* Candidate variables for final model i.e. Multivariable Logistic Regression at $p < 0.25$

** Variables statistically significant at a p-value < 0.05

Discussion

In this study the prevalence of death as an outcome CPAP was 17.7% and the factors associated were, being very preterm and having sepsis as concomitant illness.

In a study conducted in India involving 170 neonates, 30.5% of the infants required mechanical ventilation and given surfactant, and 8% of the infants died during their hospital stay. In comparison, the present study found a higher prevalence of death as an outcome of CPAP, with

17.7% of infants dying, and 5.3% requiring mechanical ventilation and almost all(99.5 %) did not receive surfactant, and the associated factor was being very preterm which goes in line with this study(4).

A study in India assessed Bubble CPAP for RDS in preterm infants, with 7% requiring mechanical ventilation and 11% dying during hospitalization, showing higher mortality in those needing ventilation. And factors associated with the outcome included sepsis and lack of exposure to antenatal steroid which is in line with this study with regard to sepsis as an associated factor . Pneumothorax occurred in 2 infants(0.03 %), which is lower compared to this study with 17.7% mortality, 2.1% pneumothorax cases, and 5.9% nasal trauma.(6)

In this study 82.3 % had improvement with bubble CPAP and only 5.4 % required mechanical ventilation which showed increased survival as compared to a study conducted in India ,in which 150 neonates were included ; of those, 71.33% showed improvement with Bubble CPAP and were successfully weaned from respiratory support. In contrast, 28.67% of the neonates required mechanical ventilation (8).

The factors associated were being very preterm and having sepsis as a concomitant illness . As compared to a study conducted in Kenya, in which neonatal death was significantly associated with birth weight ($p=0.044$) . (11).

In a study done in Pakistan 87 neonates were included there were 16 (18.4 %) neonates in whom bubble CPAP was unsuccessful and apnea was significantly associated with the outcome ($p=0.0025$) while others had no significant association(13)

The possible justification for the higher level of death in the present study might be attributable to differences in magnitude of concomitant illness, gestational age of the preterm, differences in level of set up, and sample size.

Conclusion

The outcome of Bubble CPAP was death in 33 (17.7%) of the neonates which was higher than the other studies and being very preterm and having sepsis as concomitant illness were identified as having statistically significant association with death as an outcome .

Limitation of the study

The research was done in a single tertiary hospital and since its a cross sectional study long term outcome was not studied.

Recommendations

Early recognition and treatment of sepsis and implementing strict infection control measures

Greater efforts should be put in to decrease the burden of premature deliveries to decrease the frequency of RDS and its complications

To conduct further prospective studies

Enhanced follow-up care for infants who have undergone CPAP therapy may help in early detection of long-term complications and provide timely interventions.

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