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CLINICAL STUDY OF NEONATES RECEIVING OXYGEN THERAPY AND THEIR OUTCOMES

Neonatology

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KEYWORDS

INTRODUCTION

Oxygen administration is a common therapy in neonatal nurseries.[1]

Many neonates who get admitted in SNCU OR NICU receive oxygen therapy. Common clinical situations in which baby needs oxygen[2]:-

1. Need for resuscitation at birth
2. Birth asphyxia
3. Respiratory distress
4. Hypoxemia (SpO2 <87% or paO2 <50 mm of Hg) in room air
5. Cyanosis
6. Hypothermia
7. Recurrent apneic attacks

Hypoxemia as well as hyperoxemia[3, 4] are harmful to the baby. SpO2 alone is not always indicative of adequacy of oxygen therapy.

In a study oxygen therapy each year over 5,000 infants (~ 2% of all infants born) in Australia receive oxygen therapy during their initial stay in a neonatal nursery and almost 300 of these infants required continued oxygen therapy at home after discharge[5].

The incidence of oxygen therapy is dependent on gestational age at birth with 97% of [7] 27 weekers receiving supplemental oxygen, whilst 79% of 28-31 weekers receive oxygen therapy during their initial hospitalisation[5].

If one could identify the preventable risk factors it would help to anticipate and intervene early for a better outcome.

Among neonates needing oxygen therapy, outcome depends not only on optimum oxygen therapy [SpO2 88-92% with lower and upper limits 85-95%] but also on clinical condition and biological maturity. Outcome determinants may differ from place to place.

If one can identify factors contributing to negative clinical outcome despite optimum oxygen therapy it will help improve management in addition to oxygen therapy.

Usual relation between SpO2 and paO2 is as follows[6, 8]:

Oxyhemoglobin saturation (SpO2)	PaO2
0 to 85%	0 to 45 mm of Hg
85 to 95%	45 to 65 mm of Hg
95 to 100%	65 to 500 mm of Hg

Though there is an approximate relation between SpO2 and paO2, paO2 always cannot be accurately predicted from SpO2 [9]. Ideally continuous arterial blood gas monitoring also will be required in certain neonates. In our situation where continuous paO2 monitoring is not feasible, there is a need to observe reliability of continuous SpO2 monitoring in maintaining optimum paO2.

AIMS AND OBJECTIVES

a) To identify maternal, perinatal and clinical factors in neonates needing oxygen therapy after birth.
b) To observe relation between pulse oximetry (SpO2) and ABG (SaO2 and PaO2).
c) To observe outcome in the babies (Survived or Expired) and identify factors associated with outcomes.

PATIENTS AND METHODS

The study was started after the protocol was approved by institutional ethics committee. Informed consent from the parent/legal authorized guardian is obtained.

Design of the study: Prospective cohort study.

Population: Neonates needing oxygen therapy.

Inclusion: Neonates born in DR.PSIMS &RF and getting admitted to NICU with a need for oxygen therapy.

Exclusion: Neonates born outside.

Sample size: 300 consecutive neonates needing oxygen therapy.

Follow up duration: Discharge or Death after starting O2 therapy.

Study period: November 2014 to October 2016.

Variables measured:
In the above sample of neonates the following variables will be measured.

Maternal variables:
Age, Height, Weight,Consanguinity Gravid,Para, Maternaldiseases, Maternal risk factors for infection and drugs and anesthetics.

Perinatal factors:
PROM and its duration,
Liquor-amnio (Clear, MSAF, Blood stained) mode of delivery,

Baby variables:
Gender
Gestational age (according to first trimester scan / LMP/ modified Ballard's score),Birth weight, Weight Category, Maturity Intrauterine Growth, Delivery Method, LSCS Indication, Fetal Distress,Congenital Anomaly, Delivery Care interventions, APGAR 1min, 5 min, 10 min, spo2 1 min,5 min, 10 min,

SpO2 at starting of oxygen therapy, fiO2, vital signs (by multi para monitor), ABG 30 min after starting oxygen therapy and as and when required by clinical condition of the baby Clinical and Laboratory Problems of neonate,O2 therapy starting time (hours), stopping time (hours) Diagnoses (HIE, heart diseases, respiratory distress). Treatment given,Final outcome.

Methodology:
A detailed case history was taken, general and systemic examination were performed. The observations were noted in a case proforma

Statistical Analysis:
The data was entered into case proforma , and converted into Electronic database using Microsoft excel 2007.Statistical analysis was done using EpiInfo™ 7.1.5.2 of centre for disease control,USA and Medcalc15.11.4 ,Belgium .

Numerical continuous variables were summarized as mean or median with corresponding 95% confidence limits, standard deviation and range. Normality of distribution is tested by D'Agostino-Pearson test which computes a single P-value for the combination of co-efficient of skewness and kurtosis .If the continuous variables were having non-normal distribution despite logarithmic transformation, median and corresponding 95% confidence limits were considered for further statistical analysis.

The Mann-Whitney U test was used to test the significance of the difference between medians of two independent samples and t-test for difference between means.

Categorical variables were summarized by frequency, percentage and its 95% confidence limits. Degree of association between categorical variables is evaluated by chi-squared test or Fisher exact test.

A test statistic was considered significant if the resulting P-value is small (P<0.05).

OBSERVATIONS & RESULTS

Most of the mothers of neonates receiving oxygen therapy are gravida one and para one and with at least one alive child.

The mothers with at least one abortion are nearly 73% (95% CI 57.2% to 85%) and with two abortions is 23%.

Parental consanguinity of some degree is present in 11.6%, among the study population.

Among the mothers of neonates receiving oxygen therapy about 13.33% have preeclampsia, 12.89% have gestational hypertension, 6.22% have hypothyroidism, 3.11% have eclampsia and Gestational diabetes mellitus in 2.22%.

Most of the mothers are not anemic (97%), not asthmatic (98.2%), not hypertensive (87.11%).

The prevalence of anemia, asthma, eclampsia, GDM and epilepsy are low.

About 36.6% mothers needed antenatal steroids showing the suspicion of premature labor. Antenatal folic acid is not received by 3.11% of mothers. All mothers received Iron, calcium and tetanus toxoid injections.

Babies delivered by Caesarean section are 46.22% among which 31% are by emergency cesarean sections. About 54% are vaginal deliveries. Fetal distress is observed in 6.22% of babies, PROM in about 9.8% and PPROM in about 6%. MSAF was observed in 24% of the babies.

But the duration of PROM is not abnormal (Geometric mean 8.9hours).

The median APGAR score at 1 minute is 6. Score at 5 minute is 7 and at 10 minutes is 9.

Out of 4 babies with APGAR recorded at 15 minutes, 2 babies who survived are having a score of 10 and 9 respectively and other 2 babies who expired are having scores 0 and 3 respectively.

Delivery room care warmth, suction, stimulation are given to all babies. About 30.67% required bag and mask ventilation, 13.33% required intubation, 5.78% required chest compressions,1.78% required epinephrine at birth.

The median gestational age of babies receiving oxygen therapy is 38 weeks, and median weight being 2610 grams. This implies that a significant number of term and normal birth weight babies needed admission in NICU for oxygen therapy.

The median age at admission in these babies is 1st hour of life.

Sepsis is found in 20% of babies among the study population with bacterial sepsis accounting for majority (97.73%).

The common clinical problems in neonates are jaundice(42.67%), pneumonia (41.33%), perinatal asphyxia (26.67%), sepsis (20.44%) followed by prolonged activated partial prothrombin time (17.33%), bleeding diathesis (16%), DIC (11.56%).

The common supportive therapies needed by the babies among the study population are phototherapy in 49%, Continuous positive airway pressure in 26.67%, platelet transfusions in 18%, Fresh frozen plasma transfusions in 15% and The common supportive therapies needed by the babies among the study population are phototherapy in 49%, Continuous positive airway pressure in 26.67%, platelet transfusions in 18%, Fresh frozen plasma transfusions in 15% and mechanical ventilation support in 7%.

There is a significant difference in gestational age between the survived and expired groups. Median gestational age in survived is 38 weeks (95%CI 38 to 38 weeks) and in expired group is 35 weeks (95%CI 32.1 to 37 weeks)

There is a significant difference in Birth weights between the survived and expired groups. Median birth weight in survived group is 2640 grams (95% CI 2560 to 2734 grams) and in expired group is 2055 grams (95%CI 1261.7 to 2533 grams).

Babies who did not need continuous positive airway pressure, mechanical ventilator support, phototherapy are having decreased mortality, when compared to those who require them with odds ratio 0.38 (95%CI 0.15 to 0.93), 0.02 (95%CI 0.004 to 0.11), 4.88 (95% CI 1.82 to 15.19) respectively.

Babies in whom breast feeding could be started have more survival chance, when compared to babies in whom breast feeding could not be initiated, with odds ratio 48 (95% CI 15.3 to 162.1).

The first ABG done at a median age of 4.5 hours of life shows a significant difference in the SaO2 values between expired (94.4%, 95% CI 84.1% to 96.8%) and survived (97%, 95% CI 96% to 97.7%).

This shows that babies' survival is significantly more when ABG done at median age of 4 hours has SaO2 between 96% and 98%.

In the cohort of neonates receiving oxygen therapy the case fatality rate is 14.1% (95% CI 9.8% to 19.6%).On multivariate logistic regression analysis the factors associated with risk of death in babies receiving oxygen therapy are delivery room interventions (oxygen,bag and mask, endotracheal tube intubation, chest compression, epinephrine, intravenous fluids) with odds ratio 8.24 (95%CI 1.77 to 38.36), shock with Odds ratio 9.75 (95% CI 0.79 to 119.38), prothrombin time prolongation with Odds ratio 17.24 (95% CI 2.38 to 124.83), antenatal steroids 2nd dose to mothers odds ratio 8.42 (95% CI 1.67 to 42.44), Breast feeding could not be started, odds ratio 130.06 (95% CI 20.01 to 845.28) and requiring mechanical ventilation support with odds ratio 37.33 (95% CI 2.25 to 617.77).

Table-1 Correlation between oxygenation status by pulse oximetry and ABG

		1st SpO2	2nd SpO2	3rd SpO2	4th SpO2	ABG1 SO2	ABG2 SO2	ABG3 SO2	ABG 4SO2	ABG1 PO2	ABG 2PO2	ABG3 PO2	ABG4 PO2	
SpO2 1st	**r**		0.172	-0.037	0.667	**0.395**	0.125	-0.054	0.2	**0.355**	0.06	-0.008	0.4	
	P		0.2081	0.874	0.2189	**<0.0001**	0.3737	0.8218	0.8	**<0.0001**	0.672	0.9747	0.6	
	n		55	21	5	124	53	20	4	125	53	20	4	
SpO2 2nd	**r**	0.172		0.479	0.649	0.25	**0.42**	0.585	0.316	0.251	**0.468**	0.527	0.632	
	P	0.2081		0.0282	0.2362	0.0709	**0.0017**	0.0067	0.684	0.0672	**0.0004**	0.0168	0.3675	
	n	55		21	5	53	53	20	4	54	53	20	4	
SpO2 3rd	**r**	-0.037	0.479		-0.632	0.192	0.588	**0.823**	- 0.211	0.141	0.538	**0.789**	0.316	
	P	0.874	0.0282		0.2531	0.4305	0.0081	**<0.0001**	0.789	0.5538	0.018	**<0.0001**	0.6838	
	n	21	21		5	19	19	20	4	20	19	20	4	

SpO2 4th	r	0.667	0.649	-0.632		-0.4	0	0	0.8	-0.4	-0.6	0	0.4
	P	0.2189	0.2362	0.2531		0.6	1	1	0.2	0.6	0.4	1	0.6
	n	5	5	5		4	4	4	4	4	4	4	4
Spea rman rank correl ation coefficient													

The SpO2 values recorded at median age of 4 hours are correlating with ABG SaO2 and PaO2 done at same time.

The second SpO2 Values recorded at median age of 27.7 hours of life are correlating with corresponding ABG SaO2 and PaO2.

Similarly the third SpO2 recorded at median age of 58 hours is correlating with the ABG SaO2 and PaO2.

The degree of correlation between SpO2 and ABG values is having increasing trend when observed from 4 hours to 60 hours of life.

DISCUSSION

In this prospective cohort study of 225 neonates, who received oxygen therapy during their stay in NICU of rural teaching hospital, the following observations are made and compared with available literature:

Maternal problems observed during pregnancy in our study are preeclampsia(13.3%),gestational hypertension (12.9%), hypothyroidism (6.2%), eclampsia (3.1%), and gestational diabetes mellitus(2.22%).

In our study the proportion of gestational hypertension is similar to other studies[11,13,14,16,18,19,10].

The proportion of preeclampsia is higher in Nilufuret al[14] and Bahubaligane et al[18] study and lower in Hafiz et al[16] study when compared with our study.

The prevalence of maternal eclampsia in Nilufuret al[14], Hafiz et al[16], Bahubaligane et al[18] studies is similar to our study.

Other studies are reporting higher proportion of gestational diabetes mellitus compared to our study.

In our study anemia prevalence in our population is very low (3%) compared to other studies. Other studies reported prevalence range of 32 to 60%

The pre gestational maternal problems observed in our study are anemia(3%), asthma (1.8%), hypertension (2.89%) and epilepsy(1.78%).

The proportion of mothers in our study receiving antenatal steroids is 36.6% indicating the proportion of premature labor suspected by obstetrician. This is corresponding to the proportion of preterm babies in our study which is 35%.These observations indicate high proportion of preterm deliveries in our population, when compared with WHO prevalence of preterm deliveries in low income countries like India is 12% (range 5 to 18%).In a study by Hafiz et al antenatal steroids were required in 2.4% of mothers of the neonates admitted which is far below when compared with our study.

The prevalence of preterm babies in our study is 35% is similar to that of the other studies above[14,15,16,20,19].

In sayidbakriyaet al[20] and hafiz et al [16] the prevalence of preterm neonates is more.

Though most of the mothers in our study received folic acid about 3.1% did not receive indicating the need of efforts to make it 100%, as it prevents an important congenital anomaly of neural tube defects. There is one baby with meningomyelocoele in our study populationNatal problems observed in our study are meconium stained amniotic fluid (24%), premature rupture of membranes(9.8%), fetal distress(6.2%) and PPROM(6%).But the duration of PROM(geometric mean 8.9 hours) is not clinically defined abnormal duration.

Delivery room factors and clinical factors in neonates receiving oxygen therapy

The median Apgar score at 1 minute is 6, score at 5 minute is 7 and at 10 minutes is 9

In our study the 1 minute APGAR is 6 which is below the observations suggested value in a normal new born baby (About 90% of normal term newborns have an APGAR between 8 and10 during their first breath in first 10 seconds) and it showed improvement by 10 minutes.

These observations indicate that many babies in our study had in utero problem and could not establish physiologically normal extra uterine cardiopulmonary status upto 10 minutes.

In general all the babies are having normal SpO2 from 1 minute to 10 minutes after birth. Nevertheless, 30% of babies needed oxygen in delivery room, about 30.7% required bag and mask ventilation in delivery room and later all the 225 babies needed oxygen therapy in NICU.

This is indicating that babies who had normal oxygen status immediately after delivery developed problems in the coming hours which necessitated oxygen therapy. So one has to be cautious and observe babies for a few hours after birth without getting complacent with the normal oxygen saturation values in the delivery room.

So in our population APGAR scores up to 10 minutes still may be of use for exercising caution despite normal pulse oximetry readings.The proportion of severely depressed babies in delivery room is 13.3% as indicated by the requirement for endotracheal tube intubation and 6% requiring chest compressions. The proportion of severely depressed babies is high in our study compared to prevalence of such severely depressed babies reported in literature 1 to 2%.

The common clinical problems identified in these babies are jaundice(42.67%), pneumonia (41.33%), perinatal asphyxia (26.67%), sepsis (20.44%) followed by prolonged activated partial prothrombin time (17.33%), bleeding diathesis (16%) and DIC (11.56%).

Jaundice per se is not the primary disorder. It is most likely a part of sepsis because no hemolytic anemia or other reasons could be found in these babies. Among them 20.4% have culture proven sepsis and remaining 23% are most likely due to clinical sepsis.

The proportion of very seriously ill to seriously ill neonates in our study is from 7% to 27% as indicated by the requirement of CPAP and ventilator respectively.

Oxygenation status by pulse oximetry and arterial blood gas analysis in babies receiving oxygen therapy:

In our study at 4 hours, 27.7 hours, 60 hours the SpO2, SaO2 and PaO2 corresponding values are as follows:In our study the correlation between SaO2 and SpO2 is ranging from r values of 0.4 to r value of 0.8.

Though correlation values are low to moderate, all the values of SpO2 and SaO2 are within normal range. But the previous studies done in sick newborns show that pulse oximetry values were highly correlated with measured SaO2 values; values of 92 ± 3% were associated with PaO2 values of 45 to 100 mm of hg[23,29].

In the studies by other investigators Jung Hwan choi et al, Deckardt and Steward, 1984; New, 1985; Durand and Ramanathan,1986; Harris *et al.* 1986; Ramanathan*eta/.* 1987; Jennis and Peabody, 1987; House *et a/.* 1987; Fanconi, 1988 there isvery good linear relationship between simultaneous pulse oximetry SpO2 and measured Sa02 by co-oximeter(r = 0.9)[21-28].

Differing fetal hemoglobin levels with differing gestational age babies and various other clinical factors which influence oxy-hemoglobin dissociation curve like acidosis may result in varying correlation values between pulse oximeter and arterial blood gas analysis in different studies.

Risk factors associated with mortality in neonates receiving oxygen therapy:

Antenatal steroid need to the mother in our study is found to be a risk

factor for neonatal mortality on multivariate analysis. The risk of baby dying is associated with mother receiving 2 doses of steroid.

This can be explained by the higher degree of prematurity in babies whose mothers received antenatal steroids.

In our study by Kruskal-wallis test the median gestational age of babies of mothers who received first dose of steroid is 33 weeks, the median gestational age of babies of mothers who received 2nd dose of steroid is 35 weeks and median gestational age of babies of mothers who received no steroids is 38 weeks.In post hoc analysis there is significant difference between gestational age of babies of no steroid mothers and other 2 groups (1st dose and 2nd dose) but not between gestational age of 1st dose and 2nd dose babies.

Test statistic- 66.68 Correlated for tie Ht: 68.125 Degree of freedom: 2 P < 0.000001 But gestational age is not found to be a risk factor on multivariate analysis.

This shows that prematurity per se is not mainly responsible for mortality but the complications like DIC, prolonged prothrombin time, shock, encephalopathy associated with prematurity are responsible for mortality.

The proportion of expired babies in the clear amniotic fluid group is 16.7% and in meconium stained amniotic fluid group is 5.8%.
The lesser mortality in meconium stained amniotic fluid group compared to clear amniotic fluid group is likely to be due to following reasons:

1. Probably there are factors other than meconium stained amniotic fluid which are responsible for mortality.
2. Meconium aspiration syndrome babies who are more mature, when taken appropriate clinical care, are likely to survive compared to clear amniotic fluid group babies with prematurity and its associated complications like DIC, prolonged PT, sepsis, encephalopathy.

In the clear amniotic fluid group more preterm babies are found. Their gestational age ranges from 28 to 42 weeks where as in meconium stained amniotic group gestational age is ranging from 35 to 41 weeks.The proportion of babies who expired is more when there was need for delivery room care oxygen therapy, bag and mask ventilation, intubation, chest compression, epinephrine and intra venous fluid.

Babies who did not require delivery room care (oxygen, bag and mask, intubation, chest compression, epinephrine, intravenous fluid) are 0.3 times (95% CI 0.1 to 0.6; p value 0.002) less likely to die when compared to babies who needed these interventions.

The babies who needed delivery room care are 8.2 times more likely to die when compared to those who did not require these interventions.

APGAR at 1 minute is significantly lower in expired group (score 3.5) compared to survived group (score 6).APGAR at 5 minute is also significantly lower in expired group (score 6.5) compared to survived group (score 7).APGAR at 10 minute is also significantly lower in expired group (score 8) compared to survived group (score 9).

These observations indicate that about 30% of babies in our study had in utero problems and they could not establish physiologically normal extra uterine cardiopulmonary status. This is evidenced by the observations of a good number of babies needing delivery room care interventions like oxygen therapy, bag and mask, intubation and chest compressions.

The SpO2 at 1 minute, 5 minutes and 10 minutes showed a significant difference between the survived and expired groups.

The median SpO2 1 minute in survived group is 74% (95%CI 72% to 75%) where as in expired group is 65% (95% CI 60.4% to 67.8%).

The median SpO2 at 5 minutes in survived and expired groups is 85% (95% CI 85% to 85.1%) and 77% (95% CI 72.7% to 80.0%) respectively.The median SpO2 at 10 minutes in survived group is 93% (95% CI 92% to 94%) and expired group is 88% (95%CI 82% to 90.4%).

Though in expired groups the SpO2 values are as per guidelines indicated normal values for the age, in the survived group the values are at much higher level compared to that of expired groups. These require further well defined studies.

The overall case fatality rate (Nonspecific /crude CFR) in the babies receiving oxygen therapy in our study is 14.15%.In swarnakaret al[12] study in neonates with respiratory distress the case fatality rate is 22.86%.

In nilufurshireen et al[14] and John B M et al[15] study the case fatality rate in neonates with birth asphyxia and respiratory distress is 16% and 14.5% respectively which is in par with our study.Leeanne et al[17] and sayidbakria et al[20] study is reported case fatality rate far below our study.

On multivariate logistic regression analysis the factors associated with risk of death in babies receiving oxygen therapy are Delivery room care interventions like oxygen therapy, bag and mask, intubation and chest compressions, epinephrine and intravenous fluid with odds ratio 8.24 (95%CI 1.77 to 38.36).

Shock with Odds ratio 9.75 (95% CI 0.79 to 119.38),

Prothrombin time prolongation with Odds ratio 17.24 (95% CI 2.38 to 124.83), Antenatal steroids 2nd dose odds ratio 8.42 (95% CI 1.67 to 42.44), Breast feeding could not be started odds ratio 130.06 (95% CI 20.01 to 845.28, Requiring mechanical ventilator support with odds ratio 37.33 (95% CI 2.25 to 617.77).

These observations suggest that in babies receiving oxygen therapy there are factors other than optimum oxygen therapy that influence the mortality. When these factors are anticipated/ identified early, better and focused care to those babies with these risk factors can be given. It will help to reduce mortality further in these studies.

In a study by john B M et al the factors associated with mortality are birth weight<1620grams (OR 1.002 95%CI 1.00 TO 1.004),gestational age<31 weeks(OR 0.60 95%CI 0.42 TO 0.86), APGAR<6(OR 0.59 95%CI 0.30 TO 1.15), Downes>3(OR 1.42 95%CI 0.85 to 2.36), oxygen saturation <86%(OR 1.02 95% CI 0.86 to 1.21).

In a study by lee anne et al unattended deliveries (OR 2.51), premature infants (OR 2.280), maternal fever with prematurity (OR 7.53) are the factors associated with death.

However these factors were not found as risk factors for mortality in our study.

SUMMARY AND CONCLUSION

In this prospective cohort study of 225 neonates admitted in NICU of rural teaching hospital receiving oxygen therapy the following are the important observations

1. Common maternal problems during pregnancy are preeclampsia (13%), gestational hypertension (13%). Interestingly the prevalence of maternal anemia is very low (3%). The proportion of mothers received antenatal steroids is 36.6%.
2. The prevalence of prematurity among these admitted babies is 35%.
3. The proportion of severely depressed babies who needed endotracheal tube intubation in delivery room is 13.3% and 6% of delivered babies needed chest compression in delivery room. About 30% of babies needed oxygen therapy and bag and mask ventilation in delivery room.
4. The common clinical problems encountered are jaundice (a marker of sepsis) in 42.7%, pneumonia in 41.3%, perinatal asphyxia in 27.1%, sepsis in 20.4%, prolonged APTT in 17.3% and prolonged PT in 9.1% and bleeding diathesis in 16%.
5. The properties of seriously ill to very seriously ill neonates during their stay in NICU is 7 to 27% who needed CPAP and or ventilator support.
6. The correlation between SpO2 by pulse oximetry and SaO2 by blood gas analysis is ranging from r value of 0.4 to 0.8. Nevertheless, the median SpO2 by pulse oximetry is 97% to 98%. Hence pulse oximetry looks satisfactory in monitoring the oxygenation status of neonates.
7. The risk factors for mortality among babies receiving oxygen therapy are:

- Babies needing delivery room interventions (oxygen, bag and mask, endotracheal tube intubation, chest compressions, epinephrine and intravenous fluids) are having higher risk of death (OR 8.24)
- Neonates with shock have higher risk of death (OR 9.75)
- Prolonged prothrombin time is associated with higher risk of death (OR 17.24)
- Mothers requiring antenatal steroids is associated with higher risk of death of neonates (OR 8.42)
- Breast feeding when could not be started due to the clinical condition is associated with higher risk of mortality (OR 130.1)
- Needing mechanical ventilation support is associated with higher risk of death (OR 37.3)

8. The clinical characteristics and risk factors are compared with other studies and differences are noted.
9. The identification of the risk factors associated with mortality in this population of babies will help in future reduction of mortality by focused and closely monitored care to such group of babies.

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