Original Research Article

Impact of cesarean section on transient tachypnea of the newborn: a longitudinal study

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ABSTRACT

Background: Transient tachypnea of the newborn is a benign condition. The aim of the study is to find any correlation between the mode of delivery and occurrence of transient tachypnea of newborn.

Methods: Study is proposed to assess the risk factor like caesarean section and its relationship with occurrence of TTN in term neonates and the clinical course of TTN cases admitted in Neonatal intensive care unit (NICU), Department of Pediatrics, Kamineni Institute of Medical Sciences, Narketpally, Nalgonda, Telangana.

Results: During the study period, total number of deliveries in our hospital was 4576. Of 356 term neonates with respiratory distress admitted in NICU, the most common cause was found to be early onset sepsis i.e. 168 of 356 cases accounting for 47.19%, followed by transient tachypnea of newborn i.e., 68 of 356 cases accounting for 19.10%.

Conclusions: The mode of delivery i.e., caesarean section has a significant impact on transient tachypnea of newborn (TTN) with a relative risk of 3.78 compared to normal vaginal delivery. The majority of cases had mild respiratory distress and were relieved of symptoms within 3 days of hospital stay.

Keywords: Transient tachypnoea of the newborn, Cesarean section, Respiratory distress, Newborn, Mode of delivery

INTRODUCTION

Transient tachypnea of newborn is a benign condition characterized by tachypnea that develops shortly after birth but resolves within 2-5 days.¹⁻³ Transient tachypnea of the newborn (TTN) was first described by Avery in 1966 in infants born at term who developed rapid respiration, with grunting and retraction at or shortly after birth.³

The presents usually within 6 hours of life with tachypnea (60-120/min), grunting with or without cyanosis and requires oxygen. The symptoms usually resolve by 48 hours, occasionally lasting as long as 5 days.

The possible causes of tachypnea in the newborn range from benign conditions such as transient tachypnea of the newborn (TTN) to more serious conditions such as primary pulmonary disease, sepsis, cardiac disease, metabolic problems, hypovolemia, anemia, polycythemia, and neurologic abnormalities.^{3,4}

Though it is a benign self-limiting disease, it is of concern because it is one of the common causes of respiratory distress in term babies and cause of morbidity and there are some cases which needed ventilatory support which are termed as "malignant TTN".⁵⁻⁹

Though there are many studies suggesting caesarean section as a risk factor for TTN but there is very minimal

data in our geographic area. This study is proposed to assess the risk factor like caesarean section and its relationship with occurrence of TTN in term neonates and the clinical course of TTN cases admitted in NICU, Department of Pediatrics, Kamineni Institute of Medical Sciences, Narketpally, Nalgonda, Telangana.

Aims

To study the impact of caesarean section on transient tachypnea of the newborn (TTN) in term neonates.

Objectives

To study the association between mode of delivery and occurrence of transient Tachypnea of newborn, to assess the course of transient tachypnea of newborn in terms of severity and duration of hospital stay.

METHODS

This study was done in the Department of Pediatrics, Kamineni Institute of Medical Sciences, Narketpally, during the period of September 2012 to October 2014.

This is a hospital based case series study, where 68 term neonates satisfying the clinical diagnostic criteria for TTN were taken up for the study. This study was approved by the research ethics committee at Kamineni Institute of Health Hospital.⁷

Inclusion criteria

Term neonates, born after 37 or more weeks of gestation, with clinical diagnostic criteria of transient tachypnea of newborn.

Exclusion criteria

Newborns with congenital malformations specially affecting the cardio-respiratory system, birth asphyxia (APGAR score <7 at 5 minutes), neonates with gestational age <37 week, sepsis, meconium aspiration syndrome, respiratory distress syndrome, mothers with alcohol or drug abuse, maternal diabetes and maternal asthma, metabolic disorders: hypocalcemia, hypoglycemia and polycythemia, instrumental deliveries.

Meconium aspiration syndrome was excluded when there were no abnormal chest radiography findings (irregular pattern of increased density throughout the lung) and no meconium staining of the skin. Respiratory distress syndrome was excluded when there were no reticular-granular patterns on the chest radiograph and no surfactant therapy was needed. Sepsis was excluded when there were no perinatal risk factors, no clinical signs and symptoms of sepsis (hypothermia, dull activity) WBC >5,000/mm³, negative C-Reactive Protein, and no focal infiltration on chest radiography and no growth in blood culture.

All cases taken up for the study, were subjected to detailed history taking and thorough clinical examination.

Gestational age was determined based on modified Ballard's scoring system.¹¹

The severity of respiratory distress was assessed according to the Downe's score.¹²

Clinical severity score

Downe's score for respiratory distress.

Table 1: Downes' score for respiratory distress.

Score	0	1	2
Respiratory rate/min	<60	60-80	>80
Cyanosis	None	At room air	With 40% O ₂
Retractions	None	Mild	Moderate-severe
Grunting	None	Audible with Stethoscope	Audible without Stethoscope
Air entry	Clear	Decreased	Barely audible

The following investigations were done: complete blood count, peripheral smear study, I:T ratio, C- reactive protein, blood culture and sensitivity, serum electrolytes, blood glucose, chest X-ray.

Course of TTN was assessed in terms of: severity of respiratory distress (was assessed according to Downe's score) and duration of hospital stay.

Duration of hospital stay was assessed in terms of resolution of signs and symptoms.

All information related to history, clinical examination, investigations, course during hospital stay, outcome was recorded in pre-structured proforma. The data collected was analysed using chi-square test in statistical package for social sciences (SPSS) version. p<0.05 was considered statistically significant. The association between mode of delivery and TTN, i.e the impact of caesarean section on TTN was shown as relative risk.

RESULTS

During the study period, total number of deliveries in our hospital were 4576. Among these deliveries, 3808 fulfilled the inclusion criteria of gestational age >37weeks and 768 were excluded as they were preterm neonates. Of these 3808 term neonates, 92 were excluded after application of exclusion criteria (instrumental deliveries, n=52; maternal diabetes, n=32; maternal asthma, n=4; congenital

anomalies affecting cardio-respiratory system, n=4). Remaining 3716 term neonates were enrolled for statistical analysis.

Table 2: Distribution of study subjects by different mode of deliveries (n=3716).

Mode of delivery	No. of cases (n)	
	N	%
Normal vaginal delivery (NVD)	1246	33.53
Caesarean section (CS)	2470	66.47
Elective CS	1020	27.44
Emergency CS	1450	39.03
Total term deliveries	3716	100

Table 3: Distribution of study subjects according to cause of respiratory distress in term neonates (n=356).

Etiology	No. of cases	
	N	%
Early onset sepsis	168	47.19
Transient tachypnea of newborn	68	19.10
Meconium aspiration syndrome	62	17.41
Perinatal asphyxia	32	8.98
Metabolic acidosis	14	3.94
Others	12	3.38
Total	356	100

Table 4: Distribution of TTN cases according to mode of delivery (n=68).

Mode of delivery	No. of cases	
	N	%
Normal vaginal delivery	08	11.77
Elective CS	32	47.06
Emergency CS	28	41.17
Total	68	100

Table 5: Relation between mode of delivery (elective CS versus NVD) and transient tachypnea of newborn (TTN) (N=40).

Type of lscs	TT					Total
	Yes		No			
	N	%	N	%		
Elective CS	32	3.14	988	96.86	1020	
NVD	08	0.64	1238	99.24	1246	

NVD: normal vaginal delivery, CS: caesarean section. *p=0.03.

Of 3716 term deliveries, 356 term neonates (9.5%) were admitted with respiratory distress to NICU. Among them,

288 term neonates had other cause of respiratory distress (early onset sepsis, n=168; meconium aspiration syndrome, n=62; perinatal asphyxia, n=32; metabolic acidosis, n=14; others, n=12) and after excluding these causes, 68 neonates were admitted with clinical diagnostic criteria of transient tachypnea of newborn.

Table 6: Distribution of cases according to severity of respiratory distress. (n=68).

Severity of respiratory distress	No. of cases
Downe's Score	%
Mild (0-4)	82.35
Moderate (4-6)	17.64
Severe (>6)	
Total	100

Table 7: Relation between mode of delivery and duration of hospital stay in TTN cases (n=68).

Mode of delivery	Duration of hospital stay					Total
	<3 days		3-5 days			
	N	%	N	%	N	%
CS	46	76.67	14	23.33	60	100
NVD	08	100	-		08	100

CS: caesarean section; NVD: normal vaginal delivery * p=0.28 not significant.

Of 3716 term deliveries: 1246 were delivered through NVD i.e 3.53%, 2470 were delivered through CS i.e 66.47%. Among 2470 CS (66.47%): 1020 were elective CS i.e 27.44% and 1450 were emergency CS i.e 39.03%.

Table 8: Relation between mode of delivery and severity of respiratory distress (n=68).

Mode of delivery	Severity of respiratory distress					
	Mild		Moderate		Total	
	N	%	N	%	N	%
CS	48	82.4	12	17.6	60	100
NVD	08	-	--	--	08	100

CS: caesarean section; NVD: normal vaginal delivery. *p=0.3. – it's not statistically significant.

In our study of 3716 term deliveries, 356 were admitted in NICU in view of respiratory distress i.e 9.58%.

Of 356 term neonates with respiratory distress admitted in NICU, the most common cause was found to be early onset sepsis i.e 168 of 356 cases accounting for 47.19%, followed by transient tachypnea of newborn i.e 68 of 356 cases accounting for 19.10%. The cases with Meconium aspiration syndrome (MAS) were 62 of 178 cases accounting for 17.41%, followed by perinatal asphyxia and metabolic acidosis 32 and 14 i.e 8.98% and 3.94% respectively. Others included 4 cases of hypoglycemia, 2

case of hypocalcaemia and 6 cases with HMD picture on chest X-ray. In total, other causes accounted for 3.38%.

In our study, transient tachypnea of newborn was found to be the 2nd most common cause of respiratory distress among term neonates admitted in NICU.

In present study, among total 68 cases of TTN, 32 were delivered through elective CS i.e 47.06%, 28 were delivered through emergency CS i.e 41.17%, 08 were delivered through normal vaginal delivery accounting for 11.77%.

A total of 60 cases of 68 TTN cases were delivered through caesarean section i.e 88.23%. The proportion of transient tachypnea of newborn cases in CS is 60/2268 i.e 2.42%, whereas the proportion of transient tachypnea of newborn cases in NVD is 8/1246 i.e 0.64%.

The calculated relative risk is 3.78 with 95% CI of 1.339 to 10.69, the chi-square value is 6.40 and p value is 0.0114. This shows that the risk of TTN in caesarean section is 3.78 times higher than in normal vaginal delivery.

This result is statistically significant as $p < 0.05$. This shows caesarean section acts as a significant risk factor for transient tachypnea of newborn in the present study.

The proportion of transient tachypnea of newborn cases in elective CS is 3.14%, whereas the proportion of transient tachypnea of newborn cases in Emergency CS is 1.93%. The calculated relative risk is 1.6 times, the chi Square value is 1.36 and p value is 0.2428.

There is no statistical difference in proportion of cases of TTN in elective CS and emergency CS. This implies there is no significant difference between the number of TTN cases delivered by elective and emergency caesarean sections in present study.

The proportion of transient tachypnea of newborn cases in Elective CS is 3.14%, whereas the proportion of transient tachypnea of newborn in NVD is 0.64%. In present study, the calculated relative risk is 4.89 (95% CI of 1.66 to 15.08), with a chi-square value of 8.68 and p value of 0.03. The risk of TTN in elective CS is 4.89 times higher than in NVD.

As $p < 0.05$, it is statistically significant that elective CS plays a significant role in TTN when compared to NVD. The proportion of transient tachypnea of newborn cases in emergency CS is 1.93%, and the proportion of transient tachypnea of newborn in NVD is 0.64%.

The calculated relative risk is 3.01 (95% CI of 0.99 to 9.30) and the chi-square value is 3.38 with p value of 0.03. As p value is < 0.05 , it is statistically significant. The risk of TTN in emergency CS is 3.01 times than that in NVD.

Thus, it shows, in present study, emergency CS also has an impact on TTN when compared to NVD in study. Majority of cases were males i.e. 54 constituting 79.42%, females were 14 constituting 20.58%. A male predominance is seen in present study.

The severity of respiratory distress in TTN was mild in majority of cases i.e 56 of 68 cases accounting to 82.35%, moderate in 12 of 68 cases i.e 17.64%. There were no cases with severe respiratory distress in present study. The duration of hospital stay, that is the duration for resolution of signs and symptoms is 3 days in 79.41% of cases and 3-5 days in 20.59% of cases. There were no cases with symptoms persisting for more than 5 days. This shows majority of TTN cases were admitted for less than 3 days in present study.

The mean duration of hospital stay was 1.9 ± 1.07 days in the present study. In total 68 cases of TTN delivered by caesarean section 54 cases i.e 76.67% were admitted for less than 3 days and 14 cases i.e 23.33% were admitted for 3-5 days. Whereas in TTN cases delivered by NVD, there were no cases admitted for more than 3 days and all the 8 cases were relieved of symptoms within 3 days of hospital stay.

The proportion of cases with mild respiratory distress was 48 of 60 neonates delivered through CS i.e 82.4% and the proportion of cases with moderate severity was 12 of 60 neonates i.e 17.6% in caesarean section. In TTN cases born through NVD, mild respiratory distress was seen in all 8 cases i.e 100%. There were no cases of moderate severity in neonates delivered through NVD.

The calculated risk estimate of severity of distress in CS was 0.2 when compared to NVD, which was not statistically significant. In present study, the cases with moderate severity of respiratory distress were more in neonates delivered through CS.

DISCUSSION

Respiratory distress is one of the common reasons for the indication of hospitalization during neonatal period in NICUs. Congenital pneumonia, early onset septicaemia, meconium aspiration syndrome, transient tachypnea of newborn, hyaline membrane disease, pneumothorax, other metabolic causes are common causes of respiratory distress in neonates.

Although morbidity and mortality rate is low in TTN, it is associated with an increased economic burden because it requires hospitalization, detachment from mother, numerous differential diagnostic interventions. So diagnosis and management of TTN is of concern. The risk factors for TTN reported in previous studies are Caesarean section, male gender, maternal diabetes, maternal h/o asthma. Among which mode of delivery i.e the impact of caesarean section on TTN was studied in the present study.^{7,8,13-17}

In our prospective hospital based study, the incidence of respiratory morbidity was 9.5% in term neonates delivered in our hospital.

Transient tachypnea of newborn was noted in 68 cases of 3716 term deliveries accounting for 1.8% i.e., 18 per 1000 neonates.

In present study of 3716 term deliveries, the proportion of caesarean sections was more than normal vaginal deliveries, i.e twice that of NVD, this indicates an increasing trend towards Caesarean section. The percentage of CS in our study was 66.47% which was in accordance with the data provided by Smith et al, where it was shown as 65% to 82% in some countries with private health centre.²² In study by Fedaker et al also the CS rate was high i.e 71.6%.²¹ However, globally the CS rate is varying from 18% and 31%, and in a study done at Asia, the CS rate was shown as 22.5% by WHO.^{21,22,24}

This high proportion of caesarean deliveries in present study may be because the place of study done was a tertiary care centre, where most of the cases admitted were those referred from other health care centers with maternal or fetal complications. This can be justified by the data in present study which shows emergency CS was more than elective CS. This shows most of the caesarean sections were done in emergency indications but not electively.

The most common indication of elective caesarean section was previous CS, followed by cephalo-pelvic disproportion and the most common indication for emergency CS was non-progression of labor, fetal distress, previous CS in labour and other maternal medical emergencies.

This study was conducted to study the impact of caesarean section on TTN. Similar studies were conducted by Tutdibi et al at Germany, Liston et al at Canada, Dani et al at Denmark, Fedaker et al at Turkey and Takaya et al at Japan.^{14,17,19,21,23}

Data in our study was collected prospectively. Information on type of delivery was validated before data entry and diagnosis of different etiologies of respiratory distress and TTN was made taking clinical and radiological criteria into consideration.

In present study, incidence of TTN was found to be 18 per 1000, this was high when compared with other studies. The incidence of TTN was ranging from 5.7 to 9 per 1000 in other studies.

This high incidence of TTN in present study when compared to other studies may be explained by the high rate of caesarean deliveries in the present study i.e 66.87%. Though TTN is one of the common causes of respiratory distress, there is wide variation in incidence of TTN in different studies. This may be because it is a diagnosis of exclusion, difference in sample size taken up for the study,

and a geographical variation. In addition, the inclusion and exclusion criteria like preterm deliveries, maternal diabetes and maternal asthma may have also influenced the incidence of TTN.^{14,23,24}

The number of TTN cases in present study was less because it was done in single tertiary care hospital in rural area and for a shorter duration when compared to other studies which were retrospective population based studies and done in multiple hospitals on a larger population.

The most common cause of respiratory distress in NICU was congenital pneumonia in the study done by Mathur et al at Delhi i.e 57.33%; study done by Fedaker et al at Turkey found TTN to be the most common cause of respiratory distress among term neonates i.e 76.7%; whereas in our study early onset sepsis was most common cause of respiratory distress i.e 47.19% of all term neonates admitted in NICU with respiratory distress.^{21,24}

This wide variation in the etiology of respiratory distress between our study and Fedaker et al may be because of geographical variation, where study by Fedaker et al was done at Turkey. Our study was in conformity with the study done by Mathur et al done at Delhi, however, the small difference of 10% may be due to inclusion of preterm neonates.^{21,24}

In our study, the proportion of TTN cases, as a cause of respiratory distress is 19.10% among term babies admitted in NICU, that is in conformity with the study done by Smith et al. at South Africa where the percentage of TTN cases was 24.4% of respiratory distress cases among term neonates born after 37 weeks of gestation.²² But there is wide variation with study done by Fedaker et al. may be due to geographical variation and more number of caesarean deliveries when compared to other studies.²⁴

The male predominance in our study (79.41%) is in accordance with many other studies done by Morrison et al at Denmark and Dani et al at Italy, who showed male gender as a risk factor for transient tachypnea of newborn (TTN). Dani et al study done at Italy showed a male preponderance of 57.57%.^{18,19}

The percentage of TTN cases among total NVD in present study was 0.64% that is matching with the study done by Dani et al where it was 0.5%. It was 3.7% in study done by Takaya et al at Japan.^{17,19}

In present study, the total TTN cases among caesarean section were 60 of 2470 cases i.e 2.42%. In deliveries by elective CS, it was 32 out of 1020 deliveries i.e 3.14% and in deliveries by Emergency CS it was 28 out of 1450 i.e 1.93%.

The proportion of TTN cases among elective CS was 3.14% which was comparable to Dani et al study, where it was 1.4%. However, the proportion of TTN cases among emergency caesarean deliveries was high in study done by

Dani et al i.e 14.7%, which was not comparable to our study, in which it was only 1.93%.¹⁷

In present study, the calculated relative risk of TTN in elective CS when compared to NVD is 4.89 with a p value of 0.03 which is matching with the study done by Tutdibi et al, where the odds ratio was 4.8 and $p < 0.01$.¹⁴

Other studies by Dani et al and Liston et al also clearly shows the impact of Elective cesarean section on transient tachypnea of newborn when compared to NVD with an odds ratio of 1.86 and 2.82 respectively.^{19,23}

In present study, emergency CS has a relative risk of 3.01 times compared to NVD on TTN. This was in accordance with a study done by Dani et al where the odds ratio was 2.86.¹⁹

However, the odd's ratio was 1.78 in a study done by Liston et al at Canada, i.e the risk of TTN was more in emergency CS when compared to NVD. However, the risk was not that high as in our study, because Liston et al compared TTN in infants delivered by emergency CS (i.e CS in labour) and spontaneous vaginal delivery. Whereas in our study emergency CS included those born by Caesarean section done in labor (i.e with indication of previous CS in labour, Cephalo-pelvic disproportion in labour,) and due to any maternal medical emergencies. The inclusion of maternal medical emergencies might have been responsible for this difference in risk ratio.²³

However, in present study, there is no much difference between the impact of elective and emergency caesarean sections on TTN. This was in contradiction to the study done by Tutdibi et al where there was clear difference between relative risk of elective and emergency CS on TTN.¹⁴ This may be because, in our study we defined emergency CS as caesarean section done in indications like fetal distress, non-progression of labor, cephalo-pelvic disproportion in labor and any maternal medical emergencies. But in study done by Tutdibi et al the maternal medical emergencies were taken under elective CS, and emergency and CS was considered only if the cesarean sections were done when the mother was in labor, i.e they divided the study subjects to two groups i.e with labor and no labor group. The study by Tutdibi et al, implies the protective role of labor on TTN.¹⁴

In total, caesarean section has a clear impact on TTN, caesarean section acts a significant risk factor for TTN when compared to NVD. Both elective and emergency caesarean sections have a greater risk when compared to NVD. This may be due to loss of hormonal influence of adrenaline on epithelial Na channels, that is present during a normal labour.^{5,11} The present study was in accordance with previous studies.

In a retrospective population based study done by Tutdibi et al from 2001 to 2005, the average duration of hospital stay or duration of oxygen supplementation in TTN cases

was 1.3 ± 1.1 days, in study done by Riskin et al the average duration of hospital stay was 7.2 ± 5.6 days, whereas in study done by Fedaker et al at Turkey the average duration of hospital stay or duration of tachypnea in all term neonates admitted with respiratory distress was 4.3 ± 0.9 days.^{14,21,25}

In present study the mean duration of hospital stay was 1.9 ± 1.07 days, which was in accordance with study done by Tutdibi et al. The wide variation with study done by Fedaker et al. may be because it included not only TTN cases but also other term neonates with respiratory distress of various etiologies.^{11,21}

In present study, 76.67% of neonates born through CS were admitted in hospital for less than 3 days and 23.3% of those were admitted for >3 days. This was in comparison with study done by Fedaker et al, in which the duration of hospital stay was less than 3 days in 64.7% of study subjects born by caesarean section and more than 3 days in 35.3%.²¹

In present study all the cases of TTN delivered through NVD were admitted only for less than 3 days whereas in study by Fedaker et al. 60.3% were admitted for <3 days, and 39.7% were admitted for >3 days. This variation may be because Fedaker et al studied duration of tachypnea not only in TTN but also in all term neonates admitted with respiratory distress.²¹

Limitations

Limitations of the study are the sample size is small and the number of actual cases manifesting with transient tachypnoea. A larger sample size is needed to get a more accurate picture of the incidence of transient tachypnoea of the newborn. This study was done in a tertiary hospital and the incidence in a primary or secondary level center setting is not known.

CONCLUSION

The mode of delivery i.e caesarean section has a significant impact on transient tachypnea of newborn (TTN) with a relative risk of 3.78 compared to normal vaginal delivery. The majorities of cases had mild respiratory distress and were relieved of symptoms within 3 days of hospital stay.

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