
Timing of Elective Repeat Cesareans Section: A Risk Factor for Acute Neonatal Respiratory Morbidity. "A Hospital- Based Study"

Tala A. Al-Awqati CABP*
Sundus K. Al-Juboury CABP*

Dina Nabeel Kamal CABP*
Wissam Akram Salman CABOG**.

Abstract:

Background: Respiratory morbidity as a result of failure to clear lung fluids is common and can be challenging for neonates delivered by elective repeated cesarean delivery without being exposed to labour.

Aim: To study the impact that timing of elective repeated cesarean delivery at or near-term, following an uncomplicated and low risk pregnancy, has on the development of acute neonatal respiratory morbidity compared with infants born via spontaneous vaginal delivery, aiming to provide evidence that can aid obstetricians in planning and counseling for elective repeated cesarean section, ultimately improving neonatal respiratory outcome thus decreasing neonatal morbidity and mortality.

Patients and Methods: We conducted a prospective observational study of a cohort of 616 infants of gestational ages from 36 to 40 completed weeks, born to women who have had a low risk and uncomplicated pregnancy, of which 214 were born by elective repeated cesarean delivery without prior labor compared to 402 born by spontaneous vaginal delivery. All deliveries took place at the Obstetrics and Gynecology department of Al Yarmouk Teaching Hospital, during the period of the study from the 1st of July 2008 to 31st of June 2009. The risk of developing acute respiratory morbidity, Respiratory distress syndrome (RDS) and Transient tachypnea of newborn (TTN), in both groups were studied. Infant parameters: neonatal outcome, gestational age, Weight, sex, length of hospital stay as well as maternal parameters: Age, parity and mode of delivery were all analyzed, exclusion criteria were set for both maternal and infant parameters.

Results: Overall acute neonatal respiratory morbidity risk, including Transient tachypnea of the newborn and Respiratory distress syndrome, was significantly higher in infants born by elective repeated cesarean compared with vaginal delivery, (Relative risk (RR) =4.0005, 95%Confidence Interval (CI)=3.0309-5.2803, $p<0.0001$), The risk for developing Transient tachypnea in infants born by elective repeated cesarean section showed a fourfold increase compared to infants delivered vaginally, (RR=4.2389, 95%CI =3.1208-5.756, $p<0.0001$); similarly the risk for Respiratory distress syndrome was increased six fold (RR=6.8462, 95%CI=3.0571-15.3315, $p<0.0001$). Respiratory morbidity rate increased from gestational age of 36 weeks to 38 weeks, no significant difference found at 39-40 weeks gestation. Multiple logistic regression analyses showed that gestational age was a significant factor effecting the development of respiratory morbidity ($p=0.0000$). Male newborns delivered via elective repeated cesarean were more at risk to develop respiratory distress than females, this difference was statistically not significant in infants delivered vaginally.

Conclusion: In comparison with spontaneous vaginal birth, infants delivered by elective repeat cesarean at or near -term were at significantly increased risk to develop acute respiratory morbidity; this risk increased progressively with decreasing gestational age.

Introduction:

Respiratory morbidity is still considered an important complication of elective cesarean deliveries at term and near -term infants, this was first reported by usher et al in 1964^{1}, many studies had addressed this issue since^{2}.

The increasing rates of cesarean deliveries worldwide have the potential for a significant impact on public health and health care costs due to the morbidity associated with this subgroup^{3}, similarly rates of cesarean sections are continuously increasing in developing countries with an estimated rate of 12%, with regional rates ranging between 3 to 26 percent^{4, 5}.

Thus rates of respiratory morbidities in neonates are expected to increase.

Our study evaluated the association between the timing of elective repeated cesarean section and mode of delivery as risk factors for the development of acute respiratory morbidity in neonates born to a cohort of women with low risk pregnancy. We also analyzed the risk of respiratory morbidity stratified according to the gestational age of the newly-born.

Patients and methods:

This is a prospective hospital-based study carried out at the obstetrics and gynecology department and the Special care baby unit (SCBU) of Al Yarmouk Teaching hospital, Baghdad, during a one year period from the 1st of July 2008 to the 31st of June of 2009.

During the study period, 11263 deliveries occurred in the obstetrics department; a cohort of (616) singleton newborns of gestational ages stratified in strata of one week from 36 to 40 completed weeks; 214 infants were born by elective repeated cesarean section (ERCD) and 402 infants were the product of spontaneous vaginal delivery (SVD).

Elective repeated cesarean delivery was defined as a preplanned second or more cesarean delivery without onset of labor and before rupture of membranes^{6, 7}; while spontaneous delivery is an unassisted uncomplicated and non induced vaginal birth.

All infants had their initial assessment at the delivery rooms and after primary stabilization,

examination was carried out by the most senior resident, those infants who are stable and showing no signs of respiratory distress were discharged to postnatal wards for rooming in with their mothers, while those neonates who required resuscitation, showed respiratory distress symptoms and required oxygen support were admitted to SCBU for further evaluation and respiratory support.

The diagnosis of the respiratory distress (RDS,TTN) was made clinically by the on call registrar and confirmed by experienced pediatrician ;criteria for diagnoses of RDS and TTN done in agreement with standard pediatric criteria including clinical and radiological findings ;criteria for diagnosing RDS include: oxygen –dependence increasing during the first 24 h; absence of any signs of infection ; and typical radiological pattern with reduced air content, reticulogranular pattern of the lung, and air bronchogram; as for TTN the criteria includes :any oxygen supplement required during the first 6h which does not increase during the subsequent 18 h; the usual improvement in clinical condition in 3-6 h; and chest radiographs which are either normal or show reduced translucency, infiltrates and hyperinflation of the lungs^[8,9].

Neonatal data recorded were, gestational age as estimated by maternal last menstrual period date or an early ultrasound.

A manual weighing scale (Secca, Germany) was used to weigh the infants to the nearest 0.01 gm. The agar score and length of hospital stay by days until discharge from SCBU were documented for those who required admission. Infants with gross congenital anomaly, multiples, Intrauterine growth retardation, congenital infection, congenital pneumonia, sepsis, meconium aspiration, birth asphyxia, premature rupture of membrane, were all excluded from this study.

Maternal parameters recorded were the age, parity, and mode of delivery; exclusion criteria for conditions capable of influencing the risk to neonates were set as: women who had labor prior to ERCD, severe preexisting or acute maternal illnesses such as hypertension, eclampsia, diabetes, renal failure, smoking, oligohydramneous. Mothers who gave birth by spontaneous delivery with similar low risk criteria were enrolled in the study as the comparison group.

Statistical analysis: the rate of respiratory morbidity, relative risk (RR) and 95% confidence interval were calculated for the two groups using the confidence interval analysis. To evaluate the effect modification by gestational age we used stratified analysis. Multiple logistic regression analysis was used to evaluate for potential confounding variables (maternal age, parity, infants weight). A P-value of less than 0.05 was regarded as significant.

Results:

During the period of the study from the 1st of July 2008 to 31st of June 2009 ,there were (11263) live births delivered at the department of obstetrics and gynecology of Al Yermouk teaching hospital ;6874 (61%)births were vaginal deliveries and 4389 (38.9%) were births by cesarean section .

We selected a cohort of 616 infants born to mothers who have had a low risk and uncomplicated pregnancy; 214 (34.7%) had been delivered by an elective repeated cesarean section (ERCD) and the outcome of these infants were followed up, the remaining 402 (65.2%) were born to mothers who had uncomplicated spontaneous vaginal delivery (SVD) without serious perinatal complications, and their outcome were also followed out, (Table1).

Table 1: Demographic characteristics

Parameter	ERCD		SVD		P-value*
	Mean	SD	Mean	SD	
Maternal age	27.004	5.348	25.17	6.307	0.0002
Parity	3.62	2.594	2.425	1.748	<0.0001
Infant body weight	3147.196	446.889	3118.731	396.9	<0.0001
Infant gestational age	37.630	1.314	38.0622	1.1790	0.0001

From the overall study group, 169(27.4%) had developed respiratory morbidity (RDS, TTN); 126(20.4%) were males and 43(6.98%) were females (fig.1); male infants delivered via ERCD were two times more at risk to develop acute

respiratory morbidity (RR: 2.684, 95%CI=1.751-4.115, p<0.0001).We found no significant gender difference in susceptibility to develop respiratory morbidity in infants born via SVD.

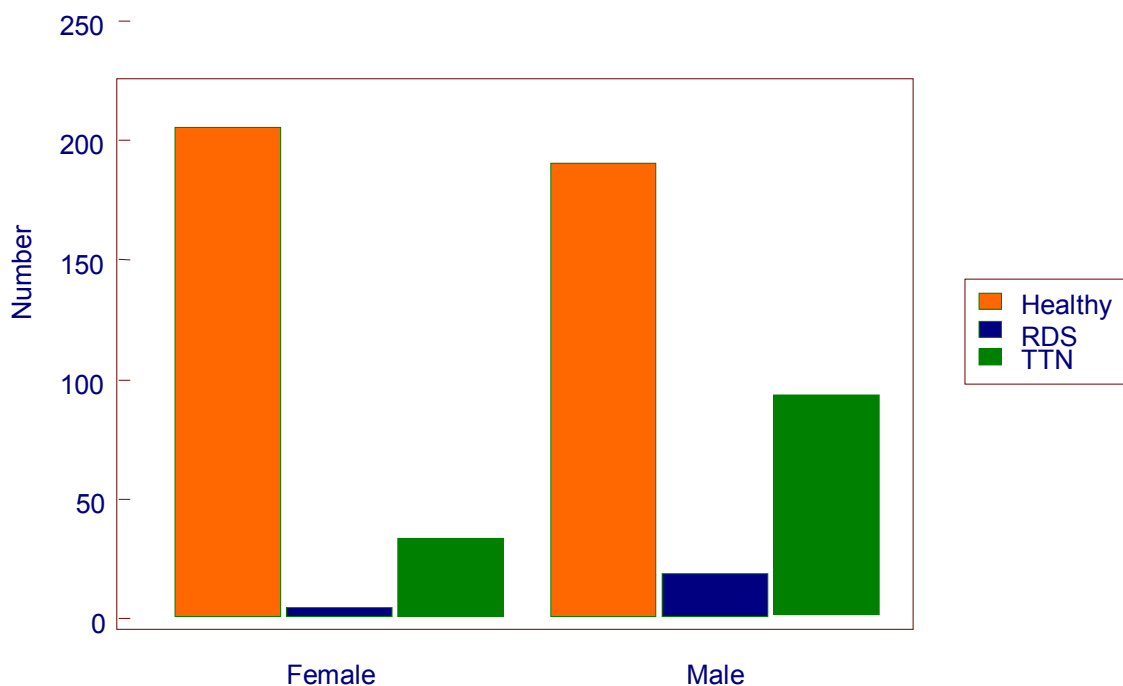


Figure1: Respiratory morbidity according to gender

The overall acute respiratory morbidity rate (TTN & RDS) in infants born by ERCD was 18.6%, 15.7% (97/616) were diagnosed with TTN and 2.9% (18/616) diagnosed as having RDS; While the rates in babies born via SVD to low risk mothers were 8.7% (54/616), 7.4% (46/616) for TTN and 1.2% (8/616) for RDS .

Infants delivered by ERCD were at higher risk to develop overall respiratory morbidity (RR=4.0005, 95%CI=3.03-5.280, $p < 0.0001$), for TTN the risk was (RR=4.238, 95% CI=3.120-5.757, $p < 0.0001$)

and the risk for RDS was (RR=6.846, 95%CI =3.057-15.331, $p < 0.0001$).

Infants delivered via ERCD showed a progressive reduction in the rates of respiratory morbidity with each week of gestation 36-40 (p for trend < 0.0001), (fig2). Compared to 39-40 weeks gestation, gestational ages 36-38 weeks collectively there was a threefold increase in the risk for developing respiratory morbidity (RR=3.447, 95% CI=2.0008-5.9403, $p < 0.0001$).

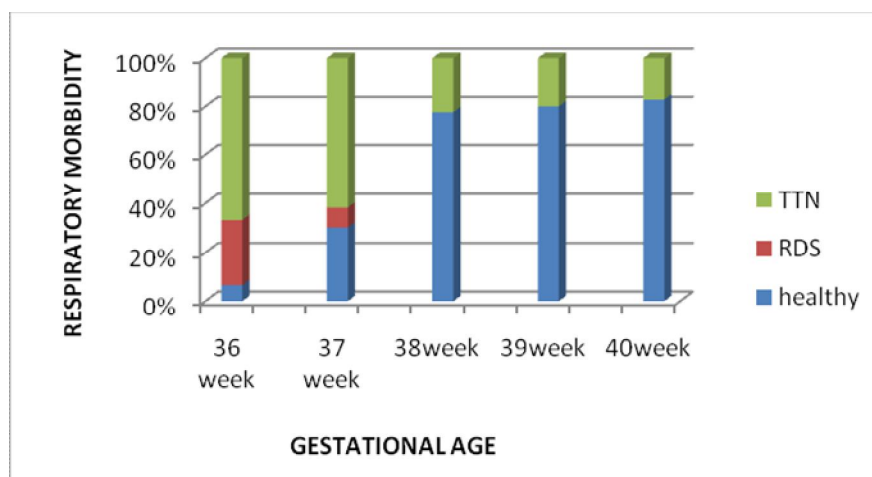


Figure 2: Rate of Respiratory morbidity according to gestational age in infants born via ERCD

Logistic regression analysis which included gestational age, maternal age, newborn weight, showed that gestational is an important factor determining the occurrence of respiratory distress, (OR 0.4157, 95% CI=0.3209-0.5384), p -value= 0.0000.

We found no difference in length of hospital stay in both groups, there was a single mortality in the group born by ERCD with the diagnosis of RDS.

Discussion:

The study demonstrated a significant increased risk of acute neonatal respiratory morbidities (TTN, RDS), in infants born by ERCD to mothers with uncomplicated pregnancy at the obstetrics department of Al Yermouk teaching hospital during the one year period of the study, compared with infants born via spontaneous vaginal delivery.

Male singletons delivered via ERCD were found to be more at risk to develop respiratory distress (RDS, TTN) therefore admission to SCBU than females; this is consistent with studies done by Kasap et al and Dani et al and Yee et al, who found that male sex was a major risk factor for RDS and TTN; this could be explained by the hypothesis that male fetuses mature later which can mean that they have a poor ability to react to stress, respond to inflammation, and regulate their blood pressure^{8,10}; while we found no significant gender difference in the cohort who had been delivered via SVD.

This study also showed a fourfold overall risk increment of acute respiratory morbidity in infants delivered via ERCD compared to those delivered vaginally, which was consistent with the study done by Morrison et al. also several studies had demonstrated somewhat similar findings with a range of 2 to 3 times increased risk^{6,7,9,11,12,13}, explanation on the bases that respiratory morbidity results from the failure to clear lung fluids which is common in delivery without labor that deprives the fetus from the physiological events in the last few weeks of pregnancy and changes in hormonal milieu of the fetus and its mother that results in rapid maturation and preparation of the fetus for the delivery and neonatal transition^{3,14,15}.

In this study cohort of term and near-term infants of gestational ages between 36 to 40 weeks, TTN had higher rates in infants delivered by ERCD (45%) compared with (11.4%) of vaginally delivered neonates with a fourfold increased risk for this morbidity; several studies showed a range 2 to 3 fold increased risk^{9,11,13,16,17,18}; while RDS rates were of (8.4%) in ERCD and (2%) of SVD infants with a six fold increment of risk; these findings are consistent with several studies showed 2 to 7 fold increased risk^{9,11,13,16}.

The study also showed that an important factor in determining respiratory morbidity of the newborn was the gestational age at time of delivery; as there was a progressive increased rate of respiratory

morbidity with each less week of gestation, while no significant difference at 39-40 weeks; this is consistent with the few studies that stratified results by gestational age and included a near-term category^{13,17,19-22}.

We found no difference in length of hospital stay in either group, probably because of the similarity of the epidemiology of the disease in both groups as well as a larger sample may be needed.

Conclusion and recommendations:

Accurate dating of the mother pregnancy and as near term as possible planning of ERCD is necessary to minimize the risk of respiratory morbidity and therefore the risk of being admitted to SCBU and thus exposure to multiple procedure, investigation and nosocomial and iatrogenic hazards. This goes with the American academy of obstetrics and Gynecology guidelines that neonates less than 39 weeks of gestation should not be delivered by ERCD.

Based on the results of this and the other studies and being a developing country whose neonatal health care facilities still lacks intensive care units with respiratory support equipments and properly trained nursing staff and shortage of resources, we suggest carrying out an ERCD as near term as possible which may have a role in decreasing respiratory morbidity therefore SCBU admissions and further exposure of the neonates to hazardous atmosphere.

References:

- 1- Usher RH, Maclean F, Maughan GB. Respiratory distress syndrome in infants delivered by C Caesarean section. *Am j Obstet Gynecol*, 1964; 88:806-15.
- 2- Hansen AK, Wisborg K, Uldbjerg N, Henriksen TB. Risk of respiratory morbidity in term infants delivered by elective cesarean section: cohort study. *BMJ* 2008; 336:85-7.
- 3- Ramachandrapa A, Jain L. Elective cesarean section: it's impact on neonatal respiratory outcome. *Clin Perinatol*, 2008; 35:373-93.
- 4- Stanton CK, Holtz SA. Levels and trends in Cesarean birth in the developing world. *Studies in family planning*, 2006; 37(1):41-48.
- 5- Hassan S. Ba'aqueel. Cesarean delivery rates in Saudi Arabia: A ten-year review. *Ann Saudi Med*; 2009 May-Jun; 29(3): 179-183.
- 6- Deluca R, Boulvain M, Irion O, Borner M, Pfisters RE. Incidence of early neonatal mortality and morbidity, after late-preterm and term cesarean delivery. *Pediatrics* 2009; 123:e1064-e1071.
- 7- Morrison JJ, Rennie JK, Milton PJ. Neonatal respiratory morbidity and mode of delivery at term: influence of timing of elective caesarean section. *Br J Obstet Gynecol*. 1995; 102 (2): 101-106.

- 8- Dani C, Real MF, Bertini G, Wiechmann L, Spagnalo A, Tangucci M, Rubatelli FF. Risk factors for development of respiratory distress and transient tachypnea in newborn infant, Eur Resp J 1999; 14:155-159.
 - 9- Zanardo V, Simbi AK, Franzoi M, Solda G, Salvadori A, Trevisanuto D. Neonatal respiratory morbidity risk and mode of delivery at term: influence of timing of elective caesarean delivery; Acta Paediatr 2004; 93:643-647.
 - 10-- Kasap B, Duman N, Ozer E, Tali M, Kumaral A, Ozkan H. Transient tachypnea of the newborn: predictive factor for prolonged tachypnea. Pediatric International 2008; 50:81-84.
 - 11- Hook B, Kiwi R, Amini SB, Fanaroff A, Hack M. Neonatal morbidities after elective repeat Caesareans section and trial of labor. Pediatrics 1997; 100:348-353.
 - 12- Hales KA, Morgan MA, Thurnac GR. Influence of labor and route of delivery on the frequency of respiratory morbidity in term neonate. Int J Gynecol Obstet 1993; 43:35-40.
 - 13- Annibale DJ, Husley TC, Wagner CL, Southgate WM. Comparative neonatal morbidity of abdominal and vaginal deliveries after uncomplicated pregnancies. Arch Pediatr Adolesc Med. 1995; 149:862-7.
 - 14-Levine EM, Ghai V, Barton JJ, Strom CM. Mode of delivery and risk of respiratory diseases in newborns. Obstet Gynecol.2001; 97:439-42.
 - 15-Faxelins G, Haghevik K, Lagercrantz H, Lundell B, Irestedt L. Catecholamine surge and lung function after delivery .Arch Dis Child,1983;58:262-6.
 - 16- Madar j, Richmond S,Hey E.Surfactant deficient respiratory distress after elective delivery at term. Acta Paediatr 1999; 88: 1244-8.
 - 17- Fisler RE, Cohen A, Ringer SA, Liberman E. Neonatal outcome after trial of labour compared with elective repeat cesarean section .Birth.2003; 30:83-
 - 18- Richardson BS, Czikk MJ, da Silva O, Natale R. The impact of labour at term on measures of neonatal outcome.AmJ Obstet Gynecol. 2005; 192: 219-26.
 - 19- Many A, Helpman L,Vilani Y ,Kupferming M J,Lessing J B,Dollberg S. Neonatal respiratory morbidity after elective cesarean section. J Matern Fetal Neonatal Med2006; 19:75.
 - 20-Heinzmann A, Brugger M, Engels C, Prompeler H,Superti-Furga A ,Strauch K,Kruger M. Risk factors of neonatal respiratory distress following vaginal and caesarean section in the German population. Acta paediatr. 2009; 98: 25-30.
 - 21- Kamath BD, Todd JK. Glazne JEr, Lezotte D, Lynch AM. Neonatal Outcomes after Elective Cesarean Delivery. Obstet Gynecol 2009; 113: 1231-38.
 - 22- Yee W, Amin H, Wood S. Elective cesarean delivery, neonatal respiratory distress. Obstet Gynecol 2008; 111:823-28.
-
- *Special Care Baby Unit, Al -Yermouk Teaching Hospital.
 **Obstetrics &Gynecology department, Al-Yermouk Teaching Hospital