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Elective Cesarean Section Induction Delivery Time and Development of Transient Tachypnea of The Newborn; A Prospective Clinical Study

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ABSTRACT

Background: Neonates born via elective cesarean section have a higher risk of respiratory complications such as respiratory distress syndrome or transient tachypnea of the newborn (TTN).

Objectives: To assess the relation between each of the induction delivery time and the uterine incision delivery time during Cesarean Section (CS) with the incidence of transient tachypnea of the newborn.

Patients and methods: This was a prospective cohort study conducted on a total of 110 pregnant women at term (completed 37 weeks) scheduled for elective Cesarean Section at Obstetrics and Gynecology Department at El Mansoura University Hospital. **Results:** Our results showed that there were no statistically significant relations between all sociodemographic characteristics (Age, Menstrual history, Parity, Number of abortions, Number of normal vaginal delivery, Number of Cesarean Section delivery, Duration of pregnancy by date/weeks, Duration of pregnancy by US/weeks, Surgical history, BMI, PPD, FL, FHR, Placenta, HB, Platelet, INR, blood groups and (RH) of the studied cases and incidence of TTN among their neonates (P>0.05). There was no statistically significant correlation between induction to delivery interval, uterine incision to delivery interval, and skin incision to delivery interval in the context of incidence of TTN (P>0.05).

Conclusion: Induction delivery time, skin incision delivery time and the uterine incision delivery time during CS seemed to have no significant correlation with the incidence of transient tachypnea of the newborn, likewise the Apgar score.

Keywords: Elective cesarean section induction delivery time, Tachypnea of the newborn

INTRODUCTION

Cesarean delivery is associated with increased risks for adverse obstetric and perinatal outcomes in the subsequent birth as malpresentation, placenta previa, antepartum hemorrhage, placenta accreta, prolonged labor, uterine rupture, preterm birth, low birth weight, and stillbirth in their second delivery [(1)].

Neonates born via elective cesarean section have a higher risk of respiratory complications such as respiratory distress syndrome or transitory tachypnea of the newborn [(2)]. Transient tachypnea of the newborn; also known as-type 2 respiratory distress syndrome (RDS), wet lung syndrome-represents the commonest cause of neonatal respiratory distress, with a prevalence range between 0.33 to 3.9%. It is a pulmonary disorder that affects lung parenchyma and characterized by pulmonary edema [(3, 4)]. Despite being a benign and self-limiting disease, still the associated hypoxemia with transient tachypnea of the newborn and respiratory failure may increase the morbidity, length of hospital stay, risk of chronic pulmonary disease later on and death [(5, 6)].

The aim of this study was to assess the relation between each of the induction delivery time and the uterine incision delivery time during CS with the incidence of transient tachypnea of the newborn.

PATIENTS AND METHODS

This was a prospective cohort study conducted on a total of 110 pregnant women at term (completed 37 weeks) scheduled for elective CS at Obstetrics and Gynecology Department at El Mansoura University Hospital. From January 2022 to April 2022.

Inclusion criteria: Women at term (completed 37-42 weeks), women having singleton, non-anomalous fetus and age: 20-39 years old.

Exclusion criteria: Women with maternal medical disorders (hypertensive disorders with pregnancy, heart disease, renal disorders, diabetes mellitus, infections, APL syndrome), Intrauterine growth restriction, Maternal drug affecting respiratory centers intake prior to CS (morphine and related opioid), Premature rupture of membranes, Cesarean deliveries due to obstetric emergency; such as, fetal distress, antepartum hemorrhage and malpresentation (breech, transverse).

Methods

All patients were subjected to the following

Thorough history taking, the gestational age from the first day of the last menstrual period provided that the patient was sure of date and no recent history of hormonal contraception, obstetric ultrasonographic study and basic laboratory investigations (Blood grouping, Rh typing, CBC).

Examination: General examination (Vital signs and complexion).

At the time of delivery: Complete blood picture (CBC), coagulation profile, (Random blood sugar, preoperative ultrasound examination also was done for every participant. All caesarean sections were done by the same

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surgical team, by the same technique for all cases, and with spinal anesthesia by the same anesthesiologist; so that the surgeon's skill did not affect the results of the study.

Collected data: The induction delivery interval in seconds i.e., from the start of induction of anesthesia till cord clamping (I-C interval), The uterine incision delivery interval from the time of uterine incision till cord clamping (U-C interval), The duration of fetal extraction starting from incision of the skin till clamping of the cord (S-C interval). Neonatal gender, weight, and 5-minute Apgar score was registered. The diagnosis of transient tachypnea of the newborn was established by the pediatric team based on the following criteria; Occurrence of tachypnea (defined as respiratory rate >60/min) within 6 hours from delivery, persistence of tachypnea for at least 12 hours and exclusion of known respiratory or non-respiratory disorder (as meconium aspiration syndrome, congenital heart disease, hypoglycemia, hypocalcemia, polycythemia).

Apgar score: The Apgar test was done by a doctor, midwife, or nurse. The provider examined the baby's: Breathing effort, Heart rate, Muscle tone, Reflexes and Skin color). Each category is scored with 0, 1, or 2, depending on the observed condition.

Sample Size Calculation: A sample size calculation was conducted to investigate the correlation between the Apgar score after 5 minutes and the duration till umbilical cord (UC) clamping. In a previous study, [7], a correlation coefficient of 0.264 was observed. To ensure an 80% probability of detecting a correlation difference of 0.264, assuming the null hypothesis correlation remains at 0.264 and the alternative hypothesis posits no correlation (0.00), a sample size of 110 was determined. This calculation was performed using the PASS program version 11.0.8, utilizing a two-tailed hypothesis test with a significance level of 0.05 and tests for a single correlation.

Ethical consideration: The research approval of the study was obtained from Institutional Review Board (IRB) of Faculty of Medicine at Mansoura University before starting the study. The researcher clarified the objective and aim of the study to the subjects included in the study. The researcher assured maintaining anonymity and confidentiality of subject's data. Subjects were informed that they were allowed to choose to participate or not in the study and that, they had the right to withdraw from the study at any time without giving any reasons. Ethics, values, culture and beliefs of subjects were respected. The consent of participants to share in the study should be also obtained. This work should be carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical Analysis

Data were analyzed using SPSS (Statistical Package for the Social Sciences) version 22. Qualitative data were presented as number and percent and were compared by Chi-Square test and Fischer exact test. Quantitative data were tested for normality by Kolmogorov Smirnov test. They were described as mean, standard deviation (SD), median, and range and were compared by Student t test and Mann Whitney U test. Correlations were calculated using Pearson's correlation. P value <0.05 was considered significant.

RESULTS

The mean age of the studied cases was 29. All the studied cases had regular menstruation (100%). The median number of parity, abortion, normal vaginal delivery and CS delivery were 3, 2, 2 and 1 respectively. The mean duration of pregnancy by date/weeks and duration of pregnancy by US/weeks were 38.01 and 37.88 respectively (Table 1).

Table (1): Sociodemographic characteristics and obstetric history of the studied Cases:

	n=110	%
Age/years, mean ± SD (min-max)	29.03±4.94 (20-39)	
Menstrual history regular		
Every 28 days	24	21.8
Every 29 days	22	20.0
Every30 days	64	58.2
Parity	3(1-10)	
Number of abortion	2(1-4)	
Number of normal vaginal delivery	2(1-6)	
Number of CS delivery	1(1-4)	
Duration of pregnancy by date/weeks , Median(min-max) mean ± SD	38(37-40) 38.01±0.76	
Duration of pregnancy by US/weeks , Median(min-max) mean ± SD	38(37-40) 37.88±0.73	

SD: Standard Deviation CS: Cesarean section Min: Minimum Max: Maximum US: Ultrasound

This table shows that regarding neonatal sex, the percentage of male to female was (47.3/52.7). The mean neonatal weight, Apgar 5 minutes were 3123.18 gm and 8, respectively. The percentage of positive TTN among the studied cases was 10.9% (Table 2).

Table (2): Neonatal characters' ad outcome among studied cases

	n=110	%
Neonatal sex	52	47.3
Male/Female	58	52.7
Neonatal weight (gm) , mean ± SD	3123.18 ±310.94	
Apgar 5 minutes , mean ± SD, Median(min-max)	8.0 ±1.2, 8(6 -10)	
TTN		
-VE	98	89.1
+VE	12	10.9

This table shows that there were no statistically significant relations between all sociodemographic characteristics (Age, Menstrual history, Parity, Number of abortions, Number of normal vaginal delivery, Number of CS delivery, Duration of pregnancy by date/weeks, Duration of pregnancy by US/weeks, Apgar score, Surgical history, BMI, PPD, FL, FHR, Placenta, HB, Platelet, INR, blood groups and (RH) of the studied cases and incidence of TTN among their neonates (P>0.05) (Table 3).

Table (3): Relation between sociodemographic characteristics of the studied cases and incidence of TTN among their neonates

	Negative TTN (N=98)	Positive TTN N=12	test of significance
Age/years mean ± SD	28.99±4.89	29.33±5.59	t=0.226 p=0.821
Menstrual history regular			
Every 28 days	21(21.4)	3(25)	MC
Every 29 days	19(19.4)	3(25)	P=0.825
Every30 days	58(59.2)	6(50)	
Parity , Median (min-max)	3(1-10)	4(2-6)	Z=1.01 P=0.312
Number of abortion Median (min-max)	2(1-4)	2(1-3)	Z=0.111 P=0.912
Number of normal vaginal delivery, Median (min-max)	2(1-6)	2(1-3)	Z=0.449 P=0.654
Number of CS delivery Median (min-max)	1(1-4)	2(1-3)	Z=0.944 P=0.345
Duration of pregnancy by date/weeks Median min-max)	38(37-40)	38(37-39)	Z=0.366 P=0.715
Duration of pregnancy by US/weeks, Median (min-max)	38(37-40)	38(37-39)	Z=0.171 P=0.865
APGAR score5 minutes	9(6-10)	8(7-10)	z=0.654
Median (min-max)			p=0.524
Surgical history -ve	50 (51)	6(50)	χ^2=0.004 P=0.947
+ve	48(49)	6(50)	
BMI(Kg/m2) mean ± SD	31.94±1.88	31.23±1.73	t=1.24 p=0.217
PPD (weeks) mean ± SD	37.89 ±0.81	37.92 ±0.67	t=0.08 p=0.939
FL (weeks) mean ± SD	37.63±0.80	37.42± 0.90	t=0.867 p=0.388
FHR, mean ± SD	132.43±7.42	132.67±10.69	t=0.100 p=0.921
Placenta Anterior	9(9.2)	2(16.7)	
Fundal	86(87.8)	10(83.3)	χ^{2MC}=0.990 P=0.610
Posterior	3(3.1)	0	
HB (gm/dl) mean ± SD	10.62±0.74	10.55±0.69	t=0.316 p=0.752
Platelet (mean ± SD)	216.51±31.05	214.33±33.59	t=0.209 p=0.835
INR mean ± SD	1.00±0.012	1.0±0.0	t=0.610 p=0.543
blood groups A	54(55.1)	6(50)	χ^{2MC}=2.45 P=0.294
B	32(32.7)	6(50)	
O	12(12.2)	0	
RH	2(2.0)	0	FET
-ve +ve	96(98)	12(100)	P=1.0

FET: Fischer exact test, χ2: Chi^2 test, t: Student test, Z: Mann Whitney U test

This table shows that the relation between induction to delivery interval, uterine incision to delivery interval and skin incision to delivery interval and incidence of TTN was not statistically significant (Table 4).

Table (4): Relation between induction to delivery interval, uterine incision to delivery interval and skin incision to delivery interval and incidence of TTN:

	Negative TTN N=98	Positive TTN N=12	Test of significance
Induction delivery interval in minutes mean ± SD	3.65±2.76	14.19±3.29	t=0.640 p=0.524
Uterine incision delivery interval in minutes mean ± SD	2.05±0.49	2.098±0.59	t=0.294 p=0.769
Skin incision delivery interval in minutes mean ± SD	8.23±2.19	9.03±2.87	t=1.167 p=0.246

t: Student test

There was no statistically significant correlation between induction to delivery interval, uterine incision to delivery interval, and skin incision to delivery interval and both of Apgar score and the weight of the studied neonates (Table 5).

Table (5): Correlation between induction to delivery interval and uterine incision to delivery interval and Apgar score of the studied neonates:

	Apgar score 5 minutes	Neonatal Weight
Induction delivery interval in minutes	r=0.029 p=0.763	r=0.026 p=0.784
Uterine incision delivery interval in minutes	r=-0.148 p=0.122	r=0.106 p=0.272
Skin incision delivery interval in minutes	r=-0.231 p=0.279	r=0.189 p=0.347

r: Spearman correlation coefficient

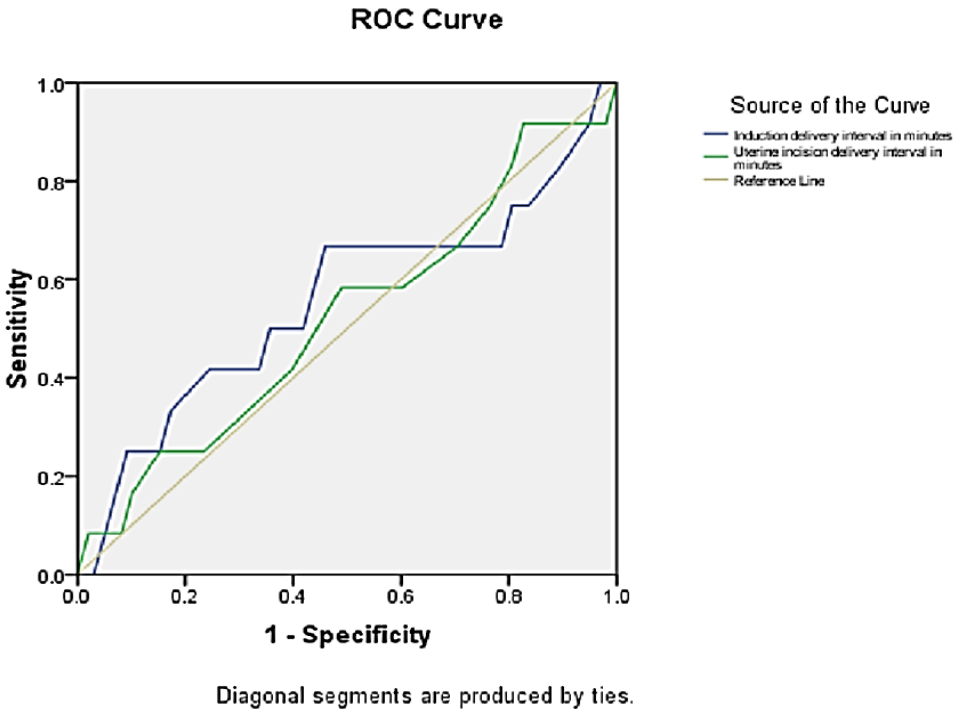

Figure (1): ROC curve of induction delivery interval in minute and uterine incision delivery interval in minutes in differentiating cases with TTN versus cases without TTN.

DISCUSSION

Concerning the incidence of TTN, the current study demonstrated that out of 110 studied cases, 12 cases (10.9%) were associated with TTN. Comparable incidence was recorded by **Zaher *et al.*** [7], who have demonstrated that out of the 100 delivered neonates, 8 neonates (8%) developed TTN and were admitted to the NICU for further management.

In contradiction to our finding, lower incidence was recorded by **Tutdibi *et al.*** [8], who have displayed that the overall incidence of TTN was 5.9 cases per 1000 singleton live births in their study cohort. In the same line, **Joseph *et al.*** [9], have displayed that; 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%.

Our findings were in consistence with the findings of the study by **Gunaydin *et al.*** [10] who hypothesized that decreasing the time among the induction of spinal anesthesia and the delivery of the fetus throughout a cesarean section could significantly reduce the occurrence of TTN.

The current study revealed that there was no statistically significant correlation between induction to delivery interval, skin incision to delivery interval and uterine incision to delivery interval in the context of Apgar score at 5 min (mean 8.0 ± 1.2, median 8 (6 - 10 min / max) of the studied neonates (P>0.05).

In the same line **Mohamad *et al.*** [11], have displayed that; there was no statistically significant correlation between initiation of anesthesia till cord clamping interval (up to 25.5 minutes) and Apgar score recorded after 1 minute and 5 minutes (p-value=0.575 and 0.674, respectively), and also there was no statistically significant correlation between uterine incision till cord clamping interval (up to 4.5 minutes) and Apgar score recorded after 1 minute and 5 minutes (p-value=0.329 and 0.237, respectively).

In our study, concerning relation between gestational age at time of elective CS of the studied cases and incidence of TTN, the current study demonstrated that; there were no statistically significant relations between duration of pregnancy at different weeks (ranged from 37 up to 40 weeks) by date/weeks, duration of pregnancy by US/weeks (P>0.05) and development of TTN.

Similarly, **Zaher *et al.*** [7], had demonstrated that TTN development showed a significant correlation with the gestational age where the group who developed TTN had mean gestational age of 38.1 plus/minus 0.35 weeks with P value 0.002. In the same pattern, **Mousa *et al.*** [12], recommended elective CS at 39 weeks gestation to decrease the risk of TTN.

Concerning relation between sociodemographic characteristics of the studied cases and incidence of TTN, the current study demonstrated that; there were no statistically significant relations between all sociodemographic characteristics like maternal age, menstrual history, parity, number of abortion, number of normal vaginal delivery, number of CS delivery, surgical history, BMI, fetal gender, BPD, FL, FHR, placenta location, HB, platelet, INR, blood groups and (RH) of the studied cases and incidence of TTN among their neonates (P>0.05).

The impact of maternal obesity was studied by **Straube *et al.*** [13], **Chen *et al.*** [14] and concluded that BMI has negative significant effects on APAGR score at one and five minutes. Also, TTN was significant with male gender, much more than female one [11,15].

CONCLUSION

Induction delivery time, skin incision delivery time and the uterine incision delivery time during CS seemed to have no significant correlation with the incidence of transient tachypnea of the newborn, likewise the Apgar score.

DECLARATIONS

- **Consent for publication:** I attest that all authors have agreed to submit the work.
- **Availability of data and material:** Available
- **Competing interests:** None
- **Funding:** No fund
- **Conflicts of interest:** no conflicts of interest.

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