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Impact of Rising Elective Cesarean Section Rates on Early Neonatal Outcome

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ABSTRACT

Background: The increased rate of elective cesarean sections (CS) has been a significant health concern worldwide due to which many long-term and short-term neonatal and maternal complications are arising. This study aimed to assess the early neonatal outcomes of elective CS and compare these outcomes with emergency CS.

Methods: A cross-sectional study was conducted using convenience sampling from March to August 2023 at Fazaia Ruth Pfau Medical College, Karachi. A total of 184 neonates born between 36 to 42 weeks gestational age delivered via elective c-section for uncomplicated single pregnancy were included. The percentage, frequency, and odds ratio were calculated using SPSS 23 with a p-value<0.05 considered significant.

Results: Out of 184 neonates, 104(57%) were born by elective LSCS and 79(43%) by emergency LSCS. Respiratory morbidities were observed in 24(23%) of neonates born via elective c-section with 40(38%) needing oxygen therapy and 8(7.6%) ventilator support. Neonatal Jaundice was significantly more common in elective LSCS 56(53.3%) while neonatal sepsis was higher in emergency LSCS 64(81%). Meconium aspiration syndrome (aOR 0.07 95%CI 0.01-0.32, p-0.001) and babies born between 36 and 38 weeks gestation (aOR 0.37 95%CI 0.18 – 0.75, p-0.001) were considerably less likely to have been delivered by elective LSCS. Neonates with shorter hospital stays of <3 days were more likely to have been delivered by elective LSCS (aOR 10.0 95%CI 1.16-85.5, p-0.012).

Conclusion: : Elective CS can have unintended consequences related to respiratory morbidity, neonatal sepsis, and jaundice. The brief hospital stays following an elective C-section are the positive aspects of our study.

Keywords: Cesarean Section, Meconium Aspiration Syndrome, Neonates, Pregnancy Complications, Respiratory Distress Syndrome, Sepsis.

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INTRODUCTION

In contemporary obstetrics, one of the most common surgical procedures performed is the lower segment cesarean section (LSCS). CS could impact a woman's physiological and reproductive health. The rates of CS have been increasing worldwide over the past 2 decades, growing from 7% in 1990 to over 20% in 2021[1]. The increasing CS trend has been linked to several recognized relevant factors. These elements include hospital policies that encourage CS and discourage vaginal deliveries following CS, the belief that it is painless and safer, and its convenience for mothers as well as families[2]. Previously the recommended overall rate for CS delivery was 10-15% in any population or region[3]. While the WHO no longer recommends a specific rate because of a large increase in medically indicated cesarean delivery rates, the perceived benefit of reduced mortality is not apparent when the rate exceeds 10%[4].

In Pakistan, the overall cesarean section delivery rate has been reported to be approximately 20% in 2018, increasing almost seven-fold since 1990[3]. The rising trend in CS rates in Pakistan and other developing countries appears to overlap with the increasing medicalization of pregnancy and childbirth[5]. Studies have shown that mothers, primarily from metropolitan populations, had a much greater rate of planned or elective cesarean deliveries[2,6]. Existing literature also suggests the rising rate of CS is concurrent with the increase in the incidence of cesarean delivery on maternal request (CDMR)[7,8]. It is a well-established fact that a cesarean section is not a risk-free procedure and can have grave consequences for both the mother and baby[9]. While the maternal risks of cesarean section are well-documented, there's also a growing body of evidence for significant health risks in newborns born via cesarean delivery [9,10].

The reason for conducting this study was the rising incidence of elective cesarean sections in our region, coupled with the lack of information on the neonatal consequences of these procedures. Our study therefore aimed to assess the early neonatal outcomes of elective LSCS and compare these outcomes in elective versus emergency cesarean sections.

METHODS

We conducted a descriptive cross-sectional study at the Fazaia Ruth Pfau Medical College, Karachi from March 2023 to August 2023. The study was approved by the Institutional Review Board (IRB) REF NO. IRB/52. The participants were selected using convenience sampling.

We identified newborns delivered via elective cesarean section for an uncomplicated single pregnancy with gestational ages between 36 weeks and 42 weeks, who are admitted to the neonatal intensive care unit (NICU). Newborns born via emergency cesarean section due to oligohydramnios, gestational diabetes, hypertension, placental abruption, breech delivery, and low-lying placenta were included to compare neonatal outcomes with those delivered by elective cesarean section. Cases of intrauterine death, stillbirth, and normal vaginal delivery were excluded.

Neonatal outcomes such as APGAR score at 1 and 5 minutes, respiratory morbidity including transient tachypnea of the newborn (TTN), meconium aspiration syndrome (MAS), respiratory distress syndrome (RDS), oxygen demand, and need for invasive or noninvasive respiratory support were the immediate outcomes; additional outcomes included sepsis with positive blood culture, length of stay in the NICU, neonatal jaundice, congenital heart disease, and congenital abnormalities. We compared outcomes of elective and emergency CS in terms of newborn admission, neonatal death, and neonatal morbidity. The sample size was calculated using OpenEpi version 3. The minimum sample size calculated was 177 after using a 21% prevalence of elective cesarean section, with a 6% margin of error and 95% confidence interval. Similarly, for a 22% prevalence of emergency cesarean section, the minimum sample size was 184, with a 6% margin of error and a 95% confidence interval [11-12].

Data analysis was done using SPSS version 23. Means and standard deviations were calculated for quantitative variables. Qualitative variables were reported as frequency and percentages. A chi-square test was applied (p-value <0.05) to test for association along with logistic regression to calculate the odds ratio. Both Univariate and Multivariate logistic regression models were used to examine the association between elective cesarean section and adverse neonatal outcomes.

RESULTS

A total of 184 neonates were enrolled in the study, 105 (57%) of whom were born by elective LSCS and 79 (43%) by emergency LSCS. Most neonates were between 1-5 days of age in both groups. Table 1 reports baseline neonatal characteristics among emergency and elective LSCS groups.

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Table 1: Baseline neonatal characteristics among emergency and elective LSCS groups.

Variables		Mode of delivery			p-value
		Total (n=184)	Elective LSCS (n=105)	Emergency LSCS (n=79)	
		n (%)	n (%)	n (%)	
Neonate Age	1-5 days	177 (96.2)	99 (94.3)	78 (98.7)	0.30
	6-10 days	1 (0.5)	1 (1.0)	0	
	11-28 days	6 (3.3)	5 (4.8)	1 (1.3)	
Gender	Male	107 (58.2)	64 (61.0)	43 (54.4)	0.45
	Female	77 (41.8)	41 (39.0)	36 (45.6)	
Gestational Age	36 – 38 weeks	50(27.2)	19 (18.1)	31 (39.2)	0.001*
	39 - 42 weeks	134 (72.8)	86 (81.9)	48 (60.8)	
Neonate Weight	<1.5	2 (1.1)	0	2 (2.5)	<0.001*
	1.6 - 2.4	49 (26.6)	19 (18.8)	30 (38.0)	
	2.5 - 3.5	122 (66.3)	79 (75.2)	43 (54.4)	
	>3.5	11 (6.0)	7 (6.7)	4 (5.1)	
APGAR Score	< 3 / 10	9 (4.9)	3 (2.9)	6 (7.6)	0.04*
	3 - 5 / 10	7 (3.8)	2 (1.9)	5 (6.3)	
	6 - 7 / 10	23 (12.5)	13 (12.4)	10 (12.7)	
	8 - 10 / 10	145 (78.8)	87 (82.9)	58 (73.4)	
Length of hospital stay	< 3 days	14 (7.6)	12 (11.4)	2 (2.5)	0.012*
	4 - 7 days	81 (44.0)	52 (49.5)	29 (36.7)	
	8 - 20 days	49 (26.6)	22 (21.0)	27 (34.2)	
	>20 days	40 (21.7)	19 (18.1)	21 (26.6)	

**p<0.05 was considered statistically significant using Fisher's Exact test*

A higher proportion of newborns delivered by elective LSCS were within the ideal gestational age of 39-42 weeks 86(81.9%) compared to emergency LSCS 40.8(60.8%) (p<0.001). Newborns from elective LSCS tended to have a normal weight range of 2.5-3.5 kg 79(75.2%) more frequently than those from emergency LSCS 43(54.4%) (p<0.001). Elective LSCS 87(82.9%) was associated with higher APGAR scores (indicating healthier newborns) compared to emergency LSCS 58(73.4%) (p-value of 0.04).

Tables 2 and 3 show a comparison of neonatal complications and laboratory parameters between elective and emergency LSCS groups. Respiratory morbidity, which included transient tachypnea of the newborn (TTN), respiratory distress syndrome (RDS), and meconium aspiration syndrome (MAS) was observed in about 24(23%) of neonates born via elective LSCS. Higher respiratory morbidity also resulted in increased use of head box 40(38.1%) and increased requirement for C-PAP 5(4.8%) and ventilator support 8(7.6%). Respiratory distress syndrome (RDS) was slightly more common in elective LSCS (8.6% vs. 5.1%); however, this finding was not significant. Birth asphyxia was more prevalent in emergency LSCS (11.4% vs. 5.7%); this difference, again, was statistically insignificant.

Table 2: Comparison of neonatal complications between elective and emergency LSCS

Variables	Mode of delivery		p-value
	Elective LSCS n (%)	Emergency LSCS n (%)	
TTN	10(9.5)	3(3.8)	0.11

MAS	5 (4.8)	18 (22.8)	<0.001*
RDS	9 (8.6)	4 (5.1)	0.40
Birth asphyxia	6 (5.7)	9 (11.4)	0.18
Cardiovascular disease	1 (1.0)	4 (5.1)	0.16
Episode of hypoglycemia	19 (18.1)	8 (10.1)	0.14
Infant of diabetic Mother	3(2.9)	2 (2.5)	0.99
Neonatal jaundice	56 (53.3)	29 (36.7)	0.03*
Single phototherapy	60 (57.1)	38 (48.1)	0.22
Double phototherapy	6 (5.7)	2 (2.5)	
Congenital anomaly	1	0	0.99
Sepsis	58 (55.2)	64 (81.0)	<0.001*

**p<0.05 was considered statistically significant*

TTN: transient tachypnea of the newborn , MAS: meconium aspiration syndrome, RDS: respiratory distress syndrome

Emergency LSCS had higher rates of meconium aspiration syndrome (MAS 22.8% vs 4.8%) compared to elective LSCS. On the other hand, neonatal jaundice was significantly more common in elective LSCS (53.3% vs. 36.7%). Sepsis was more frequently reported in emergency LSCS (81% vs. 55.2%). Blood cultures were positive in 11(18.2%) of suspected cases included in the study. In the elective LSCS group, 3(2.9%) were positive for gram-positive cocci and 3 for gram-negative rods. In the emergency LSCS, 1 sample was positive for gram-positive cocci and 4 samples for gram-negative rods (Table 3).

Table 3: Comparison of neonatal laboratory investigation parameters.

Variables		Mode of delivery		p-value
		Elective LSCS n (%)	Emergency LSCS n (%)	
Blood CS	Positive	6(10.3)	5 (7.9)	0.75
Total leukocyte count	<15	33(31.4)	41(51.9)	<0.001*
	15 - 20	28(26.7)	19(24.1)	
	21-30	15(14.3)	12(15.2)	
	>30	1(1.0)	3(3.8)	

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Platelets	<100	2(1.9)	1(1.3)	<0.001*
	100 - 150	6(5.7)	9(11.4)	
	151 - 300	42(40.0)	49(62.0)	
	>300	24(22.9)	16(20.3)	
Hemoglobin at admission	<10	0	1(1.3)	<0.001*
	10 - 15	22(21.0)	19(24.1)	
	16 - 20	52(49.5)	45(57.0)	
	>20	3(2.9)	10(12.7)	
C-reactive protein	<10	5(4.8)	6(7.6)	<0.001*
	10 - 20	4(3.8)	2(2.5)	
	>20	0	1(1.3)	
Coagulation profile	Deranged	3(2.9)	2(2.5)	0.99
Headbox	Applied	40(38.1)	33 (41.8)	0.65
C-PAP	Needed	5(4.8)	6(7.6)	0.53
Ventilator support	Required	8(7.6)	5(6.3)	0.78

**p<0.05 was considered statistically significant using Fisher's Exact test*

Figure 1 shows a comparison of maternal indications for cesarean delivery in both groups. The most common indication in the elective LSCS group was the previous 3 cesarean sections 22(21%) followed by the previous 2 sections 15(14%) and maternal wish 12(11.5%). In the emergency LSCS group, the most common indications were MAS 12(15%) and prolonged rupture of membranes (PROM) 12(15%).

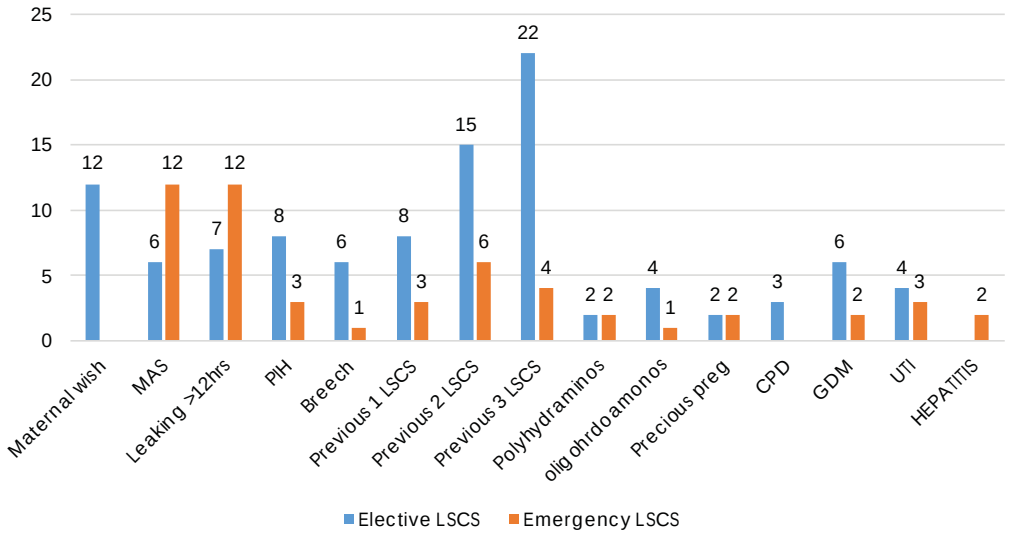

Figure 1: Maternal indications for cesarean sections.

A comparison of presenting symptoms in neonates in both groups is given in Table 4. Over 16(15%) of the babies in the elective LSCS group presented with grunting; fast breathing and delayed crying were observed in 25(23%) and 6(5%) of the newborns born via elective LSCS respectively. Yellow discoloration of the body was significantly more common in elective LSCS 47(44.8%) compared to emergency LSCS 19(24.1%) (p<0.01). On the other hand, the rate of suspected neonatal infection was significantly higher in emergency LSCS 26(32.9%) than elective 13(12.4%) with p<0.01.

Table 4: Comparison of presenting symptoms with mode of delivery.

Variables	Mode of delivery		p-value
	Elective LSCS n (%)	Emergency LSCS n (%)	
Grunting	16(15.2)	13(16.5)	0.84
Fast breathing	25(23.8)	20(25.3)	0.86
Reluctant to feed	6(5.7)	4(5.1)	0.99
Apnea	2(1.9)	1(1.3)	0.99
Vomiting	7(6.7)	6(7.6)	0.99
Delayed cry	6(5.7)	10(12.7)	0.17
Yellow discoloration of the body	47(44.8)	19(24.1)	<0.01*
Suspected neonatal infection	13(12.4)	26(32.9)	<0.01*
Any other complaint	16(15.2)	11(13.9)	0.83

**p<0.05 was considered statistically significant*

Table 5 illustrates the results of a binary logistic regression analysis evaluating the association between various factors and the likelihood of a neonate being delivered by elective LSCS. Neonates born at 36-38 weeks were significantly less likely to have been delivered by elective LSCS (aOR 0.37 95%CI 0.18 – 0.75, P-0.001). Newborns with shorter hospital stays of less than 3 days were more likely to have been delivered by elective LSCS (aOR 10.0 95%CI 1.16-85.5, p-0.012). MAS was significantly less likely in elective LSCS (aOR 0.07 95%CI 0.01-0.32, p-0.001).

Factors	Univariate OR (95% C.I)	Multivariate OR (95% C.I)
APGAR score < 3 / 10	0.33 (0.08-1.38)	0.16 (0.02-1.01)
APGAR score 3 - 5 / 10	0.26 (0.05-1.42)	0.16 (0.02-1.23)
APGAR score 6 - 7 / 10	0.86 (0.35-2.10)	0.52 (0.14-1.87)
Gestational age (36 – 38 weeks)	0.34* (0.17 – 0.66)	0.37* (0.18 – 0.75)
Stay < 3 days	6.63* (1.31-33.5)	10.0* (1.16-85.5)
Stay 4 - 7 days	1.98 (0.91-4.27)	2.72 (0.95-7.79)
Stay 8 - 20 days	0.90 (0.38-2.08)	1.10 (0.36-3.33)
MAS	0.16* (0.05-0.47)	0.07* (0.01-0.32)

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Sepsis	0.28* (0.14-0.57)	0.15* (0.04-0.57)
TLC <15	2.41 (0.23-24.3)	0.80 (0.05-11.0)
TLC 15 - 20	4.42 (0.42-45.7)	1.98 (0.14-26.7)
TLC 21-30	3.74 (0.34-40.8)	3.95 (0.27-56.6)
Platelets <100	1.33 (0.11-15.9)	6.17 (0.23-160.0)
Platelets 100 - 150	0.44 (0.13-1.49)	0.55 (0.09-3.24)
Platelets 151 - 300	0.57 (0.26-1.21)	0.74 (0.28-1.91)
Hb 10 - 15	3.85 (0.92-16.1)	2.78 (0.35-21.7)
Hb 16 - 20	3.85 (0.99-14.8)	4.98 (0.74-33.3)
CRP Negative	0.18* (0.08-0.43)	1.40 (0.27-7.14)
CRP <10	0.17* (0.04-0.69)	0.58 (0.07-4.49)
CRP 10 - 20	0.41 (0.06-2.63)	1.67 (0.08-31.8)
Yellow discoloration of the body	2.55* (1.34-4.87)	0.91 (0.29-2.84)

*Dependent Variable: Elective LSCS OR: Odds Ratio, C.I: Confidence interval, *Odds Ratio significant with p<0.05*

DISCUSSION

Elective cesarean section can result in significant adverse outcomes for neonates, including respiratory morbidity, neonatal sepsis, and neonatal jaundice. Respiratory morbidity was observed in about 23% of the newborns born via elective LSCS in our study. Various other studies have demonstrated a higher incidence of respiratory morbidity in newborns born via elective cesarean delivery versus vaginal delivery[13]. Normally, labor induces a surge in catecholamines that helps clear the fluid in the lungs and facilitates the respiratory transition to life after birth. The increased risk of complications in elective LSCS could be explained due to the absence of fetal stress and catecholamine response in newborns as the operation is performed before the onset of labor[14,15].

About 18% of the newborns in the elective LSCS group were delivered at a gestational age of less than 39 weeks, which could have contributed to increased respiratory morbidity in this group. The ACOG guidelines dictate that elective cesarean delivery should not be performed before 39 weeks without fetal lung maturity assessment as earlier delivery increases the risk of respiratory morbidity[16]. Similarly, the RCOG guidelines also do not recommend planned cesarean birth before 39 weeks gestation[17]. Previous studies have also demonstrated increased rates of NICU admissions in late preterm and early term (35-38 weeks) babies delivered by elective CS[18]. High rates of respiratory morbidity along with longer hospital stays are alarming as they contribute to the ever-increasing financial burden on the healthcare system of a developing country like Pakistan.

The most common maternal indication in our study in the elective LSCS group was previous cesarean delivery as also seen in various other studies[19,20]. Maternal wish was also reported as a common indication in this group, which is also in line with the results of previously published studies. In the emergency LSCS group, MAS and PROM were the commonest indications. Other studies in the literature have reported fetal distress, pre-eclampsia and eclampsia, non-progress of labor, cephalopelvic disproportion, and malpresentation as the most frequent reasons for an emergency section[19,21]. In our study, we also examined neonatal outcomes in babies born via elective LSCS vs emergency LSCS. Notably, most similar studies in the literature have compared neonatal outcomes of elective LSCS with vaginal delivery. Data comparing outcomes between emergency and elective LSCS is lacking.

A study conducted in Nepal compared maternal and neonatal outcomes between elective LSCS and LSCS and showed higher rates of birth asphyxia and the need for ICU admission in the latter. However, they did not compare other variables of neonatal morbidity that have been investigated in our study[19]. Our study showed shorter hospital stays in elective LSCS compared to emergency LSCS. This finding could be attributed to the overall status of neonates born via elective LSCS as the majority were born at a gestational age of 39 weeks or more with good APGAR scores and were comparatively healthier. A retrospective study by et al reported longer hospital stays in newborns born via elective

LSCS compared with those born through vaginal birth after cesarean section (VBAC)[22].

We found significantly higher rates of neonatal sepsis and suspected neonatal infections among the emergency LSCS group. These findings corroborate the results of another retrospective case-control study that showed neonatal sepsis was 85% more likely in the emergency LSCS group compared to the elective LSCS group[23].

Elective LSCS was associated with a higher risk of neonatal jaundice in our study. Belgin et al compared the incidence of neonatal jaundice between elective LSCS and normal vaginal delivery and found an increased incidence of neonatal jaundice in the former, possibly due to the use of anesthetics in cesarean sections[24]. While this does not explain the difference observed in our study, it might be worth exploring this outcome in future studies. Our study offers a comprehensive overview of the influence of elective LSCS on neonatal outcomes and highlights the need to regulate unnecessary cesarean sections in our region as they not only result in a substantial economic toll on the healthcare system but also have significant implications in terms of neonatal and maternal morbidity and mortality.

This study also had a few limitations. Firstly, it was a single-center study conducted in a private tertiary care hospital and therefore the results may not be generalizable to other populations. Additionally, due to the observational nature of the study, we could not assess potential confounders that could independently increase the risk of adverse neonatal outcomes.

CONCLUSION

Based on our research, elective C-sections can have unintended consequences related to respiratory morbidity, neonatal sepsis, and jaundice. The brief hospital stays following an elective C-section are the positive aspects of our study. It is evident that while emergency CS is associated with a higher incidence of adverse neonatal outcomes, elective cesarean section is not without its risks. Our study highlights the need to conduct such studies on a larger scale and in varying populations for more definitive results.

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ETHICAL APPROVAL

Ethical approval was obtained from the Ethics and Research Committee on 10/2/2023 with Ref No: IRB/52.

PATIENT CONSENT

Consent was taken from patients.

CONFLICT OF INTEREST

There is no conflict of interest.

AUTHORS CONTRIBUTION

SQB: conception and design, data collection, interpretation of results, manuscript writing, final review. KMAK: manuscript writing, final review.

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