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Prevalence and Common Indications of Cesarean Section and Neonatal Outcomes Among Mothers Delivered by Cesarean Section in Orotta National Referral Maternity Hospital, Eritrea: Medical Records Review

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ABSTRACT

Background: *The World Health Organization sets a cesarean delivery rate of 5–15% which is assumed to be a range that can decrease neonatal morbidity and mortality. This study aimed to assess the prevalence of cesarean section deliveries and identify determinants of neonatal outcomes at Orotta National Referral Maternity Hospital.*

Methods: *This was a medical record and register review study. Data about neonates born via cesarean section between January 1, 2021, and December 31, 2022, were extracted from the hospital's operation book. Data were gathered, recorded in an Excel spreadsheet, and subsequently analyzed using SPSS version 25. Descriptive statistics were used to summarize the data. Odds ratios, 95% confidence intervals, and both univariable and multivariable analyses were employed to assess the association between determinants and outcomes, with significance set at $p < 0.05$.*

Results: *The prevalence of cesarean section at Orotta National Referral Maternity Hospital was 20.1%. Previous cesarean section (30.9%), cephalo-pelvic disproportion (20.1%), and malpresentation and position (19.8%) were the most common indications. The stillbirth rate among neonates delivered by cesarean section was 2.9%. Patients referred from other Zoba's (AOR: 2.63; 95%CI: 1.58-4.40, p<0.001), antepartum hemorrhage as an indication for cesarean section (AOR: 12.18; 95%CI: 1.75-106.96, p=0.02), newborns delivered by emergency cesarean section (AOR: 3.36; 95%CI: 1.16-9.74, p=0.03), mothers delivered under general anesthesia (AOR: 6.61; 95%CI: 2.43-17.98, p<0.001), neonatal birth weight < 1.5kg (AOR: 8.23; 95%CI: 2.80-24.23, p<0.001) and neonatal birth weight of greater than 4kg (AOR: 15.59; 95%CI: 3.13-77.77, p<0.001) were the predictors of neonatal outcome in mothers delivered by cesarean section.*

Conclusions: *The prevalence of cesarean section deliveries was higher than the World Health Organization and national levels. Patients referred from other Zoba's, antepartum hemorrhage, emergency cesarean section, type of anesthesia, and neonatal birth weight were identified as key determinants of neonatal outcomes. Enhancing healthcare professionals' awareness of antepartum and intrapartum management is crucial to reducing neonatal morbidity and mortality.*

Keywords
Prevalence, Determinants, Cesarean Section, Neonatal outcome, Eritrea.

Abbreviations
PIH: Pregnancy Induced Hypertension; CS: Cesarean Section; APH: Antepartum Hemorrhage, BOH: Bad Obstetric History, CPD: Cephalo-Pelvic Disproportion, TAH: Trans-abdominal hysterectomy, BTL: bilateral tubal ligation.

Introduction
Cesarean delivery is defined as the birth of a fetus via a surgically created incision in the anterior uterine wall [1]. Classification of cesarean section is based on the degree of urgency: elective cesarean delivery is when the decision to perform the operation is made ahead of time and /or before the onset of labor, and all others are considered as emergency cesarean delivery [2,3]. The World Health Organization (WHO) sets a cesarean delivery rate of 5–15% which is assumed to be a range that can decrease neonatal morbidity and mortality [4,5]. Cesarean section is the most common operative delivery technique in the world, and rates have increased worldwide in recent decades, exceeding the WHO recommendation [6-9].

Early neonatal outcomes are associated with preoperative and intraoperative feto-maternal factors, which are preventable in most cases [10]. Generally, based on different literature, intrapartum-related events account for 24% of neonatal deaths, and it is possible to prevent 80% of these deaths by having accessible and quality health services, such as cesarean delivery [4,11]. Emergency cesarean section is associated with a greater risk of severe neonatal outcomes. Indications for emergency cesarean births that had the highest odds of severe composite outcomes were cord prolapse, failed instrumental delivery, and non-reassuring fetal status [5]. Prolonged labor, low birth weight, pregnancy-induced hypertensive disorders, cesarean delivery, and meconium-stained liquor were identified as determinants for low five-minute Apgar score [12]. Antepartum hemorrhage, non-reassuring fetal heart rate pattern, malpresentation and malposition, failed induction, obstructed labor, multiple gestations, and cephalopelvic disproportion were the most common indications of cesarean section in Ethiopia [12-14].

National cesarean delivery rates in different countries in Africa differ, as South Sudan (0.6%), Sierra Leone (2.9%), the Dominican Republic (58.1%), and Ethiopia (29.6%) were far more than the rate recommended by the WHO [13]. A previous study conducted in Eritrea (2009) showed that the rate of cesarean section delivery was 10.4% in Orotta National Referral Maternity Hospital (ONRMH) and 31.3% in Sembel Hospital [15]. In ONRMH, 75.3% of the operations were emergency cesarean sections, compared to 47.6% in the Sembel Hospital [15]. Furthermore, the rate of cesarean section delivery at Dekemhare Hospital, Eritrea (2022), was 10.1% [16]. The top six indications for a cesarean section at Dekemhare Hospital were: malposition (26.3%), prolonged and obstructed labor (21.2%), mal-presentation (14.4%), previous cesarean section (10.2%), amniotic fluid disorders (9.3%), and fetal distress (5.9%) [16]. Another study indicated that the prevalence of stillbirth was 2.5% and was increased for breech delivery, the presence of a congenital abnormality, referral from other health facilities, and the presence of cord injury in Dekemhare Hospital, Eritrea (2023) [17].

To the best of the researcher's knowledge, the prevalence of cesarean section and determinants of neonatal outcomes of cesarean section deliveries at the ONRMH have not been thoroughly investigated. The findings of this study help bridge the knowledge gap on these issues and support the formulation of the advantages of the deliveries. This study aimed to evaluate the prevalence of cesarean section, typical indications, and determinants of neonatal outcome in mothers delivered by cesarean section in ONRMH.

Materials and Methods
Study Design and Study Area
This was a review study of medical records and registries. This study was conducted in the ONRMH, situated in the capital city of Asmara, Eritrea. This hospital is the only National Referral Maternity Hospital for obstetrics and gynecology cases, which receives patients from all parts of the country. It is the highest-level health facility in terms of settings and health professionals, and it has different departments that provide services for delivery, high-risk mothers, gynecologic cases, operations, and various outpatient services.

Study Population
The study population consisted of all mothers who delivered at ONRMH via cesarean section during the study period.

Exclusion Criteria
Stillbirths confirmed as intrauterine fetal death antepartum with contraindications for vaginal deliveries and delivered by cesarean section for maternal indication were excluded from the study. Mothers with incomplete registers were also excluded from the study.

Sampling Procedures
A census was implemented in which all mothers who delivered by cesarean section from January 01, 2021, to December 01, 2022, at ONRMH were enrolled in the study.

Data Collection
Data were retrieved from the hospital operation book register, and further information was obtained from patients' clinical cards. Data collectors were oriented prior to data collection, and a pre-test was done to modify the data extraction tool prior to starting data collection. After the data extraction tool was amended, data were collected from October to December 2022. The collected data included sociodemographic characteristics, parity, gravidity, history of abortion and stillbirth, indications for cesarean section, and neonatal outcome (Apgar score, weight, and sex).

Data Management and Analysis

Data were entered in an Excel sheet and transported to SPSS version 25 for analysis. Data were presented using descriptive statistics, including frequencies and percentages. Baseline characteristics were compared using the chi-square test. All variables with a p-value less than 0.1 at univariable analysis were considered for multivariable analysis using the forward stepwise selection method. Logistic regression was used to estimate the odds ratio and 95% confidence interval during the univariable and multivariable analysis. In this study, a p-value <0.05 was considered significant.

Ethical Consideration

Ethical approval was obtained from the Ministry of Health, Health Research Proposal Review and Ethical Committee (Reference number 05/08/2022). Patient consent was not sought as this study used secondary data. However, the privacy of data was assured by coding the personal identifiers and removing them from the final analysis. The confidentiality of the patient's medical records was strictly maintained, and the study adhered to the principles outlined in the Declaration of Helsinki.

Results

Sociodemographic, Neonatal Outcomes, and Seasonal Variation of Mothers Delivered

A total of 13768 mothers delivered in the hospital in a two-year period (2021-2022), out of which 2852 were delivered by cesarean section, making the prevalence of cesarean section delivery of 20.1%. The majority (83.2%) of the mothers were from Zoba Maekel, and 64.4% of % mothers were aged 25-35 years, with 37.2% being nulliparous. The most common indications for cesarean section were previous cesarean section (30.9%), cephalopelvic disproportion (CPD) (20.1%), and mal-presentation and malposition (19.8%). Most (78.5%) cesarean sections were performed on an emergency basis, with 98.8% under spinal anesthesia. The prevalence of stillbirth in those delivered by cesarean section was 2.9% (Figure 1). Most (83.4%) newborns had a birth weight of 2.5-4kg. Patients referred from other Zobas, multigravida, grand multiparous, antepartum hemorrhage, emergency cesarean section, cesarean hysterectomy, type of anesthesia, and neonatal birth weight less than 1.5kg were associated with a higher risk of stillbirth (Table 1). The highest rate of cesarean section delivery was in October (10%), and the lowest was in January (6.1%) (Figure 2).

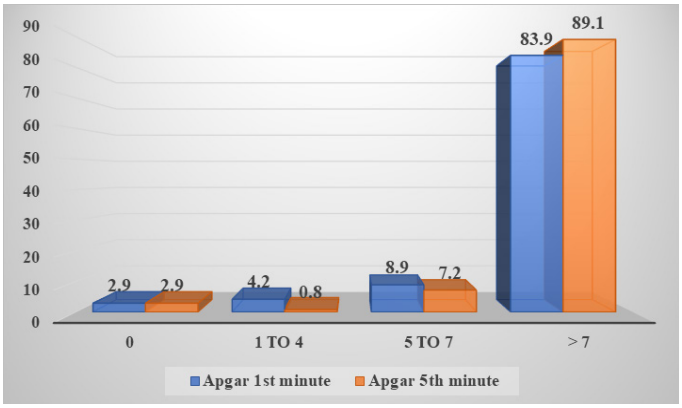

Figure 1: Perinatal Outcome of Neonates delivered by cesarean section in ONRMH.

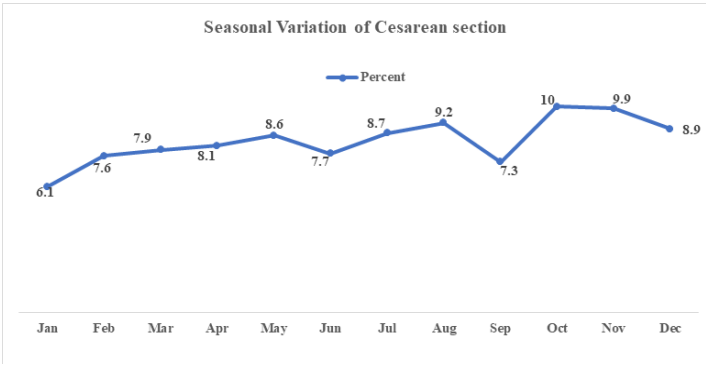

Figure 2: Seasonal Variation in Mothers Delivered by Cesarean Section at ONRMH, 2021-2022 (N=2852).

Table 1: Association of variables with Neonatal Outcome of Mothers Delivered by Cesarean Section in ONRMH, 2021-2022 (N=2852).

Variables	Categories	Total N (%)	Neonatal outcome N (%)		p-value
			Livebirth	Stillbirth	
Address (Zoba)	Maekel	2372 (83.2)	2321(97.8)	51(2.2)	<0.001
	Other Zoba's	480(16.8)	448(93.3)	32(6.7)	
Age of respondents (years)	<25	641 (22.5)	619 (96.6)	22 (3.4)	0.19
	25-35	1838 (64.4)	1792(97.5)	46 (2.5)	
	>35	373 (13.1)	358 (96.0)	15 (4.0)	
Gravidity of respondents	1	987 (34.6)	964 (97.7)	23 (2.3)	0.010
	2-4	1464 (51.3)	1425 (97.3)	39 (2.7)	
	5 and above	401 (14.1)	380 (94.8)	21 (5.2)	
Parity of respondents	0	1061 (37.2)	1038 (97.8)	23 (2.2)	0.008
	1-4	1681 (58.9)	1629(96.9)	52 (3.1)	
	5 and above	110 (3.9)	102(92.7)	8(7.3)	
History of abortion	No	2485 (87.1)	2414 (97.1)	71 (2.9)	0.661
	Yes	367 (12.9)	355 (96.7)	12 (3.3)	
History of stillbirth	No	2718 (95.3)	2638 (97.1)	80 (2.9)	0.636
	Yes	134 (4.7)	131 (97.8)	3 (2.2)	

Indication for CS	BOH	99 (3.5)	98 (99.0)	1(1.0)	<0.001
	APH	141 (4.9)	107(75.9)	34 (24.1)	
	Cord accident	50 (1.8)	47(94.0)	3(6.0)	
	CPD	574 (20.1)	563(98.1)	11(1.9)	
	Fetal distress	393 (13.8)	381(96.9)	12(3.1)	
	Mal-presentation	565 (19.8)	554(98.1)	11(1.9)	
	PIH	149 (5.2)	146(98.0)	3 (2.0)	
	Previous CS	881 (30.9)	873(99.1)	8 (0.9)	
Type of CS	Elective	612 (21.5)	608 (99.3)	4 (0.7)	<0.001
	Emergency	2240 (78.5)	2161 (96.5)	79 (3.5)	
Year	2021	1311 (46.0)	1273 (97.1)	38 (2.9)	0.973
	2022	1541 (54.0)	1496 (97.1)	45 (2.9)	
Procedure	CS	2806(98.4)	2730 (97.3)	76 (2.7)	<0.001
	CS + Hysterectomy	46(1.6)	39 (84.8)	7 (15.2)	
Anesthesia	General	33(1.2)	15 (45.5)	18 (54.5)	<0.001
	Spinal	2819(98.8)	2754 (97.7)	65 (2.3)	
Neonatal weight (kg)	Above 4	225 (7.9)	218 (96.9)	7 (3.1)	<0.001
	<1.5	28 (1.0)	21 (75.0)	7 (25.0)	
	1.5-2.4	221 (7.7)	215(97.3)	6 (2.7)	
	2.5-4.0	2378 (83.4)	2315 (97.4)	63 (2.6)	
Sex of neonate	Female	1363 (47.8)	1331 (97.7)	32 (2.3)	0.087
	Male	1489 (52.2)	1438 (96.6)	51 (3.4)	
Total		2852 (100.0)	2769 (97.1)	83 (2.9)	

Note: APH- antepartum hemorrhage, BOH- bad obstetric history, PIH- pregnancy-induced hypertension, CPD- cephalo-pelvic disproportion, CS-cesarean section, TAH-transabdominal hysterectomy, BTL-bilateral tubal ligation, NRS -Northern Red Sea.

Table 2: Predictors of Neonatal Outcome of Mothers Delivered by Cesarean Section in ONRMH, 2021-2022 (N=2852).

Variables	Categories	COR (95%CI)	P value	AOR (95%CI)	P value
Address (Zoba)	Zoba Maekel	1	<0.001	1	<0.001
	Other Zoba's*	3.25(2.07-5.12)		2.63(1.58-4.40)	
Gravidity	1	1		1	
	2-4	1.15 (0.68 -1.93)	0.61	0.20 (0.02-2.41)	0.21
	5 and above	2.32 (1.27-4.24)	0.006	0.28 (0.02-3.58)	0.32
Parity	0	1		1	
	1-4	1.44 (0.88-2.37)	0.15	5.98 (0.51-70.54)	0.16
	5 and above	3.54 (1.54-8.12)	0.003	4.29 (0.29-63.83)	0.29
Indication for CS	BOH	1		1	
	APH	31.1 (4.18-231.8)	<0.001	12.18(1.55-95.69)	0.02
	Cord accident	6.26 (0.63-61.75)	0.12	3.45(0.34-35.30)	0.30
	CPD	1.92 (0.24-14.99)	0.54	1.37 (0.17-11.17)	0.77
	Fetal distress	3.09 (0.40-24.03)	0.28	2.50 (0.31-20.13)	0.39
	Mal-presentation	1.95 (0.25-15.24)	0.53	1.42 (0.18-11.43)	0.74
	PIH	2.01(0.21-19.64)	0.55	0.98 (0.09-10.40)	0.99
	Previous CS	0.90 (0.11-7.26)	0.92	0.74 (0.09-6.12)	0.78
Type of CS	Elective	1	<0.001	1	0.03
	Emergency	5.56 (2.03-15.23)		3.36 (1.16-9.74)	
Procedure	CS	1	<0.001	1	0.95
	Hysterectomy	6.45 (2.79-14.88)		0.96 (0.261-3.53)	
Anesthesia	General	50.84(24.55-105.29)	<0.001	6.61 (2.43-17.98)	<0.001
	Spinal	1		1	
Neonatal weight (kg)	Above 4	1.18 (.53-2.61)	0.68	15.59 (3.13-77.77)	0.001
	<1.5	12.25 (5.02-29.87)	<0.001	8.23 (2.80-24.23)	<0.001
	1.5-2.4	1.03 (0.44-2.40)	0.95	0.60 (0.24-1.48)	0.27
	2.5-4.0	1		1	

*Other Zoba's- Northern Red Sea, Debub, Gash-Barka, Anseba

Predictors of Neonatal Outcome in Mothers Delivered by Cesarean Section

Variables as patients' residence, indication for cs, type of cs, procedure, anesthesia, parity, gravidity, and birth weight were considered for multivariable analysis. Variables with p-value <0.05 at bivariable analysis were considered for multivariable analysis using the forward stepwise selection. Patients referred from other Zoba's (AOR: 2.63; 95%CI: 1.58-4.40, p<0.001), APH as an indication for cesarean section (AOR: 12.18; 95%CI: 1.75-106.96, p=0.02), newborns delivered by emergency cesarean section (AOR: 3.36; 95%CI: 1.16-9.74, p=0.03), mothers delivered under general anesthesia (AOR: 6.61; 95%CI: 2.43-17.98, p<0.001), neonatal birth weight < 1.5kg (AOR: 8.23; 95%CI: 2.80-24.23, p<0.001) and neonatal birth weight of greater than 4kg (AOR: 15.59; 95%CI: 3.13-77.77, p<0.001) were the predictors of neonatal outcome in mothers delivered by cesarean section (Table 2).

Discussion

The prevalence of cesarean sections in ONRMH demonstrates significant variability in comparison to previous studies, namely 10.4% (ONRMH, Eritrea) [15], 10.1% (Dekemhare Hospital, Eritrea) [16], and Ethiopia (29.55%) [13]. This discrepancy may be attributed to a higher number of referrals from other Zoba's. Besides, particularly in Zoba Maekel, all mothers requiring cesarean sections were directed to ONRMH during duty hours for emergency procedures. Besides, mothers referred from Other Zoba had a higher rate of stillbirth compared to the Zoba Maekel. This could be explained by the fact that the referrals could have lower awareness of antenatal care utilization and could not get immediate intervention to prevent the neonatal mortality.

The study reported a stillbirth prevalence of 2.9%. This stillbirth rate exceeded the national average (1.8%) and the survey in Dekemhare Hospital, Eritrea (2.5%) [17]. Additionally, stillbirth rates were highest among patients from the NRS and Debub region, emphasizing the impact of referral of high-risk cases to this hospital, which was consistent with a previous study in Dekemhare Hospital, Eritrea. [17]. This higher stillbirth rate could be explained by the fact that other factors, such as congenital anomalies, the type of stillbirth (macerated or stillbirth), and whether fetal heartbeat was absent during admission, were not documented, which can inflate the stillbirth rate.

The most common indications for cesarean section were repeat cesarean section, CPD, and malpresentations. These findings were consistent with prior studies in Eritrea [15,16] and Ethiopia [13,18]. In addition, antepartum hemorrhage, including uterine rupture, placenta previa, and placental abruption, was linked to higher stillbirth, and this was similar to reports from other studies [12,18]. This is mainly because, in most patients with antepartum hemorrhage, the cesarean section was done for maternal indication, which could have another neonatal risk that predisposes them to stillbirth.

This study revealed that most cesarean sections were performed on an emergency setting and resulting in a higher rate of stillbirth when compared to elective procedures. This was consistent with a previous study in the same hospital [15] and with previous studies indicating that emergency cesarean sections were associated with a greater risk of severe neonatal outcomes [5,11,18-22]. This is mainly due to the nature of the operation, which is for fetal or maternal complications that need emergent intervention to prevent neonatal or maternal complications.

Patients delivered under general anesthesia were associated with a higher risk of stillbirth. The procedure of general anesthesia may not explain this, but patients delivered by cesarean section under general anesthesia could be critical due to their obstetric complications, such as uterine rupture, antepartum hemorrhage with hemorrhagic shock, eclampsia, and other medical conditions, which could have higher neonatal mortality.

Very low birth weight (<1.5kg) and macrosomia (>4kg) were associated with a higher stillbirth rate. This result could be due to the presence of other neonatal complications, including prematurity and intrauterine growth restriction [11,12]. The macrosomia could be referrals from other health facilities, mainly with obstructed labor or uterine rupture, which could be associated with neonatal mortality. This study revealed that patient address, emergency cesarean section, general anesthesia, and very low birth weight and macrosomia were retained as the main determinants of neonatal outcome, which was consistent with several studies [23-31].

Seasonal variation in cesarean section rates was observed, with higher rates in October and November. This resulted in an increased number of primigravid women giving birth in October and November, mainly because wedding ceremonies and cultural holidays are commonly held in January. Furthermore, the study identified a small proportion of mothers under the age of 18, indicating that underage marriage persists, leading to potential complications with adverse neonatal and maternal outcomes.

The present study had some limitations. This study relied on reviewing medical records; moreover, it did not ascertain the outcomes of neonates admitted to the neonatal ICU with poor Apgar scores or maternal complications. Additionally, the impact of antenatal care on neonatal outcomes was not explored. The study's power may have been influenced by the small sample size of stillbirth cases. Further prospective study to determine the determinants of neonatal outcome and prevalence of cesarian section on a larger sample size is highly recommended.

Conclusion

This study identifies that patients referred from other Zoba, APH, general anesthesia, emergency cesarean section, very low birth weight, and macrosomia were the key determinants of neonatal outcomes following cesarean section. The prevalence of cesarean section and stillbirth rate was higher than in previous studies. Enhancing the management of cesarean deliveries, especially in emergency cases, is crucial in improving neonatal health and reducing adverse outcomes. Optimizing and empowering referral

systems are essential steps in achieving better neonatal outcomes in this context.

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