

Maternal and Fetal Health Outcomes of Cesarean Sections (CS) in Ethiopia: Results from Retrospective Cross-sectional study of Southern Ethiopia Gurage Zone Governmental Hospitals

(Short title: In Hospital Maternal and Fetal Outcomes following Cesarean Sections in Gurage Zone, Ethiopia)

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Abstract

Background: The most common obstetric surgery performed nowadays is a cesarean section. Despite the fact that cesarean delivery is the safest mode of delivery in high-risk scenarios, it also appears to have a higher risk of maternal and newborn morbidity and mortality than vaginal delivery, and in low-resource settings, the risks are doubled. In this study we investigated fetal and maternal outcomes following Cesarean sections in southern Ethiopia, specifically in the Gurage region, to better understand and quantify the prevalence of these outcomes and to provide recommendations based on the findings.

Methods: Institutional based retrospective cross-sectional study was conducted in Gurage Zone governmental hospitals from February 21/2021- March 13/2021 on the hospital medical records of mothers who delivered by cesarean section from February 2019 to January 2021. The total sample size was 398 and collected from five governmental hospitals. The collected data was entered and analyzed using STATA version 15. Binary and Multiple Logistic regressions were used to identify associated factors for maternal outcome and fetal outcome.

Results: Out of mothers included in the study, **86 (23.4%) had poor maternal outcomes**. The prevalence of **poor fetal outcome was 75 (19.74%)**. Obstetric complications, medical diseases, and Ante Partum Hemorrhage as an indication for Cesarean Section are statistically significant factors for poor maternal outcomes. Also, Medical disease and Cephalic Pelvic Disproportion as an indication for Cesarean Section are statistically significant factors for poor fetal outcome.

Conclusion & Recommendation: The numbers are not uniformly high or low when compared to other regions of Ethiopia, but they are closely related, suggesting a need for immediate collaborative evidence-based interventions to improve hospital capacities and preoperative optimization strategies, since pregnancy-related complications, preoperative hemorrhages, and preoperative medical conditions all contributed to poor maternal and neonatal outcomes.

Keywords: Cesarean section, In hospital, outcomes, Maternal Complication.

Introduction

Cesarean section is an obstetric surgical procedure involving making an abdominal incision followed by a uterine incision to safely deliver a baby for both fetal and maternal reasons. A cesarean section may be either elective or emergency (1,2). Cesarean deliveries have become more common as advances in anesthetics and other surgical techniques have improved the outcomes and safety of the procedure. (3).

Around 22.9 million cesarean section surgeries are estimated to be performed each year globally. CS is one of the most successful procedures for preventing maternal and perinatal death and morbidity; yet, it is still associated with a higher risk of maternal morbidity and mortality than vaginal birth (4,5). American College of Obstetricians and Gynecologists (ACOG) revealed that CS significantly increases the women's risk of pregnancy-related morbidity and mortality compared to women delivered by vaginal deliveries(4).

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It is anticipated that as the number of CS increases, various serious maternal complications will increase, especially in low resource settings with a limited capacity to perform safe surgical procedures and deal with associated complications (3,5).

In LMICs where maternal mortality is disproportionately high, particularly in Sub-Saharan Africa, where it is at its highest, 62.5 percent of women who deliver by CS have poor maternal outcomes (6). Compared to vaginal delivery, maternal mortality after CS is about three times higher, ranging from 10.1 to 31.9 deaths per 10,000 patients. Postpartum hemorrhage 61(39.4%), hypertensive complications (39.2%), puerperal infection (25.1%), and other indirect obstetric causes (15%) are the most common causes of maternal mortality in CS 15(9.7%) (7–9). Also, intrapartum neonatal mortality accounts for about 73% of global neonatal intra-partum deaths in these regions, and neonatal mortality post-cesarean delivery in sub-Saharan Africa is higher than the global average (10,11).

The maternal death rate in Ethiopia, the most populous landlocked country in Sub-Saharan Africa, has decreased by half since 2000, although the maternal mortality rate of 412 per 100,000 live births and the infant mortality rate of 67 per 1,000 are still too high (12). According to research conducted in the Tigray Regional State of North Ethiopia, 19.3% of women who underwent CS had adverse maternal outcomes. The major short-term complications found were wound infection 7%, endometritis 3.6% and bleedings requiring blood transfusion 2.8%. In contrast, hysterectomy 1.7%, uterine rupture 0.6% and maternal death 0.28% were the significant long-term and serious maternal complications found (13).

Despite different studies carried on assessing the rate and outcomes of CS in Ethiopia, there is a scarcity of data on the in-hospital outcomes of patients following CS. The purpose of this study is to address the lack of information regarding the in-hospital outcomes of women and newborns following CS surgeries in the Gurage zone, Ethiopia, where this information is significantly less available than in other parts of the country. This study is expected to fill in the information gap and suggest possible solutions to reduce maternal and newborn mortality and morbidity both in the study region and nationally and respond to WHO's request for more research and evidence in this area (3).

Methods and Materials

The study was conducted in Ethiopia, Gurage zone Governmental hospitals from February 21/2021- March 13/2021 G.C. This study is registered at <http://www.researchregistry.com> with Registration number: researchregistry7477. This study is reported according to STROCSS criteria (14).

Gurage zone is located in the Southern Nations, Nationalities, and Peoples' Region (SNNRP) of Ethiopia and has 21 woredas, 5 administrative cities with a total population of 1,807,892. There are seven governmental hospitals found in the zone: Butajira General Hospital, Wolkite University Specialized Teaching Hospital, Gunchere

Primary Hospital, Quante Primary Hospital, Buee Primary Hospital, and Gedebano Gutazer Wolene Hospital and Agena Primary Hospital. Gedebano Gutazer Wolene hospital and Agena hospital don't provide surgical services including CS. As a result, this study was conducted with the rest hospitals, which give surgical services.

An Institutional based retrospective cross sectional study was conducted in five governmental hospitals located in Gurage zone, SNNP, Ethiopia. All medical records (Charts) of the randomly selected mothers who delivered by cesarean section in these five governmental hospitals in the previous two years (February 2019 to January 2021 G.C.) were reviewed and their data was entered into the prepared questionnaire tool. A total 398 sample size was used, and the sample was selected by simple random sampling after proportional allocation was done for each hospital.

Addis Ababa University (AAU) has granted ethical approval to this study with a waiver for patient consent since it is a chart review with de-identifying patient-related information, and the Midwifery Department has written a letter of support. Further, the hospital's CEO and medical director have authorized the collection of data from their respective hospitals following receipt of the support letter.

Data Collection Tool and Analysis

Data was collected using data abstraction tool, which was prepared after reviewing different previous literature (13,15–17) and customized based on the objectives of this study.

The data were checked for completeness, cleaned for inconsistencies and missing values, it was entered and analyzed by using STATA version 15. A binary logistic regression was done separately to identify factors associated with maternal and fetal outcomes. Those variables which are significant at a p-value of $P < 0.2$ were entered into the multivariable logistic regression model, and an adjusted odds ratio (AOR) with 95% confidence interval at a p-value of $p < 0.05$ was used to describe the variable that is an independent predictor of the outcome variable.

The linearity of the relationship between the Dependent Variables and the continuous predictor variable was graphically tested. Variance inflation factors were used to measure multi collinearity and for model construction, a simultaneous approach was used. To compare candidate models, the likelihood ratio test was performed. The model definition was checked using a link test to see whether any important variables were left out or if the link function was correctly stated. The Hosmer-Lemshow goodness of fit statistic and the ROC curve were used to visually verify the result.

Results

Socio-demographic Characteristics of the mothers

In the past two years (February 2019 to January 2021 G.C), 2109 Cesarean Delivery was performed in these five selected hospitals. Three hundred sixty-eight mothers were included in the study, and 7.6% of records were excluded due to data incompleteness. As shown in Table 1, most

women were in the age range of 25 – 29 years, and the mean age is 26.8 years with a standard deviation of 5.1. Most of the women's' were married, 353(95.92%) and rural residents 193(52.32%).

Table 1: Socio-demographic Characteristics of mothers who had Cesarean Delivery in Gurage zone governmental hospitals from February 2019 to January 2021.

Variables		Frequency	Percentage (%)
Age	15-19	15	4.08%
	20-24	109	29.62%
	25-29	137	37.22%
	30-34	66	17.94%
	35-39	36	9.78%
	>40	5	1.36%
Marital Status	Single	15	4.08%
	Married	353	95.92%
Residence	Urban	175	47.68%
	Rural	193	52.32%

Obstetrics History and Medical History of the mothers

As described in Table 2, around 222(60.22%) of the mothers were referred from other health institutions. Most of the mothers, 172 (46.74%), were multi-para. Of the mothers who had a cesarean delivery, only 28(7.61%) had coexisting medical history, and hypertension was the common medical illness. Three hundred eight 308(83.7%) had a term

pregnancy categorized in 37-42 weeks gestational age. Most of the women, 318(86.41%), had Antenatal Care (ANC) follow up, out of which 189(58%) of them had four and above ANC follow up. About 349(95.62%) of the pregnancy was singleton gestation, whereas 16(4.38%) were twin /gestation.

Table 2: Obstetric and Medical history of mothers who had Cesarean Section in Gurage zone governmental hospitals from February 2019 to January 2021.

Variables		Frequency	Percentage (%)
Referral Status	Yes	222	60.33%
	No	146	39.67%
Parity	0	100	27.17%
	I	96	26.09%
	II	86	23.37%
	III	53	14.40%
	>=IV	33	8.97%
	Gestational Age	<37	36
	37-42	308	83.7%
	>42	13	3.53%
	Unknown	11	2.99%

Obstetric/pregnancy related complications have occurred in 204 (56.2%) cases, and the most common obstetric complications were mal-presentation 81 (39.71%), antepartum hemorrhage 39 (19.12%) followed by Premature/preterm rupture of membrane (PROM) 34 (16.67%), and chorioamnionitis 8 (3.92%). Labor has started in 255 (70.64%) mothers, and the membrane has

ruptured before labor begins in 126 women. Among mothers whose membrane ruptured, amniotic fluid status was clear in most of the cases 72(64.55%) followed by meconium-stained 36(32.73%) and blood stained in around 3(2.73%) cases. Most of the mothers, 68(37.82%), were operated in the active first stage of labor, while about 69(22.12%) mothers operated in the second stage of labor

with the fully dilated cervix and most of them were operated on high station (-1 and above).

Indications for Cesarean Section

As shown in Figure 1, Mal-presentation 93(25.27%), Fetal distress 87(23.42%), Previous CS 85(23.16%), followed by CPD 65(17.66%) were the main leading indications for cesarean section. The least indication for CS was a maternal preference that accounts for about 1.9%.

Operation profiles

Three hundred thirty-two (90.22%) emergency CS has been performed. Prophylaxis antibiotic has been given in most cases (98.64%). Spinal anesthesia (97%) was the most common anaesthetic technique, followed by general anesthesia (3%). Most of the surgeries (49.46%) were completed in less than 30 minutes. A lower uterine transverse incision was performed in three hundred sixty (98%) mothers. CS was performed for the first time for two hundred sixty-three (72.05%) and for the second time in seventy women (19.73%) (Table 2).

Maternal Outcomes following cesarean section

During the research period, no maternal death was reported. Out of the total mother (368), nearly a quarter 86(23.4%) had one or more intraoperative/postoperative complications. Out of the eighty-six mothers who developed complications, the most frequently observed complications were infection 22 (5.98%), Blood transfusion 21(5.71%), Hemorrhage 20(5.43%), drop in hemoglobin or hematocrit 14 (3.8%), anesthesia complication 10(2.72%), hysterectomy 6 (1.63%) and others (1.08%) (Figure 3).

Fetal Outcomes following cesarean section

During the research period, 380 babies were delivered by CS of which 12 of them were twins. Out of which 17 (4.47%) of them died. Around 75(19.74%) of poor fetal outcomes have been encountered. Most of the newborns were males 204(53.68%). About 60(15.78%) and 38(9.9%) of newborns had poor first and fifth minute Apgar scores, respectively. Low birth weight has been seen in fifty-four newborns. 25 (6.58%) of the newborns were admitted to NICU. The reason for NICU admission was Low birth weight number 14(3.68%), Asphyxia number 6(2.36%), Sepsis number 5(1.31%) and the Meconium Aspiration Syndrome number 1(0.78%). No newborn has been sent to other facilities for further treatment.

Factors associated with maternal Outcomes

In multivariable analysis, four variables, namely medical diseases, obstetric complications, membrane rupture, and Antepartum Hemorrhage (APH) as indications of CS, were statistically significant. After comparing the models by log-likelihood ratio test, the final statistically significant variables are Obstetric complication, Medical disease and Antepartum Hemorrhage (APH) as an indication for CS.

There's a 3.39-fold increased chance of mothers with the medical disease having poor outcomes compared to mothers who hadn't had any medical condition with AOR of 3.39 [95% CI, (1.13, 10.16)]. The second significant factor is obstetric complications. There's a 2.65-fold increase in the

likelihood of mothers with obstetric complications having poor outcomes compared to mothers who hadn't had obstetric complications with AOR of 2.65 [95% CI, (1.17, 6.01)].

Ante Partum Hemorrhage (APH) as an indication for CS was the other significant factor. Women whose indication for CS were APH are 3.73 times more likely to have poor outcomes than women whose indication for CS wasn't APH with AOR of 3.73 [95% CI, (1.08, 12.83)].

Factors associated with Fetal Outcomes

Based on binary logistic regression, medical disease, gestational age, labor status, membrane rupture, cervix status, CS type, an indication for CS (Cephalic Pelvic Disproportion, Ante Partum Hemorrhage), and the number of CS performed were statistically significant. On multivariable analysis, only two variables were found to be statistically significant. Those are coexisting medical diseases of the mother and CPD as an indication for CS.

Mothers with the underlying medical diseases have a 5.78 times greater chance of resulting in poor fetal outcomes than mothers with no underlying medical conditions with an AOR of 5.78 [95% CI (1.17, 28.54)]. The other significant factor is CPD as an indication for CS. There was a 5.57-fold increase in poor fetal outcomes in mothers whose indications for CS were CPD compared to mothers whose indications for CS were other than CPD with an AOR of 5.57 [95% CI (1.74, 17.78)].

Discussion

Caesarean delivery is one of the Bellwether procedures of the *Lancet* Commission on Global Surgery, yet in Africa both the safety of this procedure and access to caesarean deliveries are poor (18). To better identify and understand the problems and aid future interventions, we investigated the maternal and fetal outcomes following cesarean sections (CS) in Ethiopian rural hospitals, located in Southern region Gurage zone. We found that 23.37% of the women with CS had poor maternal outcomes. Comparatively, this is a lower than a similar study conducted in Ethiopia in Arbaminch (38.2%) (14) and in Finote Selam (28%) (16). In contrast, the figure was higher in a study carried out in another Ethiopian region, Tigray (19.3%).

While the majority of parturient have received prophylactic antibiotics 98.64%, higher compared to Arbaminch 93.3% and the national CS review 94% (14,18), post-operative infection remains the most common complication in the zone. In different studies, factors such as timing, postoperative nursing care, ineffective techniques, and patients' medical conditions have been identified as factors affecting the effectiveness of prophylactic antibiotics (19,20). These factors may have an impact on the outcomes in this study as well, but more research is needed to identify the specific causes. Plus, the least complications were hysterectomy (1%) and reoperation (0.4%), which were also consistent with the results obtained in Tigray (1%) and Ayder (1%) (15).

This study revealed that women who had pregnancy related complications are 2.65-fold likely to develop intra- and post-operative complications as compared to women who didn't have obstetric complication with [AOR of 2.65, CI 95% (1.17, 6.01)]. This is in line with research carried out in Arbaminch, Ethiopia [AOR 2.61, CI 95% (1.43, 4.76) (14)]. 13.32 % of pregnant women did not receive ANC care during pregnancy, which could be attributed to the increased chance of developing complications. Risk assessment and risk management are key components of prenatal care and have been linked to improved maternal outcomes and fewer maternal complications, particularly for women with high-risk pregnancies (pregnancy-related complications) (21,22). This shows that there is much to be done to raise awareness of the benefits of ANC follow-up in this rural community along with increasing access to primary health care services.

Furthermore, presence of Antepartum hemorrhage is also associated with poor postoperative maternal outcomes with [AOR 3.48, CI 95% (1.01,11.96)] - this can be linked to greater preoperative blood loss and physiologic derangements, decreasing the maternal body tolerance and response to intraoperative and postoperative events, the outcome of these patients might get worsen based on the type, severity, and duration of the cause of Ante Partum Hemorrhage. Providing multiple interventions may also be necessary after CS on these patients (23), which these rural hospitals cannot provide:- such as blood transfusion (in the absence of readily available blood), providing tertiary level intensive care, and so forth (24,25).

The prevalence of poor fetal outcomes was 19.74%. It is lower than the results reported for another city in Ethiopia; Mettu at 32.9%, but higher than Harar at 1.76 % (19, 20). 90% of cesarean sections were emergency, which could have contributed to poor neonatal outcomes as it is associated with greater risks of respiratory distress due to transient tachypnea of the newborn, surfactant deficiency, and pulmonary hypertension compared with elective CS (26). In this study low birth weight accounts around 14.21%. This result is in line with a report from Arbaminch and Ayder Hospitals and lower than a study conducted in Harar (14, 17, 21). Improving emergency obstetric and surgical access is a top priority in Ethiopia, and the government has worked hard to expand this capacity over the last ten years. As a result, there has been an increase in surgical facilities from 108 in 2013 to 289 in 2019, and the number of surgical procedures per 100,000 population has risen tenfold since 2012 (27,28). However, while increasing access, there is also a significant gap in providing these facilities with emergency life-saving medical equipment and human resources, as well as improving awareness about the need for prenatal care, especially in rural areas, which may be contributing to the poor maternal and fetal outcomes seen in the study.

Conclusion and recommendations

We looked at maternal and infant in-hospital outcomes after cesarean section in Ethiopia's Gurage zone and found that poor maternal and fetal outcomes were prevalent, with 23.4 percent and 19.74 percent, respectively. When compared to other regions of Ethiopia, these figures are not uniformly

high or low, but they are closely related, indicating that immediate interventions are needed to improve hospitals capacities and patients' preoperative status, as pregnancy-related complications, the presence of preoperative medical conditions, and antepartum hemorrhages were the most common factors for poor maternal outcomes. On the other hand, the presence of a medical illness in the mother and CPD as an indication for operation are both risk factors for poor fetal outcomes. Interventions of this type will require the involvement of several stakeholders and the creation of longitudinal clinical evidence, and this study should be broadened and conducted on a large scale in Ethiopia, so that national figures can be compiled, and well-designed nationwide interventions can be developed.

Strengths and Limitation

Strength

This study may be more representative because it included many centers from varied catchment areas at a zonal level. The findings of this study reflect the outcome status of maternal and fetal complications following cesarean section; by creating a baseline from these findings, we will be able to investigate additional analytic investigations. Furthermore, the tools we employed can be applied to future Cohort studies, allowing us or any other researcher to do the research on a wider scale in Ethiopia.

Limitation: We collected data retrospectively due to lack of time and funding, which can expose documentation deficiencies and also miss some of the variables that have a significant impact on patients' outcomes.

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Authors contribution

HM assisted in conceptualization, funding acquisition, methodology, investigation, project administration, software, data curation, validation, preparation of the original draft of this manuscript, and presentation and visualization.

RT assisted in conceptualization, design of the work, methodology, reviewing and editing.

HA assisted in conceptualization, design of the work, methodology, reviewing and editing.

EB assisted in methodology, investigation, project administration, software, data curation, validation, preparation of the original draft of this manuscript, and presentation and visualization.

FK assisted in conceptualization, methodology, preparation of the original draft, reviewing and editing, presentation and visualization.

Disclosure

HM received funding from AAU for conducting this study, which was used to pay the data collectors and travel expenses.

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