



Magnitude and Determinants of Adverse Perinatal Outcomes in Tefera Hailu Memorial Hospital, Sekota Town, Northern Ethiopia

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Eshetu Seyoum¹, Alemayehu Bekele²,
Adino Tesfahun Tsegaye³, and Simon Birhanu*⁴ 

Abstract

Background. Of 133 million births globally, 3.7 million died in the neonatal period and 3 million are stillborn. The perinatal mortality rate in Ethiopia is 46 per 1000 pregnancies. However, area-specific information is limited in this regard. Therefore, this study aimed to determine the magnitude and determinants of adverse perinatal outcomes in Northern Ethiopia. **Method.** An institution-based cross-sectional study was conducted by reviewing the medical records of mothers who gave birth between September 2015 and August 2016. The completeness and consistency of data were checked. Descriptive statistics were computed. A multinomial logistic regression model was fitted to identify determinants of adverse perinatal outcomes. Odds ratio with 95%CI was used and variables that had a *P*-value of <0.05 in the final model were considered statistically significant. **Result.** The magnitude of adverse perinatal outcomes was 214/799 (27.47 %). Out of that, 10.8% had a perinatal mortality outcome, and 16.7% had a perinatal morbidity. Not using modern contraceptives (AOR = 1.7, 95% CI: 1.1-2.7), labor induction or augmentation (AOR = 3.0, 95% CI: 1.2-7.8), obstetric complications (AOR = 2.2, 95% CI: 1.1-4.5), attending antenatal care (AOR = 0.4, 95% CI: 0.2-0.8), primigravida (AOR = 0.5, 95% CI: 0.3-0.9), had no history of medical illness (AOR = 0.5, 95% CI: 0.3-0.8), and urban residency (AOR = 1.9, 95% CI, 1.1-2.9) were the significant determinants of perinatal outcome. **Conclusion.** The magnitude of adverse perinatal outcomes was considerable and 1 in 5 neonates either had morbidity conditions or died. Improving family planning utilization, ANC, referral linkage, and management of obstetric complications could help to reduce the undesirable consequences of perinatal outcomes.

Keywords

low birth weight, prematurity, perinatal mortality, stillbirth, Ethiopia

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Introduction

Worldwide it is estimated that there are 133 million live births annually, 5.9 million under-five deaths with 3.7 deaths during the neonatal period, and 3 million still-born. A total of 98% of these deaths occur in the developing world. The average neonatal mortality rate in developing countries is 31/1000 live births while it is 4/1000 live births in developed countries. In Africa, the sub-Saharan regions of eastern, western, and central Africa have neonatal mortality between 40 and 46/1000 live births. Stillbirth rates have also remained high in sub-Saharan Africa with the rate of 38/1000 live births.¹

In Ethiopia, 1 in every 35 children dies within the first month, 1 in every 21 children dies before celebrating

¹Tefera Hailu Memorial Hospital, Waghimra Zone, Sekota, Ethiopia

²Ethiopian Public Health Association, Addis Ababa, Ethiopia

³Department of Epidemiology and Biostatistics, Institute of Public Health, University of Gondar, Gondar, Ethiopia

⁴School of Nursing and Midwifery, Haramaya University, Harar, Ethiopia

*Corresponding Author:

Simon Birhanu, School of Nursing and Midwifery, Haramaya University, Harar, Ethiopia.

Email: abiubirhanu1221@gmail.com



the first birthday, and 1 in every 15 children dies before reaching the fifth birthday. According to Ethiopian Demographic and Health Survey (EDHS) 2016, the perinatal mortality in Ethiopia is 30/1000 live births and it is 44/1000 births in Amhara regional state where this study is conducted.² In a household survey done in the Amhara region, North Gondar on the prevalence and associated factors of neonatal mortality among 3600 mothers, the neonatal mortality rate was 43.8 per 1000 live births.³

Fetal and extrauterine life forms a continuum during which human growth and development are influenced by genetic, environmental, and social factors. Perinatal mortality (PNM) refers to the death of a fetus after the age of viability (28 weeks), until the first seventh day of life.⁴

Of the global magnitude of 2.6 million stillbirths around 1.6 million stillbirths occur during labor in the low/middle-income countries where a significant proportion of women give birth at home usually in the absence of an attendant.⁵ Neonatal mortality is highest during the first 24 hours of life and it accounts for 65% of all infant deaths (deaths before 1 year of age).^{6,7} Nowadays, the widespread application of neonatal intensive care improved the survival of low birth weight (LBW) infants remarkably.⁸

Perinatal mortality rate could be affected by parity, gestational age, birth weight, congenital anomalies, infections, and exposure to adverse factors during pregnancy, labor, and/or delivery.⁹⁻¹¹ Generally, it is influenced by prenatal, maternal, and fetal conditions and by circumstances surrounding delivery. Perinatal deaths are associated with intrauterine growth restriction (IUGR) which is a condition that predisposes the fetus to asphyxia and neonatal infections.^{12,13} Generally, the predictors of adverse perinatal outcomes could be maternal factors such as multiparity, multiple pregnancies, hypertensive disorders, uterine rupture, trauma, abnormal labor, diabetes, sepsis, post-term pregnancy, drugs and Rhesus incompatibility, maternal age (both high and low), and preterm delivery; fetal factor, for instance, non-vertex presentation, gestational age, prematurity, chromosomal anomalies, and non-chromosomal birth defects; placental factors such as feto-maternal hemorrhage, abruption, placenta previa, cord accident, placental insufficiency, intrapartum asphyxia, twin-to-twin transfusion, and chorioamnionitis.^{10,14,15}

The essential elements of a focused approach to antenatal care are recognizing and managing pregnancy-related complications, screening for conditions and diseases, taking preventive measures, and planning a birth. According to WHO guidelines, a higher frequency of antenatal contacts reduced the likelihood of stillbirths. Eight or more contacts for antenatal care can reduce perinatal deaths by up to 8 per 1000 births when

compared to 4 visits.¹² However, an inequity exists and young, rural, poor, and less educated women may not benefit from ANC services or may drop out due to lack of health care access and low-quality services.¹³

Although there is information about perinatal mortality in Ethiopia, and there is limited information specific to the study area. Therefore, this study aimed to determine the magnitude and determinants of adverse perinatal outcomes in Northern Ethiopia and this would ultimately contribute to overcoming the prevailing challenges in the control of perinatal mortality in Ethiopia.

Methods and Materials

Study Design and Setting

An institution-based cross-sectional study was conducted by reviewing medical records of mothers who gave birth from September 2015 to September 2016 in Tefera Hailu Metasebia Hospital (THMH), Wag Himra zone, Amhara Regional State, Ethiopia. The hospital has 128 health professionals in different fields including a surgeon, emergency surgical officers, general practitioners, health officers, nurses, laboratory technicians, and 52 supporting staff. Also, it has 32 inpatient beds (14 gynecology and 18 obstetrics) and 6 delivery beds in the gynecology and obstetrics departments. Currently, the gynecology obstetrics department runs by emergency surgical officers and midwives.

Study Population

The study population includes all neonates born in Tefera Hailu Memorial Hospital from September 2015 to August 2016. Records with grossly incomplete data with relevant information were excluded from the study. The total sample size of the study was 836. Data were extracted from registration books, delivery registration, and maternal and neonatal cards. The data were collected by 2 trained midwives under the supervision of the research team.

Operational Definitions

Adverse perinatal outcome: morbidity or mortality that happens after 28 weeks of gestation and within 7 days of birth. In this study, perinatal outcomes had 3 categories described as favorable, morbidity, or mortality outcomes. A favorable outcome was considered in the absence of morbidity or mortality.

Neonatal morbidity: when a neonate has at least one of the following clinical presentations diagnosed by a physician within 7 days of birth such as perinatal

Table 1. Socio-Demographic Characteristics of New-Borns and Their Mothers in Tefera Hailu Memorial Hospital from September 2015 to August 2016 (n=779).

Socio-demographic characteristics				95% CI	
Variable	Category	Frequency	Percentage	Lower	Upper
Residence	Urban	412	52.8	49.6	56.5
	Rural	367	47.1	43.5	50.5
Sex of newborn	Male	429	55	51.3	58.9
	Female	350	45	41.1	48.7
Age of mother	Age <18	41	5.3	3.7	6.9
	Age 18-35	671	86.1	83.7	88.7
	Age >35	67	8.6	6.7	10.5

asphyxia, thermoregulation, prematurity, infection in neonates, jaundice, metabolic disorder, meconium aspiration syndrome, neonatal seizure, neonatal hematologic problems, birth trauma, shock in the neonates, congenital malformations, and acute or emergent surgical conditions.

Perinatal Mortality (PM): the death of a fetus after the age of viability (28 weeks of gestation) until the seventh day after birth (including stillbirth).

Stillbirth or fetal death: birth after 28 completed weeks of gestation with the absence of signs of life at or after birth (death happened before or during labor and birth).

Neonatal mortality (NM): Neonatal death within the first 28 days after birth. It can also be divided into the death of a live-born baby within the first 7 days of age (early neonatal mortality-ENM) and death after 7 days until the 28th day of age (late neonatal mortality-LNM).

Low birth weight (LBW): a birth weight of <2500 g.

Very low birth weight: a birth weight of <1500 g.

Preterm birth was defined as a birth before 37 completed weeks; term birth was defined when a mother gives birth between 37 and 42 completed weeks; post-term was defined as delivery after 42 completed weeks.

A cord accident was defined as an event that happened during labor and delivery that includes cord prolapse, cord presentation, cord entanglement, and cord knot.

Antepartum hemorrhage (APH) was defined as bleeding from the genital tract of the pregnant mother after the fetus has reached the age of viability (which is after 28 completed weeks or fetal weight of 1000 gm or more), and before the fetus is delivered.

Data Management and Analysis

Data were first entered into an Excel spreadsheet and exported to SPSS version 20. Descriptive statistics were

computed, and multinomial logistic regression analysis was used to identify determinants of adverse perinatal outcomes. Factors that had a *P*-value of $\leq .20$ in the bivariable analysis and variables with well-known clinical significance with adverse perinatal outcomes were fitted into the final model of multivariable multinomial logistic regression. The odds ratio with 95% CI was used to declare the presence and strength of association. Variables with a *P*-value of $< .05$ in the final model were considered statistically significant.

Results

Socio-Demographic Characteristics

A total of 836 newborns were delivered at Tefera Hailu Memorial Hospital from September 2015 to August 2016, and 57 of them were excluded due to the incompleteness of the information on the medical records. The median age of mothers was 25 years with a range of 16 to 45. Of all the new-borns, 429 (55.1%) were males and 408 (52.8%) were from urban residents (Table 1).

Obstetric Characteristics

The total number of neonates delivered from mothers who had 1 or more obstetric complications was 69 (8.8 %). It includes antepartum hemorrhage 33 (4.2 %), premature rupture of membrane 28 (3.6%), oligohydramnios 9 (1.1%), polyhydramnios 7 (0.9 %), and malpresentation 46 (5.9 %). Of the mothers, 340 (43.6 %) were primigravida and 127 (16.3 %) had a poor obstetric history. Before the current pregnancy, 315 (40.4 %) had used modern contraceptives. The median duration of labor was 11 hours, and 49 (6.3 %) of the labor was induced. Two-hundred-ninety (36.3 %) of the mothers had never attended ANC.

The mode of delivery was vaginal for 611 (78.4 %), cesarean section or laparotomy for 146 (18.7 %), and

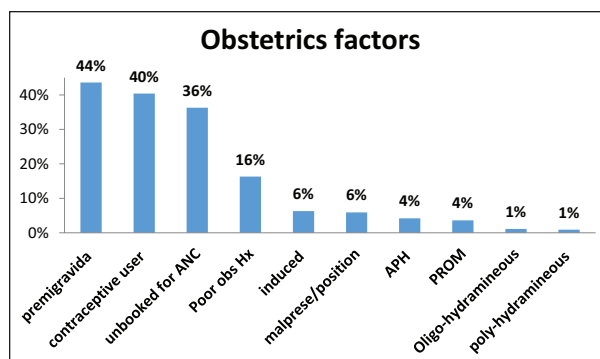


Figure 1. Obstetrics related conditions of mothers who gave birth in THMH, Amhara region, Ethiopia; September 2015 to September 2016 (n = 779).

instrument-assisted for 20 (2.6 %) mothers. A congenital anomaly was present among 12 (1.5 %) births (Figure 1).

Medical Factors

The total number of newborns delivered from mothers who had a medical illness was 96 (12 %). The medical problems were HIV 34 (4.3 %), anemia 24 (3.1 %), hypertensive disorders of pregnancy 19 (2.4 %), and others (urinary tract infection (UTI), acute gastroenteritis (AGE), and an acute febrile illness (AFI)) 23 (2.9 %).

Perinatal Outcomes

Out of the total births, 565 (72.5 %) had favorable perinatal outcomes, 84 (10.8 %) had a perinatal mortality outcome, and 130 (16.7 %) had perinatal morbidity. Overall, the magnitude of adverse perinatal outcomes (mortality and morbidity) was 214 (27.5 %).

Perinatal Morbidity Outcomes

The commonest causes of morbidity were preterm delivery, which affected 114 (14.5 %) neonates, low birth weight 120 (15.3 %), low Apgar score 92 (11.7 %), and congenital anomalies 12 (1.5%).

Perinatal Mortality Outcome

The total number of perinatal deaths was 84 (10.8 %, 95 % CI: 8.9-13.2), and out of this 63 (8.1 %) were stillbirth and 21 (2.7 %) early neonatal loss. Reasons for perinatal mortality in the hospital were: low Apgar score, which affected 73 (86.9 %) neonates, prematurity 42 (50.0 %), low birth weight 38 (45.2 %), early onset of neonatal sepsis 7 (8.3 %), asphyxia 2 (2.4 %), meconium aspiration syndrome 3 (3.6 %), and others 4 (4.8 %) (Figure 2).

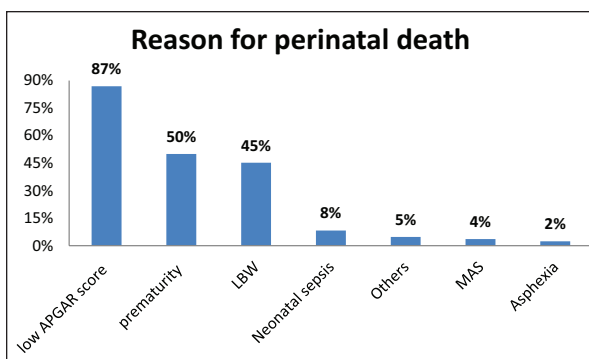


Figure 2. Reasons for perinatal mortality in THMH from September 2015 to August 2016.

Determinants of Perinatal Outcomes

In the bivariable multinomial logistic regression model residence, antenatal attendance, parity, history of modern contraceptive use, poor obstetric history, the status of labor, mal-presentation, mode of delivery, medical illness, and obstetrics complication were fitted. Factors that had a *P*-value of ≤ 0.20 on crude analysis and variables with well-known clinical significance with perinatal outcomes were fitted into the final model of multivariable multinomial logistic regression (Table 2).

The multivariable analysis using multinomial logistic regression showed the following findings.

Compared to neonates born to mothers from rural settings, neonates born to mothers from urban settings were 1.9 times more likely to have a favorable outcome than morbidity outcomes (AOR = 1.9, 95 % CI, 1.1-2.9). Compared to mothers who had not used modern contraceptives, neonates born to mothers who had used modern contraceptives were 1.7 times more likely to have a favorable outcome than morbidity outcomes (AOR = 1.7, 95% CI: 1.1-2.7). Neonates born from mothers who had a history of medical illness compared to mothers who had no medical illness were 50 % less likely to have a favorable outcome than morbidity outcomes (AOR = 0.5, 95% CI: 0.3-0.8). Neonates born from mothers with obstetric complications compared to neonates born from mothers without obstetric complications were 60 % less likely to have a favorable outcome than morbidity outcomes (AOR = 0.4, 95% CI: 0.2-0.8).

Neonates born from mothers who had ANC attendance compared to mothers who did not have ANC attendance were 60% less likely to have mortality outcomes than morbidity outcomes (AOR = 0.4, 95% CI: 0.2-0.8). Neonates born from primigravida mothers compared to multi-gravida mothers were 50 % less likely to have mortality outcomes than morbidity

Table 2. Multinomial Logistic Regression for Factors Associated with Perinatal Outcomes in Waghimra Zone Tefera Hailu Memorial Hospital from September 2015 to August 2016 (n = 779).

Variable		Perinatal outcomes			
		Favorable		Mortality	
		COR 95% CI	AOR 95% CI	COR 95% CI	AOR 95% CI
Residence	Urban	1.9 (1.3-2.8)	1.9 (1.1-2.9)**	0.3 (0.2-0.6)	0.5 (0.3-1.1)
	Rural				
ANC attendance	Yes	1.4 (0.8-1.9)	0.9 (0.5-1.4)	0.3 (0.2-0.5)*	0.4 (0.2-0.8)**
	No				
Parity	Primi	0.8 (0.6-1.3)	0.8 (0.5-1.2)	0.5 (0.3-0.9)*	0.5 (0.3-0.9)**
	Multi				
Poor obstetric history	Yes	1.0 (0.6-1.8)	0.9 (0.5-1.7)	1.4 (0.7-2.9)	0.8 (0.3-1.8)
	No				
Contraceptive use	Yes	1.9 (1.2-2.8)	1.7 (1.1-2.7)**	0.7 (0.4-1.3)	1.2 (0.6-2.5)
	No				
Mode of delivery	Operative	1.2 (0.7-1.9)	1.6 (0.9-2.8)	2.3 (1.2-4.4)*	1.4 (0.7-3.0)
	SVD				
Status of labor/delivery	Induced/augmented	0.6 (0.3-1.5)	0.7 (0.3-1.7)	3.6 (1.5-8.8)	3.0 (1.2-7.8)
	Spontaneous				
Mal-presentation	Yes	0.8 (0.3-1.9)	0.6 (0.2-1.6)	3.5 (1.4-9.1)	2.5 (0.8-7.5)
	No				
Medical disorder	Yes	0.6 (0.4-1.0)	0.5 (0.3-0.8)	0.6 (0.2-1.3)	0.6 (0.2-1.4)
	No				
Obstetrics complication	Yes	0.3 (1.3-0.5)	0.4 (0.2-0.8)	2.3 (1.2-4.5)	2.2 (1.1-4.5)**
	No				

*Reference category is morbidity outcome. **P-value of <.05.

outcomes (AOR = 0.5, 95% CI: 0.3-0.9). As compare to neonates born from mothers whose labor was spontaneous, neonates born from mothers who had labor induction or augmentation by oxytocin were 3 times (AOR = 3.0, 95% CI: 1.2-7.8) more likely to have mortality outcome than morbidity outcomes. Neonates born from mothers with obstetric complications compared to neonates born from mothers without obstetric complications were 2.2 times more likely to have mortality outcomes than morbidity outcomes (AOR = 2.2, 95% CI: 1.1-4.5).

Discussion

This study was conducted to assess the magnitude and factors affecting perinatal outcomes at Tefera Hailu Memorial hospital. The magnitude of the perinatal mortality rate in this study was 10.8% (95% CI: 8.9-13.2). It is consistent with the findings from a systemic review done on 16 hospitals in Ethiopia,¹⁴ and other studies done in Tanzania,¹⁶ and Jimma, western Ethiopia.¹⁵ However, it is higher than a study done in the North East of Iran.¹⁷ This could be explained by a difference in the socio-demographic and economic condition of the study

participants. Tefera Hailu Memorial Hospital is the only hospital in the zone that gives comprehensive obstetrics care and each Woreda in the Zone has a poor infrastructure for transportation.

The magnitude of perinatal morbidity in this study was 16.7%. This is consistent with a study done in Holland.¹⁸ However, it is lower than a study done in Australia.¹⁹ This could be explained by the socio-economic difference between the settings.

According to the multivariable analysis using multinomial logistic regression, neonates whose mothers were urban residence were 90% more likely to have a favorable outcome than morbidity outcomes compared to neonates whose mothers were rural residence. This is consistent with studies done in Canada.²⁰⁻²² This is because urban mothers have better educational status and access to health facilities. They are more likely able to reach health facilities before complications happen. Moreover, urban women have a very limited problem with transportation to health facilities which could avoid delays in accessing medical care.

Neonates born to mothers who had ANC attendance compared to mothers who did not have ANC attendance were 60% less likely to have mortality outcomes than

morbidity outcomes. It is consistent with studies done in Zimbabwe,²³ Ethiopia,²⁴ and the United States of America.²⁵ As it is known that when mothers have ANC, they get an adequate evaluation and health-related problems can be detected early. Also, they discuss their birth plan with health care providers during their ANC and they could plan to have facility delivery and would go to a health facility when their labor starts. Therefore, they are less likely to delay and to be victims of poor birth outcomes.

Neonates born to primigravida mothers compared to multi-gravida mothers were 50% less likely to have mortality outcomes than morbidity outcomes. This is consistent with a study done in Uganda.²⁶ When parity increases, the risk of developing obstetric complications increases.²⁷ Besides, multi-gravida women are most of the time older and are at a greater risk of obstetric complications.^{26,28,29}

Compared to mothers who had not used modern contraceptives, neonates born from mothers who had used modern contraceptives were 70% more likely to have a favorable outcome than morbidity outcomes. This is consistent with a study done in the United States.³⁰ Women who use modern contraceptives have better knowledge and they are more likely to have a planned pregnancy. Moreover, mothers could have a better health condition due to the planned pregnancy and that would help them to have a healthier outcome.^{31,32}

Neonates born to mothers whose labor was either induced or augmented by oxytocin compared to mothers whose labor was spontaneous were 3 times more likely to have mortality outcomes than morbidity outcomes. Women could have augmentation by oxytocin following a uterine atonia that can happen due to different reasons. When women have power failure especially after the fetus is engaged, it could prolong the labor and make the fetus asphyxiated and exacerbate the adverse birth outcomes among newborns.³³⁻³⁵ Also, women are going to have other alternative management following their power failure, and the alternatives could be surgical or instrumental delivery or augmenting the labor by oxytocin. These alternatives have their effect in altering the birth outcomes.

Neonates born to mothers who had a history of medical illness compared to mothers who had no medical illness were 50% less likely to have a favorable outcome than morbidity outcomes. Understandably, maternal illness is a risk factor for adverse birth outcomes.³⁵ When a mother has an illness, that could affect the physiology of mothers during labor, and also the disease might be transmitted to the newborn and worsen his/her condition.

Neonates born to mothers with obstetric complications compared to neonates born to mothers without

obstetric complications were 2.2 times more likely to have mortality outcomes than morbidity outcomes. Neonates born to mothers with obstetric complications compared to neonates born to mothers without obstetric complications were 60% less likely to have a favorable outcome than morbidity outcomes. This is consistent with studies done in Kenya, Tanzania, and Norway.^{27,35,36} Mothers who have obstetric complications are at risk of having poor birth outcomes and the complications would lead the newborns to have bad outcomes.

This study can be used as a baseline for other researchers and will be a source of information for planning and decision-making. However, mothers who live in the rural part of the study area are mostly giving birth at home and the findings of this study might not represent women who deliver in the community. Since we used secondary data, the result might be affected by some incomplete records.

Conclusions

The magnitude of adverse perinatal outcomes in the study area was considerable. The commonest determinants of poor perinatal outcomes were low birth weight and prematurity. Urban residence, ANC, parity, and modern contraceptive use had a protective effect on perinatal mortality while labor induction/augmentation, medical illness, and obstetric complications were risk factors of adverse perinatal outcomes. Increasing modern family planning service utilization, encouraging antenatal care follow-up service; identifying and referring clients with medical illness and obstetrics complications early is strongly recommended.

Abbreviations

AOR: adjusted odds ratio; **COR:** crude odds ratio; **CSA:** central statistical agency; **CI:** confidence interval; **EDHS:** Ethiopian Demographic and Health Survey; **SD:** Standard deviation; **WHO:** World Health Organization.

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Authors' Contributions

ES initiated the research. ES, SB, AB, and AT contributed to the proposal writing, data entry, and analysis. SB drafted the manuscript and all the other authors read and approved the final version of the manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics Approval

Ethical approval was obtained from an institutional review board of the Ethiopian Public Health Association. Additionally, a letter of permission was obtained from Tefera Hailu Memorial Hospital. Since patient records were reviewed, informed consent was waived. Names of patients were not recorded, and the information gathered was not accessible to anyone except the principal investigator and was kept locked and protected by a password.

ORCID iD

Simon Birhanu  <https://orcid.org/0000-0002-7852-5902>

Availability of Data and Materials

All data generated or analyzed during this study are included in this manuscript.

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