

Trends and outcomes of cesarean delivery in Ayder Comprehensive Specialized Hospital, Mekelle city, northern Ethiopia

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Abstract

Background: Rising rates of cesarean delivery is becoming a concern to developing countries. Though cesarean section is a life saving surgical intervention, the rise in rates has resulted in significant health problems of mothers and newborns.

Objective: The aim of this study was to describe trends and outcomes of cesarean delivery in Ayder comprehensive specialized hospital, Mekelle City, Northern Ethiopia.

Methods: Hospital based record review cross-sectional study was conducted in Ayder comprehensive specialized Hospital, Mekelle City, Northern Ethiopia from September 11, 2011 to September 10, 2016. Trained data collector and the principal investigator collected data employing a pre-tested extraction format. After checking the filled extraction format for completeness, data was entered, cleaned and analyzed using SPSS software Version 23. Chi- square test, 95% CI and P-value <0.05 was used to examine association between dependent and independent variables.

Result: In five years time (2011-2016), there were 9,348 deliveries, of which 2,911 were delivered by cesarean section which gives the overall rate of 31.1%. The cesarean delivery rate was increasing from 25.2% in 2011/2012 to 33.5% in 2015/2016 with an average annual increment of 1.7%. The most common indications for cesarean section were non-reassuring fetal heart rate pattern (22.8%), cephalo-pelvic disproportion (21.1%), and repeat cesarean delivery (14.0%) respectively, which accounts for more than half of the cesarean sections. The common maternal morbidities after cesarean delivery in the study result were anemia (37.2%) mainly those anemic before delivery and had antepartum hemorrhage; postpartum hemorrhage (3.7%), surgical site infection (1.9%), iatrogenic internal organ injury (bladder, ureter and bowel) (0.8%), and uterine vasculature laceration (0.9%). There were 4.7% stillbirths mainly in women with obstructed labor and antepartum hemorrhage, 1.8% early neonatal deaths despite resuscitation in the operation theatre before referral to neonatal intensive care unit, and 16.1% of neonates had fifth minute Apgar score of less than 7 with 12.2% of neonates admitted to neonatal intensive care unit.

Conclusion and recommendation: In this study, there is a steady increase in the rates of cesarean delivery in five years time, and complications of post-cesarean delivery are common. Further studies are necessary to investigate the factors that increase the rate of cesarean delivery and post-operative complications. Policies and efforts aimed at decreasing the unnecessary cesarean sections and its complications should be promoted and implemented at each health facility.

Keywords: trends, cesarean delivery, indications, outcome, Ethiopia

INTRODUCTION

Cesarean delivery has played a major role in lowering both maternal and perinatal morbidity and mortality rates during the past century. As any surgical procedure, it is associated with a variety of short and long term complications. Problems related to anesthesia and drugs, bleeding, injury to the bladder, aspiration pneumonia, cardiac arrest, postoperative infections thrombophlebitis are among the common short term complications, whereas scar dehiscence and high rate of repeat cesarean section are cited as the common long term complications (1).

Rates of cesarean section are of concern both in developed and developing countries. According to a study conducted by World Health Organization (WHO) in 2005, although very unevenly distributed, 15% of births worldwide were by cesarean delivery (CD) (2) and institution-based study of seven African countries was 8.8% (3). Though there is no consensus on the optimal rate of cesarean section, WHO recommends between 5 and 15% (4). Higher rates of cesarean delivery in teaching hospitals of both developed and developing countries were reported. The cesarean delivery rate, in Yale University, USA, increased from 26% to 36.5% between 2003 and 2009 (5). In one government medical college, Latur, India in 2013, the cesarean delivery rate was 23.97% (6). A population based analysis of survey data in Jordan from 2002 to 2012 also shows the cesarean delivery rate was increasing among apparently low risk mothers at university teaching hospitals from 18.2% in 2002 to 30.3% in 2012 (7), and at Sharif

teaching hospital in Pakistan in 2014 it was 21.40% (8).

The cesarean section rates in African teaching institutions also varies and in one Nigerian teaching hospital, in 2009 the cesarean section rate was 11.8% (9) and in Kilimanjaro Christian Medical Center (KCMC), a large University-referral hospital in northern Tanzania, the CS rate was ranging between 29.9 to 35.5 percent with the peak in year 2005 (10) and in one health insurance hospital in Alexandria, Egypt, the cesarean section rate ranged from 33.7% in 1999 to 57.9% in 2004 (11). In Khartoum hospital in Sudan in 2011, the rate of cesarean delivery was 43.2% (12).

In Ethiopia, large proportion of the population lacks access to essential obstetric care including cesarean delivery (13). The national population based survey study in 2014 revealed that cesarean delivery rate was 2.0 % (14) whereas the overall rate from institution-based study was 18%, which ranges between 15% in the public sector and 46% in the private sector (15). A study conducted in 1992 in Tikur Anbessa Teaching Hospital revealed that the rate for cesarean section was 10% (16), but a study conducted in 2011 in both public and private hospitals in Addis Ababa, the rate was 31.1% in the public teaching hospitals and 48.3% in private owned ones (17) and in Attat Hospital, which is a private-owned hospital located out of Addis Ababa, it was 27.6% (18). Studies conducted in Tigray, Northern Ethiopia revealed that the rate of CS rates ranged from 8.5% in Adigrat zonal hospital (19) and 21.9% in Ayder referral teaching hospital (20).

Ayder comprehensive specialized hospital is an area for post-graduate students to do their clinical practices and serves the whole Tigray region and surrounding regions like Afar and Amara. Therefore, this study was aimed at describing trends and outcomes cesarean deliveries in Ayder comprehensive specialized hospital in Mekelle City that plays a vital role in furnishing information which helps in reducing maternal mortality and morbidity resulting from unnecessarily cesarean section and its complications. These study findings will also have significant impact in improving quality of services in maternity and to allocate resources on the most common priority areas.

Methodology

The study was conducted in Ayder comprehensive specialized hospital (ACSH), which is located in Mekelle city, Tigray 783 km north of Addis Ababa, Ethiopia. ACSH is a teaching hospital for both undergraduate and postgraduate students and has 24 hours a day specialty care. It began its service in 2008 and serves close to 8 million people living in the northern part of the country. It has adult, pediatric and neonatal intensive care units for critically ill cases. Ayder comprehensive specialized hospital is selected purposively for its specialty care and is the only referral hospital with 24 hours cesarean delivery service and serving more complicated cases in the northern part of the country.

Hospital based cross-sectional study design was employed. Record reviewing was done on charts or registration of clients who had

undergone a cesarean section from September 11, 2011 to September 10, 2016. All cesarean deliveries performed after period of viability (28 weeks or 1000 grams weight) were included in the study. The data for the study was collected using a pre-tested extraction format written in English inquiring socio-demographic characteristics, obstetric history and outcomes of cesarean section. Information was obtained from operation theatre records, labor ward records, and neonatal ward records and patient cards. All data collected by the principal investigator and graduate student in clinical midwifery and checked for completeness before entry to SPSS software.

Data was entered into computer SPSS software version 23 after checking for completeness, then cleaning and coding was done. Analysis was made and results presented in the form of tables. Bivariable and multivariable binary logistic regression was done to see associations between dependent and independent variables using P value <0.05 and 95% CI as statistically significant.

Ethical clearance was obtained from the college of health sciences research and community service committee and permission letter was obtained from the hospital medical director. Confidentiality was maintained. Any information, which could negatively affect the hospital, the staffs and the clients, was not released for any third party. The clients' names were not written in the case summary.

RESULTS

Socio-demographic and Obstetric Profile

There were 9,348 deliveries at ACSH, of which 2,911 were by cesarean delivery, which gives a cesarean delivery rate of 31.1%. Of the total clients charts, 314 (10.8%) of them were not found and not included in the analysis. The cesarean delivery rate was increasing each year during the study period; it was 25.2% in September 11, 2011 to September 10, 2012 and increased to 33.5 percent in September 11, 2015 to September 10, 2016. The cesarean delivery rate was increasing each year on annual average of 1.7 percent. The age of the women ranged between 15-48 years with a mean age of 26.70 years and $SD \pm 5.58$. The majority (84.8%) of the clients were between 20-35 years of age, and about 74% of them were urban residents.

The mean parity of the study participants was 2. The average gestational age at cesarean delivery was 39.0 weeks, with standard deviation of 1.9, minimum and maximum gestation of 29 and 43 weeks respectively, and 190 (7.3%) of cesarean deliveries were done in preterm gestation. One hundred ninety three (7.4%) mothers with cesarean delivery did not have ANC follow up in any health institution. The majority of the mothers 85.7% had primary cesarean delivery. All presented in table 1.

About 1214 (46.7%) of mothers were referred from other health institutions. The majority of women, 1656 (63.8%) had no

any form of medical illness. But, about 118 (4.5%) mothers were anemic according to the WHO criteria. Other medical and obstetric illnesses identified before CD were pregnancy related hypertension in 294 (11.3%), antepartum hemorrhage in 228 (8.8%), premature rupture of membrane in 306 (11.8%), and HIV/AIDS in 57 (2.2%) clients. The majority of pregnancies were singleton 2459 (94.7%), 137 (5.3%) were twin and one triplet (See table 2).

Cesarean Delivery Variables

The majority of cesarean deliveries were emergencies- 2397 (92.3%) and most cesarean delivery cases were done under spinal anesthesia 2143 (82.5%). Almost all uterine incisions 2592 (99.8) were lower uterine segment transverse with only 3 (0.1%) cases with classical CD and one inverted T type incision and one J-shaped incision. The leading indications for cesarean delivery were non-reassuring fetal heart rate status 22.8%, cephalopelvic Disproportion (CPD) 21.1%, previous CD 14.0% and mal-presentation 10.8%, all accounts for 68.7% of the indications for cesarean section. Cesarean delivery due to obstructed labor indication ranges from 8.4% in 2011/2012 to 0.9% in 2015/2016.

Table 1: Socio-demographic characteristics of mothers who delivered via caesarean section at Ayder Comprehensive Specialized Hospital, Mekelle, Tigrai, 2016.

Year		2011/2012 N (%)	2012/2013 N (%)	2013/2014 N (%)	2014/2015 N (%)	2015/2016 N (%)	Total N(%)
Total delivery		1229	1401	1294	2271	3153	9348
Cesarean delivery		310	415	389	740	1,057	2911
Missed (percent)		48 (15.5%)	47(11.3%)	39(10.0%)	63 (8.0%)	117(11.0%)	314 (11%)
Cesarean delivery rate		25.2%	29.6%	30.0%	32.3%	33.5%	31.1%
Age (percent)	<20	20 (7.6)	21 (5.7)	31 (8.9)	50 (7.4)	86 (9.1)	208 (8.0)
	20-24	58 (19.1)	119 (32.4)	109 (31.1)	175 (25.7)	239 (25.4)	700 (26.9)
	25-29	80 (30.6)	118 (32.2)	114 (32.6)	246 (36.4)	376 (40.1)	934 (36.0)
	30-35	81 (33.9)	76 (20.5)	72 (20.6)	146 (21.6)	193 (20.5)	568 (21.9)
	>35	23 (8.8)	34 (9.2)	24 (6.8)	60 (8.9)	46 (4.9)	187 (7.2)
Address (percent)	Urban	177(67.6)	248(67.4)	241(68.9)	468(69.1)	772(82.1)	1906 (73.4)
	Rural	85(32.4)	120(32.6)	109(31.1)	209(30.9)	168(17.9)	691 (26.6)
Parity (Percent)	0	59 (22.5)	116 (31.5)	107 (30.6)	159 (23.5)	248 (26.3)	689 (26.5)
	1-4	190 (72.5)	233 (63.3)	229 (65.4)	471 (69.6)	657 (70.0)	1780 (68.5)
	≥ 5	13 (5.0)	19 (5.2)	14 (4.0)	47 (6.9)	35 (3.7)	128 (4.9)
GA (weeks) (Percent)	< 37	24(9.2)	22 (6.0)	43 (12.3)	52 (7.7)	49 (5.2)	190 (7.3)
	37-41+6	202(77.0)	291(79.1)	269 (76.9)	579 (85.5)	784 (83.4)	2125 (81.8)
	≥ 42	13(5.0)	17 (4.6)	20 (5.7)	19 (2.8)	35(3.7)	104 (4.0)
	Unknown	23 (8.8)	38 (10.3)	18 (5.1)	27 (4.0)	72 (7.7)	178 (6.9)
ANC (percent)	Yes	247 (94.3)	319(86.7)	312(89.1)	652 (96.3)	874 (93.0)	2404 (92.6)
	No	15 (5.7)	49 (13.3)	38 (10.9)	25(3.7)	66 (7.0)	193 (7.4)
Previous cesarean delivery(p ercent)	Yes	18 (6.9)	31 (8.4)	62 (17.7)	102 (15.1)	159 (16.9)	372 (14.3)
	No	244 (93.1)	337 (91.6)	288 (82.3)	575 (84.9)	781 (83.1)	2225 (85.7)

Table 2: Indications of cesarean delivery in Ayder Comprehensive Specialized Hospital, Mekelle, Tigray, Northern Ethiopia, 2016.

Year of cesarean delivery		2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	Over 5 years
Indication for Cesarean delivery (percent)	Failed trial of labor after cesarean delivery	10 (3.8)	17 (4.6)	36 (10.3)	51 (7.5)	63 (6.7)	177 (6.8)
	Repeat cesarean delivery	10 (3.8)	14 (3.8)	18 (5.1)	57 (8.4)	88 (9.4)	187 (7.2)
	Cephalopelvic disproportion	67 (25.6)	98 (26.6)	68 (19.4)	139 (20.5)	176 (18.7)	548 (21.1)
	Non-reassuring fetal heart rate	39 (14.9)	61 (16.6)	67 (19.1)	156 (23.0)	269 (28.6)	592 (22.8)
	Antepartum hemorrhage	16 (6.1)	30 (8.2)	26 (7.4)	38 (5.6)	37 (3.9)	147 (5.7)
	Malpresentation	40 (14.9)	47 (12.8)	37 (10.6)	66 (9.8)	92 (9.8)	282 (10.8)
	Obstructed labor	22 (8.4)	28 (7.6)	16 (4.6)	21 (3.1)	8 (0.9)	95 (3.7)
	Failed induction	15 (5.7)	10 (2.7)	16 (4.6)	33 (4.9)	37 (3.9)	111 (4.3)
	Abnormal labor with meconium	5 (1.9)	8 (2.2)	15 (4.3)	33 (4.9)	39 (4.1)	100 (3.9)
	Multiple gestation	14 (5.3)	16 (4.3)	17 (4.9)	27 (3.8)	49 (5.2)	123 (4.7)
	Others	24 (9.2)	39 (10.6)	34 (9.7)	56 (8.3)	82 (8.7)	235 (9.0)

Maternal and newborn outcomes

Among 2,597 mothers with cesarean delivery there were 3 maternal deaths, 2

women during 2011/2012, the other one was in 2012/2013. The mean of the post-operative hemoglobin was 10.6 gm. /dl with a standard deviation of 1.26. Nine hundred sixty six (37.2%) mothers had postoperative hemoglobin less than 11 gram/dl, which includes 118 women with anemia before the operation, and 23 (0.9%) mothers had severe anemia; less than 7 gm. /dl. The other leading early maternal complications were

postpartum hemorrhage (PPH) 97 (3.7%), surgical site infection 49 (1.9%), iatrogenic organ injury (mainly bowel, bladder and ureteric) 20 (0.8%) and uterine incision lateral extension 24 (0.9%), and spinal anesthesia hypotension 19 (0.7%) (Table 3). There were 15 (0.5%) re-laparotomies following cesarean delivery, 10 for postpartum hemorrhage, and 5 for abdominal collection or wound dehiscence.

Table 3: Maternal outcomes after cesarean delivery in Ayder Comprehensive Specialized Hospital, Mekelle, Tigray, Northern Ethiopia, 2016.

Year		2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	Five year
Maternal complication	PPH	10 (3.8)	13 (3.5)	20 (5.7)	32 (4.7)	22 (2.3)	97 (3.7)
	Iatrogenic organ injury	1 (0.4)	4 (1.1)	3 (0.9)	2 (0.3)	10 (1.1)	20 (0.8)
	Uterine incision lateral extension	1 (0.4)	2 (0.5)	4 (1.1)	8 (1.2)	9 (1.0)	24 (0.9)
	SSI	13 (5.0)	7 (1.9)	9 (2.6)	16 (2.4)	4 (0.4)	49 (1.9)
	SA hypotension	3 (1.1)	1 (0.3)	2 (0.6)	3 (0.4)	8 (0.9)	19 (0.7)
	Aspiration	0	1 (0.3)	2 (0.6)	2 (0.3)	2 (0.2)	7 (0.3)
	DVT and PTE	0	0	1 (0.3)	1 (0.1)	4 (0.4)	6 (0.2)
	No	234 (89.3)	340 (92.4)	308 (88.0)	613 (90.5)	881 (93.7)	2376 (91.5)
Post-operative Hemoglobin	<7	2 (0.8)	5 (1.3)	5 (1.4)	7 (1.0)	4(0.4)	23 (0.9)
	7-<11	100(38.2)	114(31.0)	94(26.9)	317 (46.8)	321(34.1)	943 (36.3)
	≥11	160(61.2)	249(67.7)	251(71.7)	353 (52.1)	615(65.4)	1628 (62.8)

N.B: PPH-postpartum hemorrhage, SSI-Surgical site infection, SA-spinal anesthesia, DVT-Deep venous thrombosis, PTE- pulmonary thrombo-embolism.

There were 2,736 neonates delivered, with an average weight of 3,246.95 grams and standard deviation of 659.097 and the smallest birth weight was 1000 gram and largest was 5,500 gram. Three hundred seventy (13.5%) neonates were low birth weight less than 2500 gram. There were 129 (4.7%) stillbirths mainly caused by obstructed labor and antepartum hemorrhage and 46 (1.8%) early deaths among the live births before they referred to neonatal intensive care unit. There were highest (7.9%) cesarean deliveries with stillbirths in 2011/2012 and lowest (3.0%) in 2015/2016 with average decrease per year of 0.98%. The APGAR scores at first minute, 92 (3.4%) scored between 1 and 3; 794 (29.4%) between 4 and 6; and 1721 (62.9%) more than or equal to 7. APGAR scores at the

fifth minute, 23 (0.9%) newborns got scores between 1 and 3; 396 (15.2%) between 4-6; and 2142 (82.2%) more than or equal to 7. There were 313 (12.2%) neonates referred to NICU. About 36% of neonates were referred with main admission diagnosis of early onset neonatal sepsis, 33.5% perinatal asphyxia, 23.4% hyaline membrane disease, 7.0% meconium aspiration syndrome and 0.6% congenital cardiac disease. (See table 4).

There were a total of 175 still births and early neonatal deaths before referral to NICU, but 170 neonates were included in the analysis.

Table 4: Neonatal outcome after cesarean delivery in Ayder Comprehensive Specialized Hospital, Mekelle, Tigray, Northern Ethiopia, 2016.

Year		2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	Overall
Newborn weight	<2500	50(18.0)	42(10.8)	67 (18.1)	90 (12.7)	121(12.2)	370 (13.5)
	2500-3999	192(69.1)	303(78.4)	260 (70.1)	522(73.5)	737(94.5)	2014 (73.6)
	≥4000	36 (12.9)	42(10.8)	44 (11.8)	98 (13.8)	132(13.3)	352 (12.9)
First minute APGAR score	Still birth	22 (7.9)	23 (5.9)	20 (5.4)	34 (4.8)	30 (3.0)	129 (4.7)
	1-3	16 (5.8)	18 (4.7)	20 (5.4)	18 (2.5)	20 (2.0)	92 (3.4)
	4-6	89 (32.0)	155 (40.1)	110 (29.6)	168 (23.7)	272 (27.5)	794 (29.4)
	≥ 7	151(54.3)	191(49.3)	221 (59.6)	490(69.0)	668 (67.5)	1721 (62.9)
Fifth minute APGAR score	Early death	4 (1.7)	7 (2.0)	7 (2.0)	12 (1.8)	16 (1.7)	46 (1.8)
	1-3	6 (2.3)	2 (0.5)	4 (1.1)	6 (0.9)	5 (0.5)	23 (0.9)
	4-6	48 (18.7)	60 16.5	58 (16.5)	89 (13.2)	141 (14.7)	396 (15.2)
	≥ 7	198(77.3)	295 81.0	282 (80.4)	569(84.2)	798 (83.1)	2142 (82.2)
NICU referral	Yes	38 (15.1)	51(14.3)	53 (15.4)	73 (11.0)	98 (10.4)	313 (12.2)
	No	214 (84.9)	306 (85.7)	291 (84.6)	591 (89.0)	846 (89.6)	2248 (87.8)
Admission diagnosis to NICU	EONS	18 (47.4)	15 (29.4)	16 (30.2)	24 (32.9)	38 (38.8)	111(35.5)
	PNA	13 (34.2)	24 (47.1)	12 (22.7)	21 (28.8)	35 (35.7)	105 (33.5)
	MAS	2 (5.3)	2 (3.9)	5 (9.4)	4 (5.5)	9 (9.2)	22 (7.0)
	HMD	5 (13.1)	9 (17.6)	20 (37.7)	23 (31.5)	16 (16.3)	73 (23.4)
	CCD	0 (0)	1 (2.0)	0	1 (1.3)	0	2 (0.6)

N.B: NICU-Neonatal intensive care unit, EONS- Early onset neonatal sepsis, PNA- perinatal asphyxia, MAS- Meconium aspiration syndrome, HMD- hyaline membrane disease, CCD- Congenital cardiac disease.

Table 5: Bivariate and multivariate analysis of factors associated with maternal complication postpartum hemorrhage (PPH) after cesarean delivery in Ayder Comprehensive Specialized Hospital, Mekelle, Tigray, Northern Ethiopia, 2016.

Variable		Outcome		Odds ratio (OR)	
		No PPH	Has PPH	Crude OR	Adjusted OR
Address	Urban	1861	45	3.36 (2.24-5.07)	1.89 (1.02-3.48)
	Rural	639	52		
Parity	0-4	2390	79	0.20 (0.12-0.35)	0.56 (0.20-1.55)
	≥ 5	110	18		
Number of fetuses	Singleton	2374	84	0.34 (0.19-0.63)	0.30 (0.15-0.63)
	Multiple gestation	126	13		
Labor status	Induced	312	4	0.38(0.25-0.58)	3.51 (1.09-11.36)
	Not in labor	574	45	2.32 (0.83-6.48)	
	Spontaneous	1614	48		
GA	Preterm	167	26	0.17 (0.10-0.27)	0.37 (0.19-0.71)
	Term	103	1	2.64 (0.36-19.27)	
	Post term	2069	53		
	Unknown	161	17		
ANC	No	172	21	0.27 (0.16-0.44)	0.70 (0.27-1.77)
	Yes	2328	76		
Previous CD	Yes	359	16	0.85 (0.49-1.47)	0.48 (0.25-0.94)
	No	2141	81		
Type of anesthesia	GA	422	65	2.42 (1.57-3.75)	1.64 (1.47-2.84)
	SA	2078	32		
Indication for CD	Obstructed labor	64	31	8.24 (5.19-13.07)	9.92 (5.19-18.93)
	Others	2363	139		
Type of CD	Emergency	2308	89	0.93 (0.44-1.94)	0.47 (0.19-1.15)
	Elective	192	8		
Pre-op hgb	Normal	2411	64	0.07 (0.06-0.12)	0.30 (0.14-0.62)
	Anemic	89	33		
Maternal medical illness	Yes	883	58	0.37 (0.24-0.56)	0.47 (0.24-0.92)
	No	1617	39		

N.B: GA-Gestational age, CD-Cesarean delivery, ANC-Antenatal care.

Table 6: Bivariate and multivariate analysis of factors associated with neonatal outcome among neonates delivered by cesarean section in Ayder Comprehensive Specialized Hospital, Mekelle, Tigray, Northern Ethiopia, 2016.

Variable		Neonatal outcome		Odds ratio	
		Alive	Died	Crude OR	Adjusted OR
Newborn weight, gram	Less than 1500	27	12	7.81 (3.84-15.85)	7.72(2.73-22.81)
	1500-2499	212	44	3.65 (2.50-5.33)	3.49 (1.83-6.68)
	2500-3999	1845	105	0.46 (0.23-0.92)	0.53 (0.22-1.25)
	≥ 4000	343	9		
GA	Preterm	161	32	4.44 (2.87-6.84)	3.51 (1.43-8.57)
	Term	2031	91	1.61 (0.73-3.57)	0.62 (0.30-1.27)
	Post term	97	7		
	Unknown	138	40		
Indication for CD	OL	64	31	8.24 (5.19-13.07)	9.92 (5.19-18.93)
	Others	2363	139		
Address	Rural	580	111	7.86 (4.89-12.21)	2.05 (1.31-3.20)
	Urban	1847	59		
Maternal medical illness	Yes	859	82	0.59 (0.46-0.80)	0.79 (0.40-1.54)
	No	1568	88		
Type of anesthesia	General	392	62	0.34 (0.24-0.47)	0.69 (0.44-1.07)
	Spinal	2035	108		
Type of CD	Emergency	195	5	0.35 (0.14-0.85)	0.83 (0.29-2.40)
	Elective	2232	165		
Age category	15-19	196	12	0.87 (0.47-1.60)	0.75 (0.38-1.51)
	20-34	1934	136	1.05 (0.66-1.68)	0.67 (0.31-1.47)
	≥ 35	297	22		
Number of Fetuses	Multiple gestation	130	9	0.99 (0.49-1.99)	0.85 (0.38-1.89)
	Singleton	2297	161		
Previous CD	Yes	362	13	0.47 (0.27-0.84)	0.83 (0.40-1.72)
	No	2065	157		
Parity	≥ 5	111	17	2.23 91.36-3.96)	1.36 (0.51-3.63)
	≤ 4	2316	153		
ANC follow up	No	137	56	8.50 (5.91-12.21)	2.64 (1.43-4.85)
	Yes	2294	110		
How did the patient come	Self-referred	1245	17	7.86 (4.90-12.62)	3.20 (1.82-5.64)
	Referred	1186	149		
Pre-op hgb	Anemic	84	38	8.03 (5.27-12.24)	3.23 (1.66-6.30)
	Not anemic	2347	128		
Labor status	Induction	305	11	0.85 (0.31-1.20)	0.44 (0.18-1.10)
	Not in labor	557	62	1.80 (1.29-2.51)	0.85 (0.38-1.89)
	Spontaneous	1565	97		

Discussion

Like other teaching hospitals around the world (5, 6, 7, 8-12, 17), the cesarean delivery rate has increased at an average by 1.7 percent per year in our study. Various factors can be associated with this trend, which needs further study. The largest age group on whom cesarean section was done was between 24-29 years. This was similar with studies in sub-Saharan Africa countries including previous studies from Ethiopia population (9, 15, 18, 23 and 25). This can be explained by the fact that this age group is the most common reproductive age group. Another very interesting finding is that the cesarean delivery rate among rural women significantly dropped in the last two years of study period. The expansion of primary hospitals and comprehensive emergency obstetric care can be the reason for the drop over the recent year.

Compared to previous studies from other parts of Ethiopia, where 10-32.2% of women did not attend antenatal care (18, 19), fewer women in our study (7.4%) did not have antenatal care follow up. The recent surge antenatal care follow up nationwide can be the reason behind this fact (21). Unlike many other countries from Africa and other part of the world (6, 8-11, 18 and 26), the rate of cesarean delivery for mothers with previous cesarean delivery was lower in our setup. However, this was comparable to other previous studies with in our country (17). This variation may be related with variation in trial of labor after cesarean delivery policy, which needs further study. Nevertheless, the tremendous

increase in institutional delivery over the recent years, the variation on the cesarean delivery rate in different centers, and difference on the referral cases could be among the factors deserved variation.

The majority of women had no any form of medical illness before cesarean delivery. But, 4.5% mothers were anemic according to the WHO criteria. This was lower compared with Attat hospital, Ethiopia and may be related with the increment in ANC follow up and universal iron supplementation during antenatal care (18). Other medical and obstetric illnesses identified in the mothers having cesarean delivery, were pregnancy related hypertension, antepartum hemorrhage, premature rupture of membrane, HIV/AIDS and diabetes mellitus. The majority of pregnancies were singleton 94.7% and the rest were twins with one triplet. This was similar with a study result conducted at Mizan-Aman; Ethiopia (22).

Another significant variation exists in the proportion of elective cesarean delivery from our study, especially with the developed world. A high proportion of elective cesarean delivery was reported from Finland (45.6%) and Pakistan (38.6%) (8, 24). On the other hand, our finding was similar to previous studies from Sub-Saharan Africa. Studies from Ethiopia also demonstrated high proportion of emergency cesarean delivery (15, 18, 23 and 25). It may be related with overuse of cesarean delivery and high rate of repeat cesarean delivery in developed nations and some institutions in developing countries. In our study, the

majority of cesarean deliveries were done under spinal anesthesia. Previous studies from Finland, Addis Ababa and Gondar showed lower number of cases performed under spinal anesthesia (17, 23, 24). Our experience, which showed a majority of cases performed under spinal anesthesia, is in line with the standard recommendations to decrease the major complications associated with general anesthesia such as aspiration during emergency surgery. The type of uterine incision in almost all cases was lower uterine segment transverse incision, which carries the lowest risk of postoperative complication.

The common indications for primary cesarean delivery were similar with majority of study results, but the repeat cesarean delivery rate was found to be different in different study results. It was similar with study result in Sub-Saharan countries, in teaching hospital in Nigeria, and previous study results in other parts of Ethiopia (9,17,18, 25), but it was higher in Sharif teaching hospital in Pakistan, in Kilimanjaro medical center, Tanzania and Alexandria, Egypt (8-11). During the study period there was significant decrease in cesarean delivery for obstructed labor from 8.4% in 2011/2012 to 0.9% in 2015/2016 with an average 1.5 percent decrease per year. This may be associated with the expansion of primary hospitals with cesarean delivery facility as can be described by decreased number of mother referred from rural area. Cesarean delivery for repeat cesarean delivery and non-reassuring fetal heart rate status was increasing during the study period from 7.6 percent and 14.9 percent in 2011/2012 to

16.1% and 28.6 percent in 2015/2016 respectively with average increase by 1.7% and 1.9% respectively. It may be related with less trial of labor and increased use of electronic fetal monitoring and morning report effect in teaching hospitals respectively.

There were 3 maternal deaths (1.1 deaths for 1000 cesarean deliveries) during the study period. This was much lower than study results in Malawi, 10 death per 1000 cesarean deliveries; in Attat hospital, 4 maternal deaths per 1000; and Tikur Anbessa teaching hospital, 16 maternal deaths per 1000 cesarean deliveries (16, 18, and 27). Even though it is difficult to compare the condition in a different setup, improvement in quality of obstetric service, health seeking behavior and institutional delivery may partially explain the observed variation. About 37.2% mothers had postoperative hemoglobin less than 11 gram/dl, with 0.9% mothers having severe anemia, hemoglobin less than 7 gm./dl. The overall post cesarean delivery maternal morbidity was 8.5%, which is similar with previous study results in other part of Ethiopia that ranges from 7.7% to 9.7% (17,18). The leading early maternal complications were postpartum hemorrhage, surgical site infection and uterine incision lateral extension. There were 15 (0.5%) re-laparotomies following cesarean delivery, 10 for postpartum hemorrhage, and 5 for abdominal collection or wound dehiscence. The intraoperative complications are similar with study in Finland with postpartum hemorrhage 5.0%, laceration of uterine wall or uterine vessels 1.2% and internal organ

injury 0.6%, but the postoperative complications are higher with 3.2% wound infection and re-laparotomy rate of 1.5% (24). The re-laparotomy rate is also higher in Mansoura university hospital, Egypt (28). The surgical site infection rate is also significantly lower than in Dhulinkhel hospital in Nepal 12.6% (29). This may be related with proper use of prophylactic antibiotics. Postpartum hemorrhage the most common intraoperative complication was found higher 1.6 times in cesarean deliveries with general anesthesia, 3.5 times after induction and 2 times in mothers from the rural area.

Obviously, poor neonatal outcome were associated with low birth weight and preterm birth in the study. Rural residence was also associated significantly with adverse neonatal outcome. Another significant association with poor neonatal outcome was observed with cases of obstructed labor and lack of antenatal care. Collaborative effects to decrease the incidence of obstructed labor and improved access to antenatal care may be important preventive measures to improve neonatal outcome.

Limitations: The use of secondary data, which lacks more variables, and cross sectional study more descriptive than analytic.

Conclusion and recommendation:

There is steady increase in the cesarean delivery rate over the study period. Postoperative complications are common. Further studies are necessary to investigate

the causes of increase in cesarean delivery rate. There is a need of strengthening effort to decrease the postoperative complications. Prospective multicenter studies are necessary to investigate and determine the actual picture of the condition.

Competing interests

The authors declare that they have no competing interests.

Authors contributions

HT wrote the proposal, performed the statistical analysis and drafted the paper, approved the proposal with some revisions, participated in the design of the study and data analysis. AG supervised and coordinated the proposal writing and participated in statistical analysis and writing the manuscript. AAM supervised the proposal development, and statistical analysis. All authors read and approved the final manuscript.

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