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Research Article

Analysis of caesarean section practices and consequences in Goma, DR Congo: Frequency, indications, maternal and perinatal morbidity and mortality

Abstract

Introduction: Approximately 22.9 million Caesarean Sections (CS) are performed worldwide each year, mainly to save the life of the mother and/or new-born infant. However, with nearly 2 deaths in 1,000 live births, global neonatal mortality after CS is three times higher than after vaginal delivery. Nearly 300,000 women die every year as a result of a pregnancy or a caesarean or vaginal delivery. 99% of these maternal deaths occur in developing countries.

Materials and methods: The study was conducted in the four referral hospitals in the city of Goma in DRC, between 01/11/2013 and 01/01/2016. Statistical analyses were performed using STATA/IC 15.0 for Windows. Univariate logistic regression was performed to determine which characteristics are associated with perinatal mortality. A value of $p<0.05$ was considered statistically significant.

Results: The overall frequency of CS in the four facilities was 16.2%. Goma Provincial Hospital had the highest frequency. The three main indications for CS were dystocia, scarred uterus and foetal distress. The most frequent intraoperative complications were haemorrhage and injury to nearby organs (bladder and digestive tract), and the most frequent post-operative complications were wound infections, urogenital fistulae and hypertensive disorders. Our study describes a perinatal risk of 4.4%.

Conclusion: Caesarean section should be a factor in reducing foeto-maternal morbidity and mortality if transfer conditions, working conditions at referral centre level, and health staff training are improved.

Introduction

Approximately 22.9 million Caesarean Sections (CS) are performed worldwide every year, primarily to save the life of the mother and/or the new-born infant [1]. However, with nearly 2 deaths in 1,000 live births, global neonatal mortality after CS is three times higher than after vaginal delivery [2]. Nearly 300,000 women die every year as a result of a pregnancy or a caesarean or vaginal delivery [3]. 99% of these maternal deaths occur in developing countries [3]. In Sub-Saharan African (SSA), 8.8% of deliveries are by CS [4], which is in line with the 10 to 15% recommended by the World Health Organisation (WHO) [5]. However, intrapartum mortality in SSA accounts for 73% of neonatal deaths worldwide [6]. In the Democratic Republic of the Congo (DRC), the latest demographic and health surveys show that the CS rate rose from 4% in 2007 [7] to 5% in 2013 [7].

Emergency CS is still practised too frequently in SSA [8,9], despite the negative impact on maternal and foetal prognosis, whereas elective CS rates are on the rise in developed countries [10] with less risk to maternal and perinatal health.

Several risk factors which increase maternal and perinatal morbidity and mortality intra- and post-CS have been identified, in particular the lack of qualified staff, inadequate medical infrastructure, difficulty in performing CS in due time when women need one, as well as the high cost of the procedure in relation to the population's income. One study conducted in SSA revealed that the majority of countries had limited CS capabilities; only 20% of hospitals had full-time doctors and 47% lacked anaesthetists [11]. The goal of this study was to assess the frequency, indications and maternal and perinatal risks associated with CS in Goma, and to identify the maternal factors that are associated with those risks in order to propose improvements in the practice of CS.

Materials and Methods

The study was carried out in four referral hospitals in the

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city of Goma, DRC (Bethesda Hospital, Charité Maternally Hospital, Virunga Hospital, Goma Provincial Hospital) between 01/11/2013 and 01/01/2016. It is a retrospective, descriptive and analytical study concerning all caesarean sections performed out of all deliveries that occurred during the period under study. Twin pregnancies were excluded from the study (42 twin pregnancy). The medical staff in each hospital were capable of performing a CS. A data collection form was designed. Data collection was carried out by a team of investigators made up of doctors and midwives in the four maternity units. The sources of information were the delivery record, partograph, surgical reports and neonatal records. The sociodemographic parameters (mother's age, marital status, level of education, ethnicity, occupation, primary residence, weight and height), medical and surgical history, obstetric environment (monitoring of prenatal visits), and maternal and perinatal morbidity and mortality (complications and outcome) were analysed.

Statistical analysis

The results were expressed as a percentage of the total for the categorical variables, as a mean and Standard Deviation (SD) or as a median and Interquartile Range [IQR] for the quantitative variables according to their distribution, Gaussian or otherwise, respectively.

Univariate logistic regression was performed to determine which characteristics (socio-demographic, medical or obstetrical) are associated with stillbirth. Odds ratios and their 95% confidence intervals were presented. A p-value of <0.05 was considered statistically significant.

Variables with a high percentage of missing values or without stillbirth cases were not included in the univariate analysis

Statistical analyses were performed using STATA/IC 15.0 for Windows.

Results

CS frequency and sociodemographic characteristics

The four maternity units of the hospitals had recorded a total of 4,530 deliveries, including 736 caesarean sections, during the period under study, giving an overall CS frequency of 16.2%. The highest CS frequency was recorded at North Kivu Provincial Hospital or the Goma provincial hospital. Table 1 shows the sociodemographic characteristics of the women whose records were included in the study. Overall, the women who had undergone caesarean sections were mostly married, homemakers, who had been to secondary school, were of Nande ethnicity, and living in the vicinity of the medical facility that performed the CS (Table 1). The majority of women had been to at least three prenatal visits, had had at least one prior CS, and most were first pregnancies (Table 2). The majority of these caesarean sections were performed urgently and were cases of cephalic presentation. Locoregional anaesthesia was the most common.

Table 1: Sociodemographic characteristics.

	n	%
Name of the Healthcare Facility	694	
B Hospitalc	158	22.8
CH M Hospital	86	12.4
VIRUN Hospital	206	29.7
GP Hospital	244	35.2
Mother's age (years)	688	26.8(6.2)*
Civil status	678	
Married	604	89.1
Single	74	10.9
Mother's level of education	663	
None	82	12.4
Primary	62	9.4
Secondary	301	45.4
Higher	87	13.1
Other	131	19.8
Ethnic group#	427	
Nande	165	38.6
Hunde	59	13.8
Havu	13	3.0
Shi	47	11.0
Hutu	33	7.7
Other	110	25.8
# 38.5% missing		
Mother's profession	681	
Home	526	77.2
Working	69	10.1
Other	86	12.6
Primary residence	665	
Urban		92.8
Rural		7.2
Distance in km	317	1.5(1-2.5)&
#54.3% missing		
Hospital in the health zone of the mother's village	645	
Yes	405	62.8
No	240	37.2

* mean (sd); & median (IQR).

Indications for CS

The three main indications for CS in our study were dystocia (difficult and protracted labour), scarred uterus and foetal suffering. In the majority of cases, the CS was performed by the general practitioner, the surgical protocol in the patient file was complete, and the parietal incision was mostly transverse. A small proportion of women had had a blood transfusion (Table 3).

Maternal and perinatal morbidity and mortality

Intraoperative complications included haemorrhage and injury to nearby organs (bladder and digestive tract). Post-

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Table 2: Medical characteristics.

	n	%
BMI (kg/m²)	377#	28.9(4.7)*
#45.7% missing		
History of high blood pressure	694	
No	668	96.3
Yes	26	3.7
Family hypertension	694	
No	658	94.8
Yes	36	5.2
History of diabetes	694	
No	689	99.3
Yes	5	0.7
Family diabetes	694	
No	675	97.3
Yes	19	2.7
Parity	687	
0	210	30.6
1-3	319	46.4
>=4	158	23.0
Abortion	658	
0	519	78.9
1	91	13.3
>=2	48	7.3
Number of previous caesareans	580	
0	304	52.4
1	154	26.6
>=2	122	21
Number of gynaecological surgeries other than caesarean section	447*	
0	419	93
1	19	7
2	7	4.3
3	2	1.6
* 35.6 % missing		
Number of prenatal visits during the current pregnancy	593	
0	16	2.7
1	26	4.4
2	69	11.6
3	188	31.7
>=4	294	49.6
Albuminuria	604	
Yes	82	13.6
No	202	33.4
Not sought	320	53
Sugar in the urine	598	
Yes	39	6.5
No	181	30.3
Not sought	378	63.2
Urinary tract infection	608	
Yes	179	29.4
No	249	41
Not sought	180	29.6

* mean (sd); & median (IQR).

Table 3: Obstetrical characteristics.

	n	%
Type of admission	679	
Normal before start of labour	260	38.3
Urgently during childbirth	419	61.7
Visit pattern	678	
Referral before labour onset	5	0.7
Referral during labour	131	19.3
Personal decision before labour onset	139	20.5
Personal decision during childbirth	403	59.4
If transfer, location of the health facility	144	
Facility in the hospital's health zone	87	60.4
Facility outside the hospital's health zone	57	39.6
Uterine height in centimetres before caesarean section	671	32.5(3.2)*
Presentation of the foetus	677	
Cephalic	611	90.3
Breech	53	7.8
Transverse	8	1.2
Other	5	0.7
Onset of labour	673	
Spontaneous	517	76.8
Induced	124	18.4
Caesarean section before labour	32	4.8
Type of primary anaesthesia	685	
Locoregional	429	62.8
General	254	37.2
Type of secondary anaesthesia	644	
0	625	97.1
Locoregional	9	1.4
General	10	1.6
Preoperative indications for CS 1		
Pelvic anomaly	690	121(17.5)
Scarred uterus	690	158(22.9
Dynamic dystocia	690	49(7.1)
Foetal distress	690	93(13.5)
Placenta praevia	690	26(3.8)
Other	690	248(35.9)
Postoperative indications for CS 1		
Pelvic anomaly	680	116(17.1)
Scarred uterus	680	148(21.8)
Dynamic dystocia	680	44(6.5)
Foetal distress	680	97(14.3)
Placenta praevia	680	25(3.7)
Other	680	255(37.5)
Surgical protocol in the mother's file	677	
Complete with the surgical procedure in detail and all postoperative instructions	452	66.8
Incomplete with only the surgical procedure but in detail	22	3.2
Incomplete, giving a basic summary of the surgical procedure	196	29.0
None	7	1.0
Type of parietal incision	694	
No	18	2.6
Median	296	42.7
Transverse	380	54.7
Transfusion performed	646	
Yes	37	5.7
No	609	94.3
Qualification of the person who performed the CS	673	
General practitioner	631	93.8
Surgeon	10	1.5
Gynaecologist	32	4.7

* mean (sd); & median (IQR).

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operative complications included infections (peritonitis, uterine wall suppuration, and septicaemia), urogenital fistulae and hypertensive disorders. Maternal death accounted for 0.1% of caesarean sections, and 0.1% of patients were transferred. The average length of stay in hospital was five days and the patient file was complete in 53% of cases (Table 4).

Table 4: Delivery outcomes.

	n	%
Child's Apgar score at 1 minute	678	
>=7	589	86.9
<7	89	13.1
Child's Apgar score at 5 minutes	677	
>=7	639	94.4
<7	38	5.6
Child's Apgar score at 10 minutes	677	
>=7	646	95.4
<7	31	4.6
Child's weight at birth in grams	599	3178(597)*
>=2500g	553	92.3
<2500g	46	7.7
Intraoperative complications	669	
No	653	97.6
Yes	16	2.4
Post-operative complications	667	
No	651	97.6
Yes	16	2.4
Mother's outcome	676	
Death	1	0.15
Discharge	674	99.7
Transfer	1	0.15
Infant's outcome	676	
Live birth	636	94.1
Macerated stillbirth	11	1.6
Fresh stillbirth	17	2.5
Unspecified stillbirth	2	0.3
Live birth but death within 24 hours	3	0.4
Transfer	7	1
Stillbirth	676	
No	643	95.1
Yes	33	4.9
Total length of stay in days	669	
		5(5-7)&
The person who completed the questionnaire was different to the person who performed the CS	684	
Yes	610	89.2
No	74	10.8
Patient's file complete	679	
Yes	360	53
No	319	47

* mean (sd); & median (IQR).

For the newborn infants, the average weight was 3,178grams (g). 86.9% of cases had an Apgar score of over 7 at one minute after birth, 94.4% at five minutes and 95.4% at ten minutes after birth. 4.4% were stillbirths, of which 1.6% were macerated stillbirths, 2.5% fresh stillbirths, 0.3% unspecified stillbirths, and 0.5% early perinatal mortality. More stillbirths were observed among patients living in urban settings, those who had had fewer prenatal visits during pregnancy, patients with a history of CS, multiparous patients, caesarean sections performed urgently, and when locoregional anaesthesia was used (Table 5).

Discussion

Caesarean frequency

Our study shows a CS proportion of 16.2%, which is in line with the average rate of 10 to 15% recommended by the WHO [12]. These WHO recommendations are valid particularly for scheduled caesarean sections, for which the proportion should be very low except in centres for high-risk pregnancies. The CS proportion seen in our study is higher than that seen among the general population in the Democratic Republic of Congo (DRC) [7]. One study analysed the proportion of CS in SSA and showed an average CS rate of 19% [13], which is in line with the overall estimate described in the literature [14]. Another study on the analysis of CS practices in SSA described a CS rate of 2 to 52% [15]. This study showed that this rate varies depending on the population studied and on access to healthcare [15,16].

In 2017, a study carried out in Lubumbashi (DRC) described the proportion of CS as 10.65% in urban hospital settings, which was near double those seen in the general population in DRC [17]. In 2012, a study conducted in three African countries (DRC, Burundi, Sierra Leone) described an average CS of 6.2%, with extremes of 4.1% (Masisi, DRC) and 16.8% (Kabezi, Burundi) [8].

In 2013, a study analysed data from 22 countries in SSA and showed that the CS rate had risen over time in each of the countries studied, but remained lower than 10%; these rates remained below 1% in rural populations [6]. Several factors may explain these low CS rates: inadequate qualification of staff working at prenatal-visit level [9,18], inadequate infrastructure for emergency obstetrical care [6], lack of resources for pre- and intrapartum monitoring [9], and the tendency toward promoting a natural birth at all costs [9]. Certain studies described high proportions of CS of 20% or higher, for example in Kinshasa (DRC) between 2012 and 2013, varying between 28.5% and 31.2% [19,20]. In Liberia, a rate of 35.5% was recorded in 2012 [21]. In Benin, rates of 37.6% and 51.5% were recorded in 2015 and 2016 respectively [16]. WHO experts and public health officials have expressed concern over the increase in the number of caesarean sections and its consequences in terms of maternal and perinatal morbidity and mortality [22].

Although a CS is an effective technique for preventing maternal and perinatal mortality when used appropriately, it is not risk free and is associated with short and long-term complications [23]. CS rates have risen in developed and

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Table 5: Risk factors for stillbirth (n=33).

	Stillbirths n (%)	OR (IC 95%)	p-value
Socio-demographic characteristics			
Mother's age (years)	28.2(6.0)*	1.04(0.98-1.10)	0.19
Civil status			
Married	29(4.9)	1	0.82
Single	4(5.6)	1.14(0.39-3.3)	
Mother's level of education			
None	4(4.9)	1	0.43
Primary	1(1.6)	0.32(0.03-2.95)	
Secondary	14(4.8)	0.97(0.31-3.02)	
Higher	1(1.2)	0.23(0.03-2.12)	
Other	8(6.3)	1.28(0.37-4.41)	
Mother's profession			
Home	23(4.5)	1	0.57
Work	3(4.5)	1.0(0.29-3.42)	
Other	6(7.1)	1.6(0.65-4.15)	
Hospital in the health zone of the mother's village			
Yes	16(4.0)	1	0.41
No	13(5.5)	1.37(0.65-2.91)	
Primary residence			
Urban	25(4.2)	1	0,06
Rural	5(10.4)	2.7(0.98-7.3)	
Medical characteristics			
History of high blood pressure			
NO	32(4.9)	1	0.80
Yes	1(3.9)	0.77(0.10-5.88)	
Parity	n=32		
0	3(1.5)	1	0.048
1-3	19(6.1)	4.4(1.3-15.1)	
>=4	10(6.5)	4.7(1.3-17.5)	
Number of previous caesarean sections			0.045
0	13(4.3)	1	
1	3(2)	0.45(1.13-1.61)	
>=2	10(8.3)	2.0(0.86-4.7)	
Number of prenatal visits during current pregnancy			
0	0		
1	3(11.5)	1	0.03
2	3(4.4)	0.6(0.11-3.0)	
3	11(5.9)	0.8(0.2-3.0)	
>=4	5(1.7)	0.2(0.05-0.97)	
Albuminuria			
Yes	2(2.6)	1	0.31
No	6(3)	1.2(0.23-5.9)	
Not sought	17(5.5)	2.2(0.5-9.7)	
Sugar in the urine			
Yes	1(2.6)	1	0.26
No	4(2.2)	0.87(0.9-8.0)	
Not sought	19(5.2)	2.1(0.27-15.9)	
Urinary tract infection			
Yes	5(2.9)	1	0.10
No	7(2.9)	1.0 (0.31-3.2)	
Not sought	12(6.8)	2.5 (0.8-7.1)	
Malaria parasite			
Yes	3(4.6)	1	0.12
No	8(2.5)	0.5(0.14-2.1)	
Not sought	13(6.3)	1.4(0.38-4.99)	
Obstetrical characteristics			
Type of admission			
Normal before the start of labour	8(3.1)	1	0.18
Emergency during labour	22(5.4)	1.75(0.77-4.00)	
Visit pattern			0.037
Referral before labour onset	1(25)	1	
Referral during labour	10(7.8)	0.25(0.02-2.65)	
Personal decision before labour onset	2(1.5)	0.04(0.003-0.64)	
Personal decision during labour	16(4.0)	0.13(0.01-1.28)	
Uterine height in centimetres before CS	31.9(0.91) *	0.91(0.84-1.05)	0.29
Presentation of the foetus			
Cephalic	24(4)	1	0.16
Breech	3(6)	1.5(0.44-5.3)	
Other	2(15,4)	4.3(0.9-20.7)	
Onset of labour			
Spontaneous	18(3.6)	1	0.16
Induced	9(7.4)	2.2(0.96-4.99)	
Caesarean before labour	2(6.3)	1.8(0.4-8.2)	
Type of primary anaesthesia	n=32		<0.0001
General	10(2.4)	1	
Locoregional	22(8.9)	4.0(1.9-8.6)	
Preoperative indication for CS 1			
Pelvic anomaly	32(5.8)	1	0.05
	1(0.85)	0.14(0.02-1.04)	
Scarred uterus	28(5.4)	1	
	5(3.2)	0.58(0.23-1.52)	0.26
Dynamic dystocia	32(5.1)	1	
	1(2.1)	0.40(0.05-3.03)	0.38
Foetal distress	32(5.5)	1	
	1(1.1)	0.19(0.03-1.44)	0.11
Placenta praevia	31(4.8)	1	
	2(7.7)	1.7(0.38-7.3)	0.5
Other	10(2.3)	1	
	23(9.5)	4.5(2.1-9.6)	<0.0001
Post-operative indication for CS 1			
Pelvic anomaly	32(5.8)	1	
	1(0.88)	0.14(0.02-1.06)	0.06
Scarred uterus	25(4.8)	1	
	8(5.4)	1.1(0.50-2.6)	0.3
Dynamic dystocia	32(5.1)	1	
	1(2.4)	0.45 (0.06-3.4)	0.44
Foetal distress	32(5.6)	1	
	1(1.1)	0.18(0.02-1.3)	0.09
Placenta praevia	30(4.7)	1	
	3(12.5)	2.9(0.82-10.3)	0.1
Other	12(2.9)	1	
	21(8.5)	3.1(1.5-6.5)	0.002
Type of parietal incision			
None	1(6.3)	1	0.56
Median	17(5.8)	0.93(0.12-7.5)	
Transverse	15(4.1)	0.64(0.08-5.13)	
Transfusion performed			
yes	4(11.4)	1	0.056
No	25(4.2)	0.34(0.11-1.03)	

* mean (sd); & median (IQR).

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developing countries alike, sometimes reaching very high rates as, for example, in Brazil and the United States [24]. In an analysis of 172 WHO member countries out of a total of 194 (88.7%), covering 97.6% of all births worldwide, South Sudan had the lowest CS rate (0.6%), and Brazil the highest (55.6%). The rate of 16.2% described in our study concerns all the patients who had given birth by CS in an urban setting, which is in line with several rates described in the literature [24,25].

Indications for CS

In our study, 61.7% of caesarean sections had been performed urgently during labour. The emergency CS rate in our study is as high as the rates given by other authors in the DRC and other regions of developing countries which report emergency CS rates varying from 58 to 98%. Some reasons for these high CS rates include the absence of quality prenatal care which can prophylactically detect and direct high-risk pregnancies to specialist facilities, the dramatic rise in makeshift and invalid maternity units, the low level of qualification of health staff working in these maternity units, lack of awareness of the counter-indications for vaginal birth followed by delayed transfer to specialist facilities, poor distribution of health centres and difficult access to referral facilities, as well as poverty and illiteracy among these populations [9,17,18,20]. These are common factors in, and features of developing countries, although they vary in degree.

Dystocia (difficult and protracted labour) was the leading indication for CS in our study. Dystocia is mainly caused by insufficient uterine contractions, sometimes due to cephalopelvic disproportion or no progress in foetal descent due to a tumour; however, it is sometimes difficult to make this diagnosis prior to labour [15]. Certain authors wondered whether dystocia was being over-diagnosed nowadays, in order to justify more frequent use of CS [26].

A scarred uterus accounts for 22.9% of caesarean sections in our study. The "once a caesarean always a caesarean" policy is widely applied in SSA, mainly from fear of uterine rupture during labour. This policy helps reduce both the uterine rupture rate and the emergency surgery responsible for the increase in maternal and perinatal mortality and morbidity [15]. These repeat caesareans do not, however, result in the medical benefits expected. In fact, a vaginal delivery after a caesarean section has a low risk both for the mother and for the child [27]. Despite the recommendations of the International Federation of Gynaecology and Obstetrics (IFGO), whose guidelines for vaginal delivery after a caesarean section call on doctors to encourage this type of delivery for practically all women with a history of CS [28], fewer women are having vaginal deliveries in referral hospitals in Sub-Saharan Africa.

Foetal distress accounts for 13.5% of CS in our study. The accuracy of such a diagnosis is sometimes doubtful. Foetal monitoring is not yet used continuously in many of these medical facilities and health staff training is still required for its interpretation. One study on foetal monitoring was unable to show an improvement in infant outcomes in relation to the use of a Pinard stethoscope [29]. However, the same study showed an increase in the use of caesarean sections when monitoring was used, because it is difficult to make the distinction between foetal stress and true distress, as shown by these authors [30]. Monitoring gives a high false positive for foetal distress: as such, it is advisable to use ST analysis (STAN) which is non-existent in these medical facilities. It would be worthwhile setting up foetal monitoring and ST analysis in these various facilities in order to reduce this false positive rate as well as the CS rate for foetal distress. In the DRC, one study determined foetal distress as a pre-operative indication for CS in 23% of cases in urban settings in university clinics in Kinshasa, whereas in the same period, the rates reported in semi-urban settings (Mbuji-Mayi) and rural settings in the same country were 1.5% and 0% respectively [31]. This rate of 23% in urban settings is higher than that described in our study. One explanation for this is that foetal distress is correctly diagnosed in university hospital settings where more labour monitoring equipment is available.

Breech presentation accounts for 3.4% of CS in our study, and for 3.5% of all births worldwide. One study assessed management of breech presentation over the last four decades [32]. This study showed the value of External Cephalic Version (ECV) in decreasing the incidence of breech presentation and promoting vaginal delivery for the mother's safety. In SSA, and particularly in Goma, this technique is nearly never used due to lack of adequate facilities and qualified staff. The use of ECV has attracted interest in reducing breech presentation [27]. In modern times in developed countries, obstetric practice has radically changed at several levels: the advent of foetal monitoring, the availability of operating theatres for rapid emergency CS, the advent of blood banks, antibiotics and safe anaesthesia techniques, and the availability of neonatal intensive care have made delivery in general and in cases of breech presentation safer. The liberalised use of caesarean section for breech presentation has led to an increase in maternal and perinatal mortality and morbidity and in potential risks for future pregnancies [33]. ECV represents a perinatal mortality risk in approximately 3/1000 versions performed. This mortality is due to severe placental abruption, umbilical cord prolapses and early labour. The majority of breech vaginal deliveries are still performed in Sub-Saharan Africa due to lack of vaginal breech delivery selection criteria, ECV not being widely performed, and this leads to an increase in perinatal morbidity and mortality [27].

Other indications such as haemorrhagic placenta praevia, uterine pre-rupture and rupture, and brow and transverse presentation explain the high rate of emergency CS in our study. Uterine pre-rupture and rupture account for 3% of indications for CS in our study, which is lower than the 4.9% described in the study by Kinekinda [17], but higher than those reported in developed countries [34]. The rate of 3% is almost comparable with those described in the majority of regions of Sub-Saharan Africa and attests to the quality of intrapartum monitoring [9,26].

Maternal risks

Intra- and post-operative complications in our study stood at 2.4%, and included haemorrhage following a blood

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transfusion, wound suppuration, septicaemia, peritonitis, parting of stitches, urogenital fistulae and hypertensive disorders. One study described the same maternal risks associated with CS in SSA [15]. Maternal mortality was 0.1%, and 0.1% of patients were transferred. This maternal mortality is very low compared with most of the SSA region. This decrease in mortality may be explained by the fact that patients were not monitored up to 42 days post-partum, because the average stay in hospital was five days. While CS is safer in developed countries, it still entails the risks of many major abdominal procedures in the DRC. Maternal mortality is estimated to be approximately 2 to 11 times higher after a CS than after a vaginal delivery [35].

Perinatal risks

Our study found a rate of 4.7% stillbirths. One retrospective study gave a newborn infant death rate of 9% after CS or an Apgar score lower than 7 at five minutes after birth [32]. This rate was comparable with the results described in Africa where a WHO study showed an average neonatal mortality rate of 12.9% after a CS [4]. Our results were better than those described in other studies [4,36]. The neonatal outcomes observed in our study were associated with the mother's primary residence, parity, the number of prenatal visits, the number of previous caesarean sections, the hospital visit pattern, the type of primary anaesthesia and the indication for CS. These results are comparable with those seen in other studies [37]. However, we recommend raising awareness among pregnant women as to the value of prenatal visits with a view to decreasing the maternal and perinatal risks shown in our results and those of other studies [11].

Previous studies in SSA have established a link between longer distances from the mother's home to the referral hospital and neonatal mortality [38]. Our neonatal outcomes as regards parity were worse among multiparous patients who had had three deliveries, as described in other studies conducted in Rwanda and Nigeria [32]. One possible explanation for this is that women who have more children are often poor and less educated [39]. Poverty and a low level of education have been associated with poor neonatal outcomes in SSA [36]. Unlike other studies, our study shows that spinal anaesthesia has been associated with a higher rate of perinatal mortality than general anaesthesia [40]. Our hypothesis on high perinatal mortality during spinal aesthesia is maternal hypotension, whose prevention during this technique is poorly managed in these 4 medical trainings. this leads to an increase in prenatal hypoxia and thus an increase in perinatal mortality. The epidural that leads to less of this risk had not been practiced. Most of the caesarean sections in our study were performed in an emergency. Fetal destress is one of the counter indications of spinal anesthesia. Perinatal mortality was also higher in cases of uterine pre-rupture and rupture, and when the CS was performed urgently; this is comparable with the observations of other authors [23].

There are several limitations to take into account in this study. Given the cross-cutting nature of the study, and certain shortcomings in medical practices, several variables were lacking data such as height and weight for calculating body mass index, gestational age at the time of CS, and a partograph in the medical file in order to assess the diagnosis of dystocia or dyskinesia. This study was conducted in hospital facilities in Goma, and does not therefore reflect the situation in rural areas of North Kivu and the rest of DRC.

Conclusion

Caesarean section should be a factor in reducing foeto-maternal morbidity and mortality if the transfer conditions, working conditions at referral centre level, and staff training are improved. Poor neonatal outcomes were associated with the mother's primary residence in relation to the referral hospital, the number of prenatal visits, the number of previous caesarean sections, the type of primary anaesthesia, the hospital visit pattern and the indication for CS. It may be necessary to improve the conditions for transferring patients to referral hospitals, and improve the training of health staff involved in prenatal visits in order to ensure timely detection and referral of high-risk pregnancies to referral hospitals, which must have adequate equipment for providing quality emergency caesarean sections and neonatal care in order to reduce perinatal risks associated with CS. Prospective studies could be envisaged to determine the maternal and perinatal risks associated with CS in Goma in relation to vaginal delivery.

Current knowledge on the subject

CS is a major surgical procedure that entails a high risk of maternal and perinatal morbidity and mortality in the DR Congo.

Contribution of our study to knowledge

It is the first analytical study in Goma making it possible to determine the frequency, indications and maternal and perinatal risks of CS.

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