

Research Article

Second Stage of Labor Cesarean Section Maternal and Fetal Outcomes

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Abstract

Background: Cesarean section at the second stage of labor occurs when the mother requires delivery with full dilatation of the cervix by cesarean section (CS), which poses a risk to the mother and fetus.

Purpose: To study the maternal and fetal outcomes of second-stage cesarean section.

Methods: This comparative study was conducted at Alhasahisa Teaching Hospital from August 2021 to January 2022. The study sample comprised 226 women who fulfilled the inclusion criteria, including 113 who delivered by second-stage cesarean section and 113 who delivered by first-stage labor cesarean section as controls. Data were collected using a questionnaire filled out by doctors after informed consent was obtained.

Results: The common indications in women who delivered via second-stage cesarean section were fetal distress in 62(51.9%), obstructed labor in 26(23%), and failure to progress in 25(22.1%). In women who underwent first-stage cesarean section, the common indications were failure to progress in 85(75.2%), fetal distress in 16(14.2%), and chorioamnionitis in 12(10.6%) ($p < 0.05$).

The reported maternal complications in women who underwent second-stage cesarean section were postpartum hemorrhage in 34(30.1%), sepsis in 11(9.7%), prolonged labor in eight (7.1%), extended tears in four (3.5%), umbilical cord prolapse in three (2.7%), and episiotomy in three (2.7%).

The admission to the neonatal intensive care unit (NICU) and the causes of admission were more common among the babies of the women delivered by second-stage cesarean section than the babies of the women delivered by first-stage cesarean section (p value < 0.05).

Maternal complications in women who underwent second-stage cesarean section included postpartum hemorrhage in 34(30.1%), sepsis in 11(9.7%), prolonged labor in 8(7.1%), uterine extension in 4(3.5%), umbilical cord prolapse in 3(2.7%), and episiotomy in 3(2.7%) ($p < 0.05$).

Conclusion: Second-stage labor cesarean section showed more complications of postpartum hemorrhage, sepsis, and extended tears, as well as more fetal complications, such as admission to the neonatal intensive care unit, fresh stillbirths, low Apgar scores, and birth asphyxia.

More Information

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Keywords: Second stage; Labor; Cesarean section; Maternal; Fetal; Outcome

Abbreviations : AVD: Assisted Vaginal Delivery; BMI: Body Mass Index; CI: Confidence Interval; CPD: Cephalopelvic Disproportion; CS: Cesarean Section; DDI: The decision to Deliver Interval; EFM: Electronic Fetal Heart Rate Monitoring; EWTD: European Working Time Directive; FSB: Fresh Stillbirth; IUFD: Intra-Uterine Fetal Deaths; NICU: Neonatal Intensive Care Unit; OP: Occipito-Posterior; OR: Odds Ratio; OVB: Operative Vaginal Birth; P: Para; PPH: Postpartum Hemorrhage; PV: Prevaginal; RANZOG: Royal Australian and New Zealand College of Obstetricians and Gynecologists; RCOG: Royal College of Obstetricians and Gynecologists; RDS: Respiratory Distress Syndrome; RR: Risk Ratio; SPSS: Statistical Package for Social Science; TTN: Transient Tachypnea of the Newborn; VBAC: Vaginal Birth after Cesarean Section; WHO: World Health Organization

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Introduction

Cesarean section (CS) at the second stage of labor occurs when the mother requires delivery at full dilatation by CS and poses a risk to the mother and fetus. The increasing trend of CS in the second stage of labor is a major concern in modern obstetrics [1]. The incidence of CS in the second stage of labor has increased from 0.9% to 2.2%. The second stage of labor CS has been reported to increase with increasing CS rates [2].

The literature review suggests that this trend is

multifactorial, probably due to a lack of training for junior staff in the second stage of labor decision-making and a lack of expertise in assisted vaginal delivery. An increase in primary CS has a great impact on subsequent obstetric outcomes and delivery [3,4].

The Royal College of Obstetricians and Gynecologists (RCOG) reported that 6% of primary CS occurs at full dilatation, and in 50% of these patients, instrumental vaginal delivery was not attempted [5].



Cesarean section at full dilatation is technically more challenging than CS in early labor [6]. It is also difficult to deliver a deeply engaged fetal head, which can be delivered by the Patwardhan or push methods [7]. Maternal morbidity is higher in the second stage of labor CS [8]. Maternal morbidity in the second stage of labor CS occurs in the form of extension of the uterine angles, postpartum hemorrhage, and prolonged surgical time [9]. Bladder injury and postpartum pyrexia are common complications reported during the second stage of labor CS [10].

Neonatal morbidity in terms of neonatal intensive care unit (NICU) admissions, fetal academia, hypoxemia, and prolonged NICU stay is reportedly higher in the second stage of labor CS [11].

Decision-making for CS in the second stage of labor is one of the greatest challenges in current obstetric practice. The involvement of a skilled obstetrician in the management of the second stage of labor CS aids in minimizing morbidity and mortality [12]. A previous study in Khartoum found that the second-stage cesarean section rate was 2.4%, and the overall CS rate was 26.9% during the same period [13]. Another study in Eastern Sudan on post-CS blood transfusion found the rate of second-stage CS to be 3.3% [14].

A study in Western Sudan found that second-stage cesarean section was the cause of near-miss women [15]. An Ethiopian study found that second-stage CS had four-fold complications in comparison to women not in labor [16] and found postpartum hemorrhage, uterine tear, atonia, and a greater need for antibiotics in second-stage CS [17-20].

Maternal hemorrhage (>1000 ml) is reported to occur in 4.7%–10% of CS cases at full dilatation [6], a cohort study of 393 women who had undergone either operative vaginal delivery in theatre or CS at full dilatation found that 73% of those who were considering further pregnancy achieved a further pregnancy after 3 years [21], and the psychological impact of either vaginal or abdominal operative delivery in the second stage is likely to be significant and long-lasting [22].

Similarly, the rate of neonatal intracranial hemorrhage was greater following operative vaginal delivery than following CS. This suggests that the delivery itself can be traumatic [23]. Apgar score < 5 at 5 minutes; significant trauma or sepsis) demonstrated low rates of neurodevelopment morbidity at the age of 5 years, irrespective of whether they were delivered by successful instrumental delivery or CS at full dilatation [24].

In a Nepal study, perinatal complications of meconium stain liquor were as follows: 27.77%, NICU admissions, 13.88%, Apgar score <5 at 5 min, 13.55%, NICU admission, 5.54%, and fresh stillbirth, 2.77% [25].

A cesarean section at the second stage of labor poses a risk to the mother and the fetus. The increasing trend of CS at the second stage of labor is of major concern in modern obstetrics

compared to CS at the first stage of labor. The incidence of the second stage of labor CS has increased from 0.9% to 2.2%. This may be due to a lack of trained and skilled staff in instrumental delivery. The different results in the previous study are explained by the hospital setup.

During our work in Alhasahisa maternity hospital, it was observed that second-stage CS contributes to an appreciable percentage of the emergency c/s, not only that but several serious complications and adverse outcomes were observed attended staff, patients were referred from nearby hospitals that were covered by juniors' doctors and midwives those patients who needed second stage labor CS with more complications, both fetal and maternal. This study is conducted to explore the causes of this high incidence of second-stage CS, to know how we can reduce the number of second-stage CS and end up with objective results and recommendations that might reduce this drastic scenario.

Materials and methods

This comparative study was carried out at the Alhasahisa Teaching Hospital in the Alhasahisa locality, Sudan, from August 2021 to January 2022.

The inclusion criteria for this study were that all women who delivered by first-stage labor cesarean section were selected as the control group, while all women who delivered by second-stage labor cesarean section were selected as the case group, who provided consent to participate in the study and those managed during the study period.

The study excluded women who had given birth vaginally (normal or abnormal), women who had medical disorders, women who had a placental abruption, those outside the study period and setting, those with vaginal birth after cesarean section (VBAC), and those who refused to participate in the study. The study data were collected from all women who delivered via emergency CS in 2nd stage cesarean section cases and all women who delivered via emergency CS in 1st stage of CS.

Data were collected using a pre-designed closed-ended questionnaire filled out by registrars. The independent variables were the demographic characteristics, age, parity, and gravidity. The dependent variables were maternal and fetal outcomes.

Sample size

The size of the study was determined through the following formula:

$$n = (Z^2 \times (p \times q)) / e^2$$

n: sample size required by the study

Z: the determined area under the normal curve by the desired confidence interval (CI:1.96) standard normal deviate

P: The prevalence of C/S is estimated at 2% [12].

Then, $P = 0.02$

$q = 1 - p = 1 - 0.02 = 0.98$

$e =$ the desired precision ($e = 0.05$) because the prevalence is relatively small (less than 10%)

$n = (1.96)^2 \times (0.02 \times 0.98) / 0.0025 = 159.2 = 112.9 = 113$

The sample size was 226 study participants, 113 cases of second-stage CS, and 113 delivered by first-stage CS.

The sampling technique used simple random sampling methods, collecting the number of women who delivered by the second stage as the case group and those who delivered by the first stage as the comparative group. A total of 113 mothers were enrolled in the study, representing the main study group, and 113 mothers delivered via first-stage cesarean section were selected as the comparative group.

Statistical analysis was performed via SPSS 23 software (SPSS, Chicago, IL, USA).

Descriptive statistics in terms of frequency tables, percentages, and graphs. Descriptive analysis was performed for all study variables with mean and standard deviation for quantitative data, and frequencies with proportions for qualitative data.

Bi-variable analysis to determine the associations between the main outcome variable and the other relevant risk factors using the Chi-square test (for categorical variables) and t-test (quantitative variables) statistical tests and a p -value of 0.05 or less were considered significant.

Data are presented after the analysis in the form of univariable tables, cross-tabulation (bi-variable tables), multivariable tables, figures, and narrative illustrations.

Ethical considerations were considered, and the study was approved by the ethics review committee of the Sudan Medical Specialization Board. Council of Obstetrics and Gynecology. The agreement was obtained from the administrative authorities of the Alhasahisa Hospital. Written consent was obtained from all the participants after explaining the nature and purpose of the study. Confidentiality of participants' data was considered by coding the questionnaire. The respondents were informed that the study was not associated with experimental or therapeutic intervention and that information was collected from them.

Results

The number of women aged 20 – 29 years was 105(46.5%), between 30 – 39 years 57(25.2%) were between 20 years 42(18.6%) were more than 39 years, and 22(9.7%) (Figure 1).

A total of 134(59.3%) women were from rural areas and 92(40.7%) were from urban areas (Figure 2).

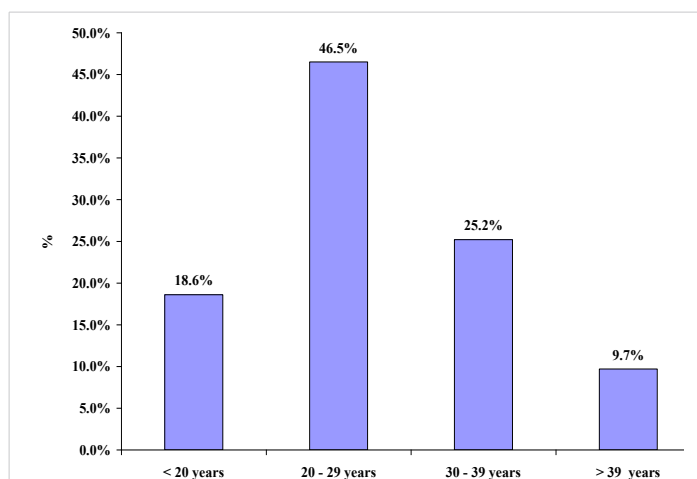


Figure 1: Age of the women delivered by Second stage CS and first-stage CS ($n = 226$).

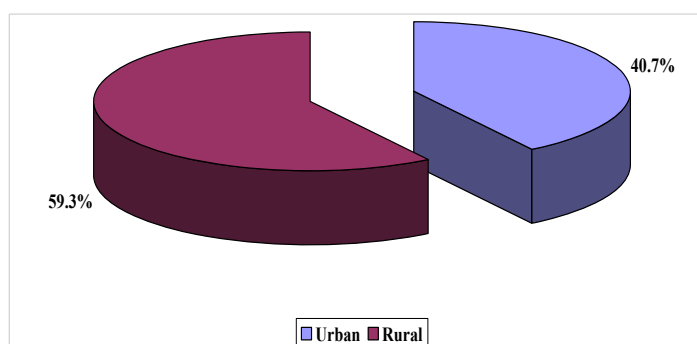


Figure 2: Residence of the women delivered by Second stage CS and first-stage CS ($n = 226$).

The numbers of women with a secondary level of education were 77(34.1%), 57(25.2%), 51(22.6%), and 41(18.1%), respectively (Figure 3).

There were 128(56.6%) multigravidas, 74(32.7%) gravida I, and 24(10.6%) grand multigravidas (Figure 4).

Nulliparous patients comprised 40(35.8%), Para1 (P1) to Para 4 (P4) were 66(58.9%), and 9(5.3%) were para 5 or more (Figure 5).

The number of women who attended regular ANC was 114(50.4%), 87(38.5%) were irregular, and 25(11.1%) did not attend (Figure 6).

The duration of the second stage of labor was more than 2 h in 69(61.1%), 2 h in 30(26.5%), and 1 h in 14(12.4%) (Figure 7).

The common indications for CS in women delivered by second-stage cesarean section were fetal distress 62(54.9%), obstructed labor 26(23%), and failure to progress 25(22.1%). Among the women who delivered by first-stage CS, the common indications were failure to progress in 85(75.2%), fetal distress in 16(14.2%), and chorioamnionitis in 12(10.6%) ($p < 0.05$) (Table 1).

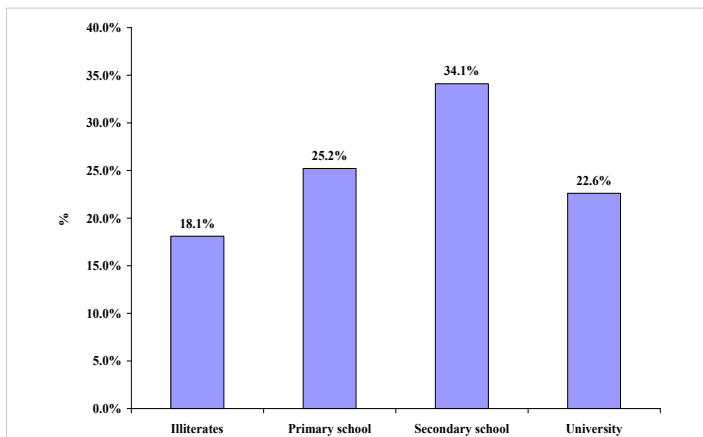


Figure 3: Educational level of the women delivered by Second stage CS and first-stage CS (n = 226).

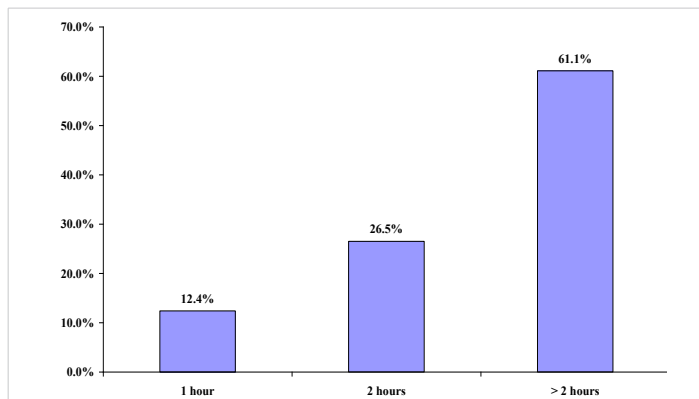


Figure 7: Duration of the second stage of labor of the women delivered by Second-stage CS (n = 113).

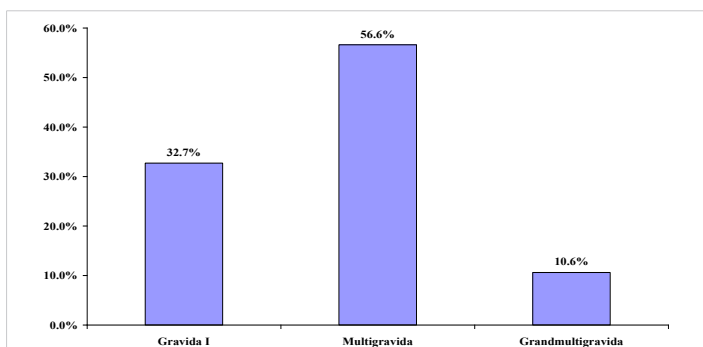


Figure 4: Gravidity of the women delivered by Second stage CS (n = 113).

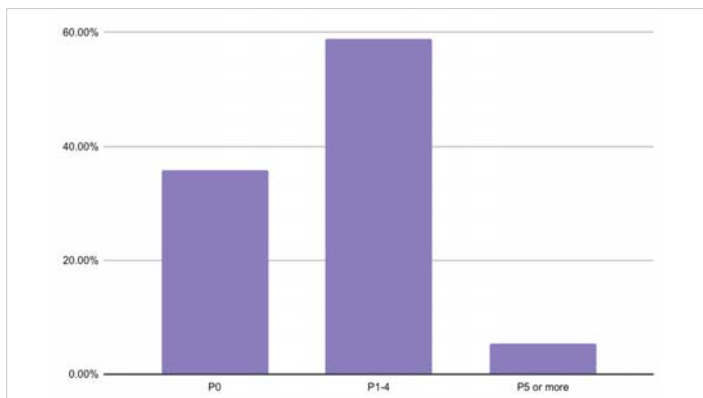


Figure 5: Parity of the women delivered by Second stage CS (n = 113).

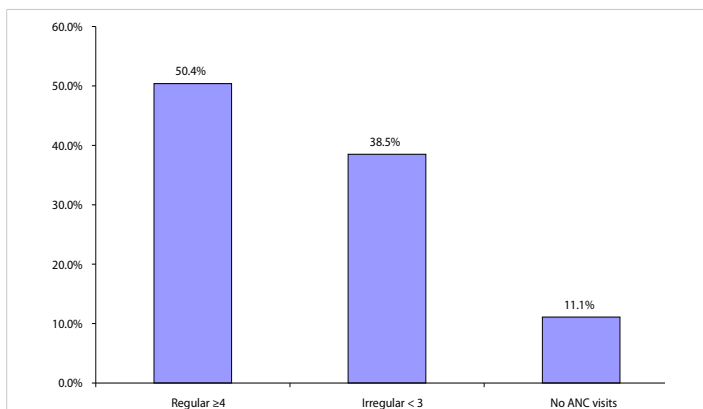


Figure 6: Number of ANC visits of the women delivered by Second stage CS and first-stage CS (n = 226).

Table 1: Indications of CS of the women delivered by Second stage CS VS first stage CS (n = 226).

Indications of 2 nd stage CS	Type of CS			
	Second Stage CS		First stage CS	
	N	%	N	%
Failure to progress	25	22.1	85	75.2
Fetal distress	62	54.9	16	14.2
Obstructed labour	26	23.0	0	0.0
Chorioamnionitis	0	0.0	12	10.6
Total	113	100.0	113	100.0

p - value = 0.01

In maternal assessment, differences were found in prevaginal examination (PV) findings (full dilatation in all women delivered by second-stage CS, station at presentation [-1 and 0 in second-stage CS]) ($p < 0.05$) (Table 2).

No significant differences were found between women who delivered by first- and second-stage CS in the duration of membrane rupture and pre-emergency CS CTG assessment ($p > 0.05$) (Tables 3,4).

The significant differences in fetal assessment outcomes between the women delivered by first- and second-stage cesarean sections were lower Apgar scores at 1 and 5 min, abnormal fetal heart rate, and suffering caput and molding among the fetuses of women delivered by second-stage CS than in first-stage CS ($p < 0.05$) (Table 5). No significant differences were found between the women delivered by first- and second-stage CS in terms of live fetuses and birth weight ($p > 0.05$), while admission to the neonatal intensive care unit and the causes of admission were more common among the babies of the women delivered by second-stage cesarean section than the babies of the women delivered by first-stage cesarean section ($p < 0.05$) (Table 6). Among the mothers, no significant differences were found between the groups delivered by the first- and second-stage CS in the vital sign assessments ($p > 0.05$) (Table 7).

The reported maternal complications in women delivered by second-stage cesarean section were postpartum hemorrhage in 34(30.1%), sepsis in 11(9.7%), prolonged labor in eight (7.1%), uterine extension in four (3.5%), and umbilical cord prolapse in three (2.7%). The maternal



Table 2: Prevaginal assessment of the women delivered by Second stage CS VS first stage CS (n = 226).

PV findings	Type of CS				p - value
	Second Stage CS		First stage CS		
	N	%	N	%	
10 cm	113	100.0	0	0.0	0.001*
9 cm	0	0.0	9	8.0	
8 cm	0	0.0	25	22.1	
7 cm	0	0.0	30	26.5	
6 cm	0	0.0	33	29.2	
5 cm	0	0.0	16	14.2	
Station of presenting part					
- 3	0	0.0	31	27.4	0.023*
- 2	10	8.8	28	24.8	
- 1	43	38.1	18	15.9	
0	38	33.6	32	28.3	
+ 1	18	15.9	4	3.5	
+ 2	4	3.5	0	0.0	
Presentation					
Cephalic	113	100.0	113	100.0	0.99**
Total	113	100.0	113	100.0	
Position					
DOA	9	8.0	8	7.1	0.98**
LOA	15	13.3	15	13.3	
ROT	12	10.6	12	10.6	
LOT	12	10.6	19	16.8	
TOP	27	23.9	27	23.9	
DOP	20	17.3	15	13.3	
LOP	17	15.0	15	13.3	
LSA	1	1.3	2	1.8	

Table 3: Duration of ruptured membranes of the women delivered by Second stage CS VS first stage CS (n = 226).

Duration of membrane rupture	Type of CS			
	Second Stage CS		First stage CS	
	N	%	N	%
< 12 hours	59	52.2	65	57.5
12 - 24 hours	44	38.9	41	36.3
> 24 hours	10	8.8	7	6.2
Total	113	100.0	113	100.0

p - value = 0.08

Table 4: Pre cesarean section CTG of the women delivered by Second stage CS VS first stage CS (n = 226).

Pre EMCS CTG	Type of CS			
	Second Stage CS		First stage CS	
	N	%	N	%
Reassuring	37	32.7	86	76.1
Suspicious	33	29.2	17	15.0
Pathologic	43	38.1	10	8.8
Total	113	100.0	113	100.0

p - value = 0.06

complications in women delivered by first-stage cesarean section were postpartum hemorrhage in 13(11.5%), sepsis in one (0.9%), umbilical cord prolapse in one (0.9%), and uterine extension in one (0.9%) (p < 0.05) (Table 8).

All maternal complications are common in the second stage of labor compared with the first stage of labor cesarean section p value < 0.05.

Table 5: Fetal assessment of the women delivered by Second stage CS VS first stage CS (n = 226).

Assessment findings	Type of CS				p - value
	Second Stage CS		First stage CS		
	N	%	N	%	
Baby gender					
Male	64	56.6	59	52.2	0.071**
Female	49	43.4	54	47.8	
Apgar score at 1 min					
< 5	39	34.5	3	2.7	0.016*
5 - 7	41	36.3	11	9.7	
> 7	33	29.2	99	87.6	
Apgar scored at 5 minutes					
< 5	21	18.6	3	2.7	0.019*
5 - 7	40	35.4	11	9.7	
> 7	52	46.0	99	87.6	
Fetal signs of obstruction					
Caput	56	49.6	10	8.8	0.015*
Molding	22	19.5	9	8.0	
No	35	31.0	94	83.2	
Total	113	100.0	113	100.0	

* Significant difference (p < 0.05); ** No significant difference (p > 0.05).

Table 6: Fetal outcomes of the women delivered by second stage CS VS first stage CS (n = 226).

Fetal outcomes	Type of CS				p - value
	Second Stage CS		First stage CS		
	N	%	N	%	
Alive	112	99.1	112	99.1	0.061**
Stillbirth	1	0.9	1	0.9	
Total	113	100.0	113	100.0	
Admission to NICU					
Yes	60	53.1	10	8.8	0.013*
No	53	46.9	103	91.2	
Total	113	100.0	113	100.0	
Causes of admission					
Birth asphyxia	18	30.0	3	30.0	0.022*
Meconium aspiration	24	40.0	1	10.0	
TTN	5	8.3	0	0.0	
Grunting	6	10.0	0	0.0	
Observation	4	6.7	6	60.0	
Signs of sepsis	3	5.0	0	0.0	
Total	60	100.0	10	100.0	
Birth weight					
< 2500 g	0	0.0	8	7.1	0.082**
2500 - 3900 g	105	92.9	94	83.2	
> 3900 g	8	7.1	11	9.7	
Total	113	100.0	113	100.0	

* Significant difference (p < 0.05); ** No significant difference (p > 0.05)

Discussion

This study included 226 women: 113 delivered by the second stage of labor cesarean section as the case group and 113 delivered by the first stage of labor CS as the control group.

A fetal outcome study found significant differences between the fetuses of women delivered by the second stage of labor CS and the fetuses of women delivered by the first stage of labor CS; admission to the neonatal intensive care unit and the causes of admission were more common among the babies of women delivered by the second stage of labor cesarean section than those delivered by the first stage of labor cesarean section (p < 0.05).



Table 7: Maternal vital signs of the women delivered by Second stage CS VS first stage CS (n = 226).

Signs	Type of CS				p - value
	Second Stage CS		First stage CS		
BP	N	%	N	%	
NAD	6	5.3	0	0.0	0.063**
Low	20	17.7	23	20.4	
Normal	87	77.0	90	79.6	
Heart rate					
NAD	16	14.2	7	6.2	0.065**
Low	2	1.8	4	3.5	
Normal	78	69.0	86	76.1	
Elevated	17	15.0	16	14.2	
Respiratory rate					
NAD	13	11.5	3	2.7	
Low	3	2.7	4	3.5	0.74**
Normal	97	85.8	106	93.8	
Temperature					
NAD	13	11.5	3	2.7	0.064**
Normal	80	70.8	92	81.4	
Elevated	20	17.7	18	15.9	
Oxygen saturation					
NAD	30	26.5	22	19.5	0.075**
Low	3	2.7	4	3.5	
Normal	80	70.8	87	77.0	
Total	113	100.0	113	100.0	

** No significant difference (p > 0.05)

Table 8: Maternal complications of the women delivered by Second stage CS VS first stage CS (n = 226).

Maternal complications	Type of CS			
	Second Stage CS		First stage CS	
	N	%	N	%
No	53	46.9	97	85.9
Prolonged labour	8	7.1	0	0.0
Umbilical cord prolapses	3	2.7	1	0.9
Uterine extension	4	3.5	1	0.9
PPH	34	30.1	13	11.5
Sepsis	11	9.7	1	0.9
Maternal death	0	0.0	0	0.0
Total	113	100.0	113	100.0

p - value 0.01

The higher rate of admission of babies delivered by second-stage CS to the NICU is due to more frequent meconium aspiration, birth asphyxia, low Apgar score, and grunting. Similar to Khaniya, et al. s study in Nepal, perinatal complications included meconium stain liquor 10(27.77%), Transient Tachypnea of the Newborn (TTN) admissions 5(13.88%), Apgar score < 5 at 5 min 5 (13.55%), NICU admission 2(5.54%), and fresh stillbirth 1(2.77%) [26,27].

An Indian study by Anusha, et al. revealed that neonatal outcome variables such as APGAR<3 at 5 min, respiratory distress, and neonatal death were observed in nine, 28, and six deliveries, respectively [28]. These findings are in agreement with those of Khaniya, et al. [25], who found no statistically significant difference between maternal and neonatal mortality rates. Another study showed similar results since it did not find an increase in perinatal death in women who had a trial of labor after CS. For example, Samal and Pallavee [28]

showed that neonatal morbidity was much higher in patients who underwent cesarean section during the second stage of labor. There was an increase in neonatal complications, such as APGAR less than 7 at 5 min, NICU admissions for more than 24 h, and neonatal septicemia (p < 0.001), which may be due to a deficiency in nursery staff.

Jombo, et al, 44% of babies required nursery admission, most commonly due to birth asphyxia (16%) and respiratory distress syndrome (RDS) (11%) [29]. Gupta, et al. reported that out of 4477 deliveries, 1466 had cesarean section with a rate of 32%. The rate of second-stage cesarean sections was 3% of total cesarean section and 1% of total deliveries [30].

The second stage of labor cesarean section had higher maternal and perinatal morbidities, such as atonic PPH (33.3%), lower uterine segment extension (7%), febrile morbidity (10%), and the need for blood transfusion (15%). There were 15.5% NICU admissions in second stage cesarean group while none in first stage group, and this may be due to the unavailability of a senior or well-trained operator

Thirukumar, et al. [31] identified more maternal and perinatal complications of the second stage of labor cesarean sections. Blood-stained urine was the major complication observed in 60% of the patients, followed by difficulty in the extraction of the baby (48%). Lower uterine segment tears and angle extensions were observed in 12% of patients; PPH and broad ligament hematoma were noted in one patient. The mean duration of the hospital stay was 2.28 days, the longer duration was 5 days for the patient as she underwent a total abdominal hysterectomy due to extensive uterine tears during a cesarean section.

All babies had an APGAR score > 7 at 5 min. Nearly 20% (n = 5) of the babies were admitted to the PBU; among them, one required neonatal resuscitation at birth, and two received IV antibiotics for possible sepsis [32].

In this study, maternal complications, such as postpartum hemorrhage, sepsis, prolonged labor, and extended uterine tears, were significantly more common among women delivered by the second stage of labor CS than among women delivered by the first stage of labor CS. The reported maternal complications in women who underwent second-stage cesarean section were postpartum hemorrhage in 34(30.1%), sepsis in 11(9.7%), prolonged labor in eight (7.1%), extended uterine tears in four (3.5%), umbilical cord prolapse in three (2.7%), and episiotomy in three (2.7%). Maternal complications in women delivered by the first stage of labor via cesarean section were postpartum hemorrhage in 13(11.5%), sepsis in 1(0.9%), umbilical cord prolapse in 1(0.9%), extended uterine tear in 2(0.9%), and episiotomy in 0(0.0%) (p < 0.05). Similar to the study by Umbeli. et al. in Omdurman maternity hospital showed that Postoperative complications were reported in 142 (30.2%), mainly due to



puerperal infection, postpartum hemorrhage (PPH), paralytic ileus, wound dehiscence and one maternal death [33] and Sucak [34].

McKelvey, et al. investigated the background and morbidity a total of 91(15.3%) of the 595 emergency cesarean sections underwent full dilatation. Instrumental delivery was attempted in 36(40%) patients. The most common maternal complications were postpartum hemorrhage, sepsis, and uterine extension tears. Seven (8 %) infants were admitted to the neonatal unit. They found that these procedures carry high maternal morbidity but relatively low neonatal morbidity, and recommended that most senior obstetricians should be involved in decision-making and delivery in these cases [35]. Babre, et al. studied indications of second-stage cesarean section. During the study period of 2760, cesarean sections were performed, of which 61 underwent 2nd stage cesarean section. Of the 61 Caesarean deliveries, 14 were given a prior instrumental trial followed by 2nd stage cesarean section. Intraoperative complications were higher in terms of blood loss, primary PPH, and extension of uterine incision, in one case bladder injury was noticed this may conclude that CS following an Instrumental trial led to higher complications, and some hospitals try to avoid this by not giving patients instrumental trial. Patwardhan method was used in 23% of cases for delivery of deeply engaged heads. Atonic PPH was observed in 11.5% of patients, and 3.3% of patients had an extension of the uterine incision [36]. Gurung, et al. studied the fetomaternal outcome of cesarean section in the second stage of labor. During the study period, there were 40,860 deliveries. A total of 18,011(44%) babies were born by cesarean section, 10484 by emergency, and 7527 by elective delivery. Of the emergency cesarean sections, 200(1.9%) were performed during the second stage of labor. The indication of CS was CPD in 92.4%, maternal complications, atonia PPH (12.5%), postpartum pyrexia (18.8%), and wound infection (4.8%).

The explanation is that the studies are in agreement with our results, and those results comply with biological reasoning and are similar to [37-39].

Study strengths and limitations

The strength of this study is that it compared women delivered by CS in the second stage of labor versus first-stage CS in all maternal and fetal outcomes, which increased the significance of the study. Our hospital is a major referral hospital that facilitates the inclusion of a high number of women, and its characteristics can be generalized to other hospitals. In addition, neonatal intensive care unit admission was evaluated and indications for cesarean section delivery were included, which increases the significance of the study.

The limitation of this study was that we did not compare preoperative and postoperative hemoglobin levels and a figure was not used to compare the population of the case group and the control group.

Postnatal complication long-term follow-up not addressed and neonatal death.

Summary

The increasing trend of CS in the second stage of labor is a major concern in modern obstetrics, which is a technically more difficult procedure than CS in early labor.

This study aimed to compare maternal and fetal outcomes between mothers who delivered second-stage CS and mothers who delivered first-stage CS.

A total of 113 mothers who delivered second-stage CS and 113 mothers who delivered first-stage CS at Alhasahisa Teaching Hospital were included.

The common indications in women who delivered via second-stage cesarean section were fetal distress, obstructed labor, and failure to progress.

Maternal complications in women delivered by second-stage cesarean section include postpartum hemorrhage, sepsis, prolonged labor, extended tears, umbilical cord prolapse, and episiotomy.

While admission to the neonatal intensive care unit and causes of admission were more common among the babies of women delivered by second-stage cesarean section, the second stage of labor CS should be performed by the most trained senior registrar. Pediatricians should attend the 2nd stage of CS.

Conclusion

The study concluded that the second stage of labor cesarean section is associated with a higher rate of maternal and fetal complications than the first stage of cesarean section. Women delivered by second-stage cesarean section showed more complications of postpartum hemorrhage, sepsis, and extended uterine tear, as well as more fetal complications, such as admission to the neonatal intensive care unit, low Apgar score, birth asphyxia, and fresh stillbirths.

Recommendations

To reduce the second-stage CS rate assisted vaginal delivery should encourage, the second stage of labor, CS, should be performed by the most available trained senior registrar. Pediatricians should attend the 2nd stage of labor CS. Hospitals covered by joints should be obstetricians on call.

Midwives should be aware of the signs of complicated CS to transfer patients as early as possible. There is an urgent need to conduct a Multi-centric study of Fetomaternal outcomes in the second stage of labor CS to obtain recommendations that may be approved as a local protocol in this situation. Women in the study area should be advised about the importance of antenatal care follow-up and health centers in the study area should provide proper antenatal care. Audit of second stage cesarean section indications.



Declaration

The Submitted manuscript contains original and authentic results, data, and ideas that have not been published elsewhere. No material from other publications has been reproduced in this article. The author of this paper read and approved the final version of the manuscript. None of the co-authors should submit the same manuscript to more than one journal.

Ethical clearance

Ethical approval was obtained from the Research and Ethics Committee of Alhasahisa. The ethical principles of autonomy, beneficence, non-maleficence, and justice, as stipulated in the ethical guidelines of the Sudan Medical Specialization Board (SMSB) and Medical Research Council, were upheld throughout the study. The approval number provided by the ethics review committee is 10270.

Written consent was obtained from all the respondents who agreed to participate in the study. The study was not associated with experimental or therapeutic interventions, and information was collected from them.

Availability of data and materials

All data and materials are available upon request.

Competing interest: No direct or indirect financial interests or conflicts exist, all authors agree with the content of the manuscript, and there are no conflicts of interest between or among them.

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Questionnaire	
Patient number:	
1. Age:	
2. Residence:	
3. Education: Illiterate () Primary () Secondary () University ()	
4. Gravidity:	
5. Parity:	
6. ANC i) Regular () ii) Irregular () iii) never at all ()	
7. Type of Em CS: 1 st stage () 2 nd stage ()	
8. Indication for Em CS in 2 nd stage : (1) Failure of progress () (2) Fetal distress () (3) Obstructed labor () (4) Chorioamnionitis ()	
9. PV findings cm	
10. Station of presenting part: -3 () -2 () -1 () 0 () +1 () +2 () +3 ()	
11. Presentation: cephalic () breech ()	
12. Position: ROA () DOA () LOA () ROT () LOT () ROP () DOP () LOP () RSA () LSA () RSL () LSL () RSA () LSA ()	
13. Duration of membranes rupture	
14. Pre-Em CS CTG: Reassuring () Suspicious () pathological ()	
15. Duration of 2nd stage labor	
16. Baby outcome: Male () Female ()	
17. Apgar score: 1 min i) <5 ii) 5-7 iii) >7 5 min i) <5 ii) 5-7 iii) >7	
18. Neonatal outcome: Alive () Stillbirth ()	
19. Admission to neonatal intensive care unit NICU: Yes () No ()	
20. If yes, indication for admission: Birth asphyxia () Meconium aspiration () others	
21. Birth weight: grams	
22. Did the neonate suffer from: i) Caput ii) Molding	
23. Maternal vitals before surgery:	
• Blood pressure	
• Heart rate	
• Respiratory rate.....	
• Temperature.....	
• Oxygen saturation	
24. Maternal complications: 1. Yes () 2. No ()	
25. If Yes:	
a. Premature rupture of membrane Yes () No ()	
b. Prolonged labor Yes () No ()	
c. Umbilical cord prolapse Yes () No ()	
d. Episiotomies Yes () No ()	
e. Perineal tears Yes () No ()	
f. Postpartum hemorrhage Yes () No ()	
g. Rupture uterus Yes () No ()	
h. Sepsis Yes () No ()	



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