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DEPARTMENT OF OBSTETRICS AND GYNECOLOGY

A FINAL THESIS

FETO-MATERNAL OUTCOMES AND ASSOCIATED FACTORS AMONG SECOND STAGE CESAREAN DELIVERY COMPARED TO FIRST STAGE CESAREAN DELIVERY IN HIWOT FANA COMPREHENSIVE SPECIALIZED HOSPITAL, EASTERN ETHIOPIA

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APPROVAL SHEET

I hereby certify that I have read and evaluated the thesis entitled feto-maternal outcomes and associated factors among second stage cesarean delivery women compared to first stage cesarean delivery at Hiwot Fana Comprehensive Specialized Hospital, Eastern Ethiopia, a cohort study prepared under my guidance by Dr. Ibsa Mohammed. I recommend that it be submitted as fulfilling the thesis requirement.

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As members of the Final MED Open Defense Examining Board, we certify that we have read and evaluated the thesis prepared by Dr. Ibsa Mohammed and examined the candidate. We recommend that the thesis be accepted as fulfilling the thesis requirements for the medical Specialty in Obstetrics and Gynecology.

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Final approval and acceptance of the thesis is contingent upon the submission of the final copy of the thesis to the Council of Graduate (CGS) through the Departmental Graduate Committee (DCG) of the candidate's major department.

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By my signature below, I declare and affirm that this thesis is my work. I have followed all ethical and technical principles of scholars in the preparation, data collection, data analysis, and compilation of this thesis. Any scholarly matter that is included in the thesis has been given recognition through citation.

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BIOGRAPHICAL SKETCH

I was born in Langei, Eastern Hararghe, Oromia, Ethiopia. I completed my primary education in my hometown and attended secondary school in the Kersa district. My preparatory studies were in Dire Dawa before I enrolled at Haramaya University's College of Health and Medical Sciences. I earned my medical doctorate from the institution in 2009 EC. Following this, I worked as a general practitioner and lecturer at Dilchora referral Hospital, affiliated with Dire Dawa University, for two years. Subsequently, I began medical specialty training in Obstetrics and Gynecology at Addis Ababa University but transferred to Haramaya University during my first year of residency due to circumstances beyond my control.

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ABBREVIATIONS AND ACRONYMS

AOR: Adjusted Odds Ratio
ACOG: American College of Obstetricians and Gynecologists
AFSOL: Active First Stage of Labor
APH: Antepartum Hemorrhage
CD: Cesarean Delivery
COR: Crude Odds Ratio
CPD: Cephalopelvic Disproportion
CS: Cesarean Section
ENND: Early Neonatal Death
EONS: Early Onset Neonatal Sepsis
G.C: Gregorian Calendar
GMH: Gandhi Memorial Hospital
HCT: Hematocrit
ICU: Intensive Care Unit
MAS: Meconium Aspiration Syndrome
MD: Medical Doctor
MRN: Medical Record Number
NICHD: National Institute of Health Child Health and Human Development
NICU: Neonatal Intensive Care Unit
OL: Obstructed Labor
PIH: Pregnancy Induced Hypertension
PNA: Perinatal Asphyxia
PNM: Perinatal Mortality
PPH: Postpartum Hemorrhage
PROM: Premature Rupture of Membrane
SNNPR: South Nations, Nationalities and Peoples Region
SPSS: Statistical Package for Social Science
SVD: Spontaneous Vertex Delivery
WHO: World Health Organization
ZMH: Zewditu Memorial Hospital

ABSTRACT

Background: Currently cesarean section is an increasing mode of childbirth. Although the safety of cesarean section is well documented, decision-making surrounding caesarean section in the second stage of labor is one of the great challenges in current obstetric practice. In addition, there is limitation of data regarding maternal and perinatal morbidity after cesarean section at full cervical dilatation study area.

Objective: To determine maternal and neonatal outcomes and associated factors comparing cesarean delivery performed in second stage of labor with those C/S conducted in first stage of labor from September 1, 2024 to December 31, 2024 in Hiwot Fana Comprehensive specialized University Hospital.

Methods: A prospective cohort study was conducted from September 1 to December 31 2024 in Hiwot Fana Comprehensive Specialized Hospital. Using Epi stat calc 7 for cohort study that utilized blood loss of > 500ml as an outcome variable 236 women were selected. 59-second stage and 177 first stage cesarean section cases were included in the study, using ratio of 1:3. Structured face-to-face interviews questioners supplemented with review of both maternal and neonatal charts were used to collect information. The collected data were entered into Epi-data version 4.6 and exported to SPSS version 22 for further analysis. Binary logistic regression and multivariable logistic regression analyses were done to identify factors independently associated with poor maternal and neonatal outcomes and statistical significance was declared at a p-value of <0.05.

Results: Over all maternal complication of second stage group was 54.2% (95%CI=42.9-58.9) compared to 21.4% (95%CI=18.1-25.6) for first stage group. Among mothers who underwent Cesarean Delivery, 75% had no known gestational age. The overall neonatal complication of second stage group was 32% compared to 10% for first stage and most common fetal complication was early onset neonatal sepsis (11.9%). Level of residency, station of fetal presenting part and method of fetal extraction were found to be significantly associated with maternal complications.

Conclusion: Composite maternal and neonatal morbidities were increased when CD was done at second stage compared to first stage cesarean deliveries. Level of the surgeon, station of fetal presenting parts and method of fetal extraction is independently associated with adverse maternal outcomes while indication for cesarean delivery, status of liquor and duration of ROM is strongly associated with neonatal outcomes.

Recommendations: The most senior residents should be involved in the management of second stage cesarean section, anticipation for need of neonatal resuscitations in second stage of labor should be made, especially for those with associated factors, and necessary preparations should be made.

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Keywords: First stage cesarean delivery, Second stage cesarean delivery, maternal outcome, neonatal outcome, associated factors

1. INTRODUCTION

1.1 Background

Cesarean section (CS) is the delivery of the fetus (es), placenta and membranes through an incision made on the abdominal and uterine walls at or after 28 weeks of gestation. An elective caesarean section (CS) is a planned cesarean delivery performed before the onset of labor or the appearance of any complication that might constitute an urgent indication for delivery while CS done during labor or due to a complication (excessive bleeding following placenta previa) that necessitates immediate delivery constitutes emergency cesarean section. CS is the most common abdominal operation performed in women globally. CS rates have increased by 21.1% and 2% in in developed and least developed countries, respectively. This increase is attributed to improved access to CS and indiscriminate use without medical indication. The health system's capacity, financial structure, and human resources profile have stronger aggregate-level effects on CS rates (Ana Pilar Betran1*, 2015).

The indications for performing CS varied tremendously over the past centuries and decades. In the 18th century, CSs were done to save fetus in a dead or dying mother. Nineteenth century saw caesarean being done to save the life of the mother. With use of safer anesthesia, suturing techniques, antiseptics, asepsis, blood transfusion and antibiotics, CS has become an increasingly safe and common procedure. The continued improvement in safety has led to CS being done on demand with no medical indications (Callaghan, 2012, Saini, 2018)

Caesarean sections can cause complications resulting in maternal death or morbidity. The morbidities associated with CS can be short term or long term. The risk of morbidity and mortality was high in women undergoing emergency CS and in women who previously had a CS. Neonatal and perinatal mortality and morbidity was also increased in CS babies. Caesarean section more than 19% does not improve maternal and neonatal outcomes. Caesarean sections are effective in saving maternal and infant lives, if they are done for medical indications(Saini, 2018)

Second stage cesarean section is a difficult procedure as it is associated with deeply engaged fetal head, less amount of liquor and thinned out lower uterine segment, thus it can lead to high risk of maternal as well as neonatal morbidities(Bishal Khaniya, 2020).

Decision-making surrounding caesarean section in the second stage of labour is one of the great challenges in current obstetric practice. This technically difficult procedure is often performed after an unsuccessful instrumental delivery with the fetal head deeply impacted in the maternal pelvis. It is associated with an increased risk of maternal and neonatal morbidity. Junior obstetric trainees are not always supervised when faced with deciding and performing these difficult deliveries. Input from a senior, more skilled obstetrician has been shown to revert decisions in favor of a successful vaginal delivery, therefore avoiding the potential risks associated with full dilatation cesarean sections(J. A. Z. Loudon, 2010)

Maternal and fetal risk factors are associated with increased chance of requiring second stage CD for failure to progress include maternal body index (BMI)above 30/m2,station at ischial spine, neonatal birth weight greater than 4kg and fetal malposition at full dilatation. The risk of second stage CD is increased when fetal malposition at full dilation by nearly two fold for occiput transverse, and more than fourfold for occiput posterior position. Failure of the presenting part to descend may be due to inadequate or uncoordinated uterine contractions, malpositions, and malpresentation of the baby or cephalopelvic disproportion. The cause of this failure to progress must be diagnosed and appropriately treated. Malpresentation or minor degrees of cephalopelvic disproportion may be sometimes overcome by encouraging the mother to vary her position. Intravenous oxytocin can be used if contractions are inadequate. Instrumental or manual manipulation, or sometimes cesarean section maybe necessary(Abenhaim and Benjamin, 2011)

The increasing trend of cesarean section at second stage of is of major concern in modern obstetrics. Decision making surrounding cesarean section in second stage of labor is one of the greatest challenges in current obstetric practice. Second stage cesarean section with an impacted fetal head can be technically difficult and associated with both maternal and fetal complications(International Journal of Clinical Obstetrics and Gynecology,2020).

Based upon the available evidence, a workshop convened by the Eunice Kennedy Shriver National Institute of Health Child Health and Human Development (NICHD), ACOG, and SMFM recommend at least a 3- to 4-hour second-stage duration for nulliparous women and
At least a 2- to 3-hour second-stage duration for multiparas, if maternal and fetal conditions permit(Catherine Y. Spong, 2015)

1.2 Statement of the Problem

CS is becoming increasingly used as a mode of delivery and is a good practice to perform a periodic clinical audit of the fetal and maternal outcomes. Despite the safety of CS, the procedure, especially in low-resource settings still poses challenges to the clinician. As the overall CS rate continues to rise, so does the CS rate at full dilatation. There is a worrying rise in the overall rate of CS at full dilatation. Audit of the second stage CS rate is a useful measure of clinical standards. Decision-making surrounding caesarean section in the second stage of labor is one of the great challenges in current obstetric practice, and ideally, decision and performance of cesarean delivery in second stage should be made by an obstetrician. This technically difficult procedure is often performed after an unsuccessful instrumental delivery with the fetal head deeply impacted in the maternal pelvis, posing even additional increased risk of maternal and neonatal morbidity.

The burden of complications of the operation and associated risk factors are unknown. Additionally, residents on training, who do not have adequate exposure and skills of how to manage possible intraoperative complications that would happen, handle the decision and management of the procedure. Even though literatures from elsewhere show better maternal intraoperative outcomes with pull method of disimpacting the fetus from the pelvis, it is unknown whether the previous practice described has been significantly changed. As a result, it is expected that CSs performed in the second stage of labor in the selected hospitals may be associated with a higher incidence of immediate feto-maternal complications than what have been described in literatures.

Studies of C/S in the second stage of labor have been reported to have higher maternal and neonatal complications than first stage C/S. Maternal complications include bladder injury, extension of the

uterine incision and tears in lower uterine segments. These complications were mainly associated with delivery of the fetal head impacted deep in the pelvis (South Africa research)

The increase of second stage caesarean sections requires urgent strategies for improved care including increased consultant presence, meticulous documentation and adequate training of junior residents before they take over the procedure. Therefore, this study will describe the rate and trend of second stage cesarean delivery, immediate feto-maternal complications associated with the surgery.

1.3 Significance of the study

Using the findings of this study, Hiwot Fana Comprehensive Specialized Hospital will be able to increase the capacity to anticipate and handle complications associated with second stage cesarean section.

Additionally, this study aids in directing health authorities in the planning and implementation of interventions to reduce second stage cesarean delivery complications through assigning skilled operator and giving continues training for junior residents and others obstetric care providers. This study will serve for clinicians, policy makers, and program planners as a resource for the design of appropriate interventions. The result of this study will also serve as a benchmark for future research.

1.4 Objectives

1.4.1 General objective

To compare maternal and perinatal outcomes and associated factors when cesarean delivery is done in second stage and first stage of labor in Hiwot Fana Comprehensive Specialized University Hospital, from September 1 to December 31, 2024.

1.4.2 Specific objectives

1. To determine adverse maternal outcomes among women who gave birth by CD at second stage compared to first stage.

2. To determine adverse perinatal outcomes among women who gave birth by CD at second stage compared to first stage

3. To identify factors affecting adverse maternal outcomes among women who gave birth by CD at second stage compared to first stage

4. To identify factors affecting adverse perinatal outcomes among women who gave birth by CD at second stage compared to first stage

2. LITERATURE REVIEW

2.1 Feto-Maternal outcomes of second stage and first stage cesarean section

2.1.1 Maternal outcomes

Cesarean section is an essential surgery that can save women and babies‘ lives, and reduces morbidity. However, cesarean section, even when medically indicated, can put women at risk, especially in environments with inadequate systems to support appropriate quality of care. Both elective and emergency CS have a higher risk of complications than a vaginal birth(Callaghan, 2012).

A cross sectional study conducted by Charmy and his colleagues found that the intra operative complications mainly found were an extension of uterine angle and broad ligament hematoma and the post operative complications were postpartum hemorrhage, bladder injury,hematuria, puerperal pyrexia, infections, and extended hospitalization and catheterization(Charmy A.Vahi and Nikita Vijay, 2022)

Several studies have compared second-stage with first-stage caesarean section. However, in most studies, women who had undergone a previous caesarean operation were excluded. These studies have reported that caesarean section in the second stage of labour results in a greater number of maternal complications than in a first-stage caesarean section. (AP Betran, 2015)

A systematic review and meta-analysis to compare maternal morbidity and mortality among cases offered cesarean section at full dilatation to those offered cesarean section prior to full dilatation. Primary maternal outcomes were defined as death, ICU admission and need for transfusion. Ten studies were finally retrieved involving 23,104 singleton childbearing women (18,160 operated in the first stage and 4944 in the second stage of labor). Second stage cesarean section seems to lead to higher maternal admissions to ICU (OR 7.41, 95% CI 2.47–22.5) and higher transfusion rates (OR 2.60, 95% CI 1.49–2.54). Second stage cesarean section seems to result significantly increased morbidity for mothers (Vasileios Pergialiotis * and Dimitrios Haidopoulos, 2014)

Study conducted in Turkey to compare maternal outcomes of CD performed in first and second stages of labor, primary maternal outcomes measured included intraoperative surgical complications, surgery duration, need for blood transfusion, endometritis, requirement for hysterectomy, unintended extension and length of hospital stay. Caesarean deliveries performed in the second stage were associated with increased intraoperative complications, unintended extensions, need for blood transfusion, higher rates of endometritis and requirement for hysterectomy and were, therefore, associated with longer operation time and hospital stay. Caesarean deliveries performed in the second stage of labour were associated with higher rates of maternal complications, particularly in women who had undergone previous caesarean delivery(O. Asicioglu, 2014)

A study done in Australia, at Royal Prince Alfred Hospital, a tertiary obstetric unit, 0f 476 second stage cesarean delivery, Forty-eight (10.1%) women had a postpartum hemorrhage of more than 1000 ml. Four of these women required blood transfusions (8.3%), and the overall transfusion rate was <1%. One woman returned to the operating room for management of postpartum hemorrhage. One infant was delivered through a laparoelytrotomy, an uncommon complication of CS at advanced dilatation where the incision is made in the upper vagina, rather than the lower uterine segment. There were three maternal intensive care unit (ICU) admissions over the 5 years. (Georgina DAVIS and LUDLOW, 2015)

In study conducted in Nepal, there were 200 second stage cesarean deliveries analyzed for maternal and neonatal complication. In terms of maternal complications, 18 (12.5%) atonic postpartum hemorrhage uterine incision extension, 27 (18.8%) postoperative fever, 7 (4.8%) wound infections were observed(Padma Gurung, 2017)

A retrospective study done last year in the same country, Nepal for one year on 65 second stage cesarean sections uncovered that the most common complications of second stage cesarean section for mother was prolonged catheterization, postpartum febrile illness followed by wound infection, postpartum hemorrhage, blood transfusion and one patient had undergone peripartum hysterectomy(Jyotsna Yadav, 2023(Jyotsna Yadav, 2023)).

Prospective observational study done in Karnataka, India also disclosed that Second-stage caesarean sections are known to be associated with increased maternal complications. Intraoperative complications such as extensions of uterine incisions, atonic PPH and bladder base injury and post-operative complications like need for blood transfusion, febrile morbidity and prolonged catheterization were found more in second stage of labor. Perinatal complications such as hyperbilirubinemia and respiratory distress were found to be more in second stage of labor(Shweta Bhatia and Vijaya M. Revankar, 2021).

A study done in Ahasahisa teaching hospital in Sudan among 113 women delivered via second stage cesarean section depicted postpartum hemorrhage, sepsis and uterine extension as maternal complications(Gurashi A and Osman A.,2024)

A study done in Nigeria to compare maternal neonatal outcomes between CD performed in the first and second stages of labor has showed that women who had CD performed in the second stage were more likely to be referred rather than institutional patients ($P<0.001$), to have longer operative time, higher blood loss, more cases of intraoperative traumas, primary postpartum hemorrhage, blood transfusion, re-laparotomy, hysterectomy, post operation pyrexia, wound infection and longer hospital stay ($p<0.05$)(K. A. Rabiu, 2011)

A study done in Ethiopian capital city, Addis Ababa to compare maternal outcomes of CDs in first stage and second stage of labor on 1006 first and second stage CDs were used. The mean blood loss was 411ml and 566ml, and total operation time was 31.12minutes and 37.5 minutes in the first stage and second stage of labor, respectively ($p<0.05$). Five mothers required blood transfusions after cesarean hysterectomy done in second stage of CD. Post operatively, 21(7.2%) of first stage CDs and 13 (13.4%) of second stage CDs had postoperative complications like postoperative fever, wound infection and requirement of blood transfusion. Fourteen (3.6%) of first stage and 11 (2.8) of second stage CDs had postoperative fever while 13 (3.4%) of first stage and 4 (1%) of second stage CDs had postoperative wound infection(Belay T, 2014)

2.1.2 Perinatal outcomes

Overall rates of severe neonatal trauma following both CS at full dilatation and CS during the first stage of labour are very low (0.2% of 549 deliveries versus 0% of 1074 deliveries, respectively), but are reported for the former group(AP Betran, 2015).
A Cesarean section done in second stage of labor has also associated additionl risks for the fetus due to the nature of this emergency situation(Callagen,2012).

Birth related problems in neonates like asphyxia, injuries, fetal academia, hypoxic ischemic encephalopathy, prolonged NICU stay and even stillbirths are common (Charmy A.Vahi and Nikita Vijay, 2022).

Study conducted in Turkey noticed that neonatal outcomes included a 5 min Apgar score <3, admission to a neonatal intensive care unit, fetal injury, septicemia and neonatal death ($p < 0.05$)(O. Asicioglu, 2014).

A systematic review and meta-analysis that analyzed primary neonatal outcomes revealed higher neonatal complications. Primary neonatal outcomes were defined as death, neonatal unit admission and 5 min Apgar score less than seven. Neonatal death rates were also increased (OR 5.20, 95% CI 2.49–10.85) along with admissions to neonatal unit (OR 1.63, 95% CI 0.91–2.91) and rates of Apgar score less than 7 in 5 min (OR 2.77, 95% CI 1.02–7.50) (Vasileios Pergialiotis * and Dimitrios Haidopoulos, 2014).

At Royal Prince Alfred Hospital, a tertiary obstetric unit, 0f 476 second stage cesarean delivery sixty-eight (14.3%) babies were admitted to the NICU for management of respiratory distress, sepsis, jaundice, subgaleal haemorrhage and observation. Thirty-five (7.4%) had Apgar scores of <5 and 9 at one and 5 min, respectively. Four babies were delivered by breech extraction at CS due to difficulty delivering a fetal head deeply impacted in the maternal pelvis. There were six confirmed subgaleal haematoma, and there were no stillbirths or neonatal deaths. One infant was delivered through a laparoelytrotomy, an uncommon complication of CS at advanced dilatation where the incision is made in the upper vagina, rather than the lower uterine segment(Georgina DAVIS and LUDLOW, 2015).

Of 200 second stage cesarean deliveries analyzed for neonatal complication in Nepal, 49 (34.2%) meconium stained amniotic fluid, 14 (9.7%) neonatal hyperbilirubinemia, 21 (15.3%) nursery admissions and 2 (1.3%) perinatal mortality were seen(Padma Gurung, 2017).

A retrospective study done last year in the same country, Nepal for one year on 65 second stage cesarean sections, the neonatal admission for NICU were birth asphyxia and respiratory distress were 50% each(Jyotsna Yadav, 2023(Jyotsna Yadav, 2023)).

Prospective observational study done in Karnataka, India also disclosed that Second-stage caesarean sections are known to be associated with increased perinatal complications. Perinatal complications such as hyperbilirubinemia and respiratory distress were found to be more in second stage of labor(Shweta Bhatia and Vijaya M. Revankar, 2021).
There was also frequent admission of newborn to NICU for meconium aspiration, birth asphyxia, low Apgar score and grunting(Gurashi A and Osman A.,2024).
A study done in Nigeria to compare neonatal outcomes between CD performed in the first and second stages of labor has showed that Infants born to women who had CD in the second stage of labor, had higher incidence of birth asphyxia, admission to neonatal intensive care unit, sepsis, seizure, need for ventilation and neonatal death ($p<0.05$); CD in the second stage of labor is associated with significantly increased maternal and neonatal morbidity as well as increased neonatal mortality(K. A. Rabiu, 2011).
A study done in our country Ethiopia in three teaching hospital in Addis Ababa showed that the neonatal complications associated with second stage cesarean sections were increased incidence of fetal injury, septicemia, admission to the neonatal intensive care unit and fetal death due to fetal head impaction into the maternal pelvis and prolonged second stage labor (Belay T, 2014)

2.2 Associated factors of adverse maternal and perinatal outcomes

Caesarean sections during the second stage are increasing in prevalence and are associated with significant and long-term psychological and physical maternal morbidity. In association with the increasing incidence of CS at full dilatation, increasing rates of failed operative vaginal delivery (8.4% in 1992 versus 12.9% in 2001, CC 0.93, $P < 0.05$) and reduced attempts at instrumental delivery (3.9% no attempt at instrumental in 1992 versus 5.3% in 2001, CC 0.47, $P = 0.002$) have also been documented. The reasons for this are likely to be multifactorial(J. A. Z. Loudon, 2010)

According to Royal College of Obstetrician and Gynecologists audit figures, about 35% of CD for singleton pregnancies are performed because of failure to progress in labor, of which a quarter occur at full cervical dilatation. In 55% of these cases no attempt was made to achieve a vaginal birth with either forceps or ventose. In those births where instrumental delivery was attempted, the audit noted a ―failed rate of 35% for ventose and 2% for forceps(Thomas, 2001)

In a retrospective cohort study done in Australia, all caesarean sections performed at full cervical dilatation were assessed between 1 January 2009 and 31 December 2013 at Royal Prince Alfred Hospital, a tertiary obstetric unit. During the index period, 8449 women were delivered by caesarean section. Of these, 476 were at full cervical dilatation >37weeks gestation with a singleton fetus in cephalic presentation. The CS rate overall was 32.4%, and this varied from 30.6% in 2012 to a maximum of 34.6% ($P = 0.0004$), and second stage cesarean accounted for 10.4% of all emergency cesarean deliveries and 5.6% of all cesarean deliveries. The most common indication (44.9%) for CS in the second stage was failure to progress without an attempt at instrumental delivery (Davis, G., et al., 2015).

In an observational study conducted at the Bakirkoy, Women‘s and Children‘s Teaching Hospital from June 2008 to July 2011 a total of 3,817 caesarean deliveries were available for analysis; 3,519 (92.19%) were performed in the first stage, and 298 (7.81%) in the second stage(O. Asicioglu, 2014)

In another study,a retrospective cohort review of all women with a singleton, cephalic fetus at term delivery by cesarean section in the second stage of labor between April 1,2013 and March 30, 2017

at Patan Acadamy of Health Sciences. During the study period, there were 40,860 deliveries. A total of 18011 (44%) babies were born by cesarean section, 10484 emergency cesarean and 7527 elective. Out of the emergency cesarean sections, 200 (1.9%) were performed in second stage of labor. In this study, the most common indication was cephalopelvic disproportion(Padma Gurung, 2017)

In Africa, there was a study done in Nigeria, Maternity Unit of the Lagos University Teaching hospital to compare maternal and neonatal outcomes between CD performed in the first and second stages of labor. Of the 347 CD available for analysis, 245 (70.6%) were performed in the first stage while 102(29.4%) were performed in the second stage of labor(K. A. Rabiu, 2011)

In a retrospective study carried out at a district maternity unit in Durban, South Africa, the hospital records of all CSs over an eight-month period were reviewed. A total of 1257 CSs were available for analysis, of which 640 were electives and 617 emergency CSs. The overall CS rate was 27.2%. There were 53 second stage CSs. The rate of second-stage emergency CS was 8.6%. In 32 (60.4%) of the 53 patients, the second stage lasted ≤ 2 hours and for the remaining 21 it exceeded two hours. Cephalo-pelvic disproportion (CPD) and fetal distress were the most common indications for CS in the second stage (55% and 23% respectively), while fetal distress and previous CS were the commonest indications in the first-stage CSs (36% and 23% respectively) ((Belay T, 2014)Davis, G., et al., 2015).

In a cross-sectional, facility-based survey of 797 facilities to describe Ethiopian national population-based and institutional cesarean delivery rates by sector, indications for cesarean delivery, fetal and maternal outcomes, and aspects of quality of care, the national population-based cesarean delivery rate was 0.6%, with regional rates varying from 0.2% to 9%. The overall institutional rate was 18%, which varied between 46% in the private for- profit sector and 15% in the public sector. Maternal indications accounted for 66% of the cesareans reviewed, and fetal indications for 34%. Three-quarters of the cesareans were recorded as emergencies, but only 12% of these had their labor monitored with a pictograph. The interval between decision and delivery was within 30 minutes for 36% of the women, 31–60 minutes for 23%, and more than 5 hours for 19%. Antibiotics were given in 94% of the reviewed cases; nevertheless, 12% of the cases reported wound infection. There were 2 maternal deaths and 14% of the newborns were stillbirths or died shortly after birth (Fesseha et al,2011)

There are no adequate studies assessing second stage cesarean deliveries in our country, but there was one prospective comparative study done in three teaching hospitals in Addis Ababa in 2012 to compare maternal and fetal outcomes of CDs in first stage and second stage of labor. During a three-month study period a total of 3238 deliveries were attended. There were a total of 1006 CDs making CD rate of 30%. First stage CDs accounted for 719 (95.7%) of emergency CDs while second stage CDs accounted for 97 (4.3%)(Belay T, 2014)

2.3 Conceptual Framework

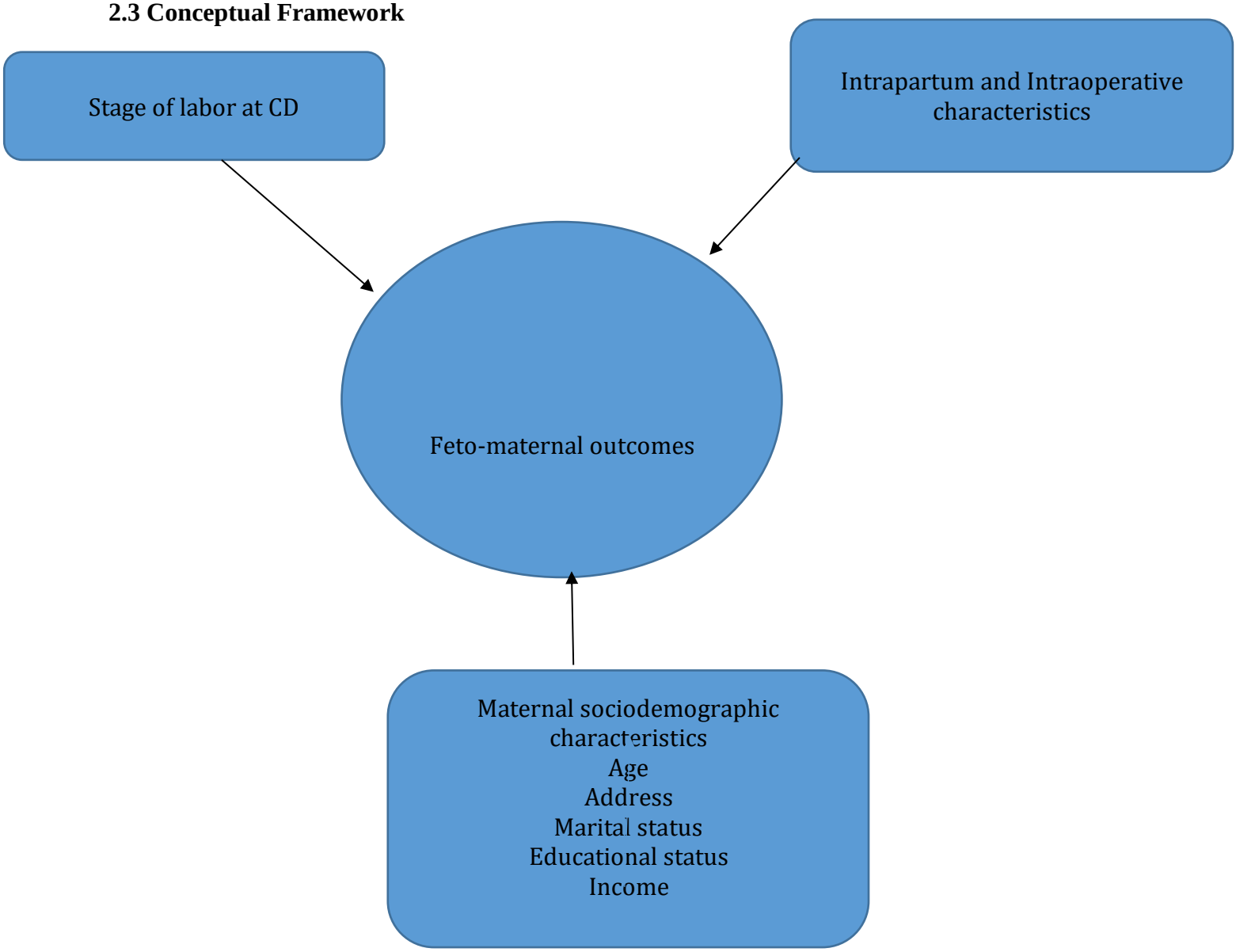

Figure 1: Conceptual framework of feto-maternal outcomes and associated factors among first and second stage cesarean deliveries in HFCSH, Harar,Eastern Ethiopia: a comparative cross sectional study

SSI: Surgical Site Infection

3. METHODS AND MATERIALS

3.1 Study area and study period

The study was conducted in HFCSUH, which is found in Harar town, Harari region, Ethiopia. Harar is located 525 km east of capital city of Ethiopia. Hiwot Fana Comprehensive Specialized hospital is used as referral hospital for Eastern Ethiopia. The hospital is also being served as teaching institution for various undergraduate, specialty and subspecialty program. The facility has four major departments (Internal medicine, Surgery, Pediatrics and Obstetrics-gynecology) and seven minor departments (psychiatry, dental clinic, radiology unit, dermatology, ophthalmology, medical oncology and ENT). Department of obstetrics and gynecology has four units which include, Labor ward, Maternity ward, Gynecologic ward, and Gynecologic Outpatient department.

Labor ward and maternity ward accommodate a total of 21 and 33 beds with about 5110 admission per year respectively. The ward is run with 20 consultants (including sub-specialties), 34 residents, and 42 midwives with an estimated annual delivery of 4092. (Source: Verbal communication with the hospital HMIS head, OBGYN department admission discharge registry and monthly perinatal audit report). This study was conducted from September 1, 2024 to December 31, 2024

3.2 Study Design

Prospective cohort study was used to compare maternal and perinatal outcomes in second stage versus first stage C/D and associated factors was assessed.

3.3 Population

3.3.1 Source Population

All women who gave birth in Hiwot Fana Comprehensive Specialized Hospital during study period.

3.3.2 Study Population

Women who gave birth by CS during first stage and second stage of labor in HFSCH in specified time.

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion Criteria

All women who gave birth at HFCSH via cesarean section in the study area and period

3.4.2 Exclusion Criteria

Women who had previous CD, twin pregnancy, IUFD and lethal congenital anomaly, or comorbidities (APH, GDM, HDP).

3.5 Sampling size determination

Sample size was calculated using Epi info 7.2 stat calc for population proportion that used for cohort study. Level of confidence of 95% and 80% power was used. Taking EBL of greater than 500ml as a primary outcome of interest and prevalence of 38.8% and 58.8% in first stage and second stage cesarean group respectively, there will be 59 cases for each group. Considering second stage and first stage cesarean section in a ratio of 1:3 (from study done in Jimma Medical Center in 2021), 59 and 177 sample size was calculated respectively. Total of 236 women were studied during the study period.

3.6 Sampling techniques/procedures

A serial (sequential) sampling technique was used to select a representative sample of the study subjects. For every second stage fulfilling inclusion criteria, the next three first stage cesarean deliveries were selected as controls for the study. The participant was assured to get the services fully whether they gave consent or not.

3.7 Data collection methods

3.7.1 Data collection tools

All women with second stage of labor fulfilling the inclusion criteria were identified, and those with first stage of labor were taken as control. Data was collected using questionnaire and checklist that contains sociodemographic characteristics of mothers, clinical presentations, laboratory data and maternal and fetal outcome parameters and associated factors. The structured questionnaire was filled after the women delivered and before the woman or neonate was discharged from the hospital. Maternal and neonatal charts was reviewed and attending physician was interviewed.

3.7.2 Data collectors and supervisor

Data collectors were one midwife, one scrub nurse and two residents each working at respective unit where data collection was undertaken. Principal investigator conducted close supervision.

3.7.3 Data collection procedure

Data collectors were trained for two days by the principal investigator on methodology, ethical concern, how to supervise and how to collect data, inclusion and exclusion criteria and data collection instruments. The study participants was encouraged to tell the relevant information while the confidentiality of their responses was assured.

The maternal socio-demographic and obstetric variables was collected through face to face interviews from participants and other data such as intrapartum variables, intraoperative characteristics and feto-maternal outcomes was collected from women's charts and by interviewing managing physicians. The patients were followed throughout their stay in the hospital to assess presence and development of complications and readmissions were also traced. The neonates admitted to NICU were followed for possible complications up to discharge or 7^{th} day of life whichever comes last

3.8 Study variables

- Stage of cesarean section (first vs second)
- Feto-maternal outcomes (adverse vs good outcomes)
- Socio demographic characteristics (age, marital status, educational status, religion, occupation, income, ethnicity, address)
- Obstetric and reproductive health conditions: ANC, Gestational Age
- Intrapartum conditions (fetal presentation, station, position, status of liquor, use of oxytocin, stage of labor at admission, duration of SSOL, type of anesthesia)

3.9 Operational definitions

Second stage cesarean section: Cesarean section that is done at full cervical dilatation

Adverse maternal outcomes: The presence of one or more of intraoperative complications, intraoperative interventions, postoperative complications, excessive blood loss or maternal death

Adverse fetal outcomes: Composite neonatal morbidity, which composed of neonatal need for resuscitation, low Apgar score, need for NICU admission, presence of Birth injury or fetal/neonatal death.

Booked – At least one antenatal visit at any of the health facility

GA – Gestational Age determined from either LNMP, early ultrasound, or ballard Score

Term – Gestational age beyond 37 weeks as calculated by either of LNMP, early Ultrasound, or Ballard Score

Urban – Place of residence from administrative capitals of zones or woredas or capital cities of regions.

Rural – Place of residence, not urban

NRFHRP- Abnormal fetal heart rate; using intermittent auscultations or continuous electronic monitoring

Operation time – Time elapsed from skin incision to skin closure.

Low Apgar score – Apgar score less than 7

ENND – Death of a newborn within 7 days of life

PPH – Hemorrhage following delivery, which required intervention of the managing team either Medically or surgically

Extension of Uterine incision – Any tear on the uterus that required additional layer of repair.

Hospital Stay – The days the mother stayed in the hospital from the day C/D was done until discharge.

3.10 Data quality control

Proper designing and pre testing of questionnaires was made on 20 mothers from Jugol hospital, Harar. Data was checked for completeness, cleaned and edited accordingly. Questionnaires was collected from trained data collectors by the principal investigator. The investigator before data entry for analysis ascertained completeness and clarity.

3.11 Data processing and analysis

Data was cleaned, coded and entered in to Epidata 4.6 and exported to SPSS version 22 for processing and analysis. Frequency distribution tables and texts were used to describe data, and measurements of central tendency like mean and median were applied. Categorical data were compared using Chi square or Fischer's exact test when appropriate. Relative risk was calculated and P value less than 0.05 was taken as statistically significant.

3.12 Ethical considerations

Ethical clearance letter was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of College of Health and Medical Sciences, Haramaya University. Permission to conduct the study was obtained from head of the hospital and respective unit. Informed, voluntary, written and signed consent was granted from the head of the hospital prior to the study process. Additionally, an informed, voluntary, written and signed consent was obtained from each respondent after providing sufficient information on the purpose of study. Sufficient information was given about the right to refuse participation or to jump some questions unwilling to answer. Confidentiality of the study participants and their details was maintained by removing personal identifiers.

3.13 Information dissemination

Data was analyzed and important conclusions and recommendations was generated. The results of the research will be presented to department of gynecology and obstetrics. The findings will also be published in a relevant scientific journal and disseminated online. The data will also be used as a base line for future studies and interventions.

4. RESULTS

During the study period, 1,532 births were documented, out of which 559 (36.5%) were delivered via cesarean section (C/D). Of these, 483 were emergency cesareans. Deliveries performed at full cervical dilation accounted for 14.6% of emergency C/Ds and 10.5% of the total cesarean deliveries

4.1 Socio-demographic characteristics

A majority of the participants in both groups came from rural areas, with 63.8% in the first-stage group and 81.4% in the second-stage group. The age of the study participants ranged between 16 and 42 years, with a mean age of 26.7 years. Most women in both groups (65.5% vs. 71.2%) can neither read nor write (Table 1).

4.2 Obstetric Characteristics

Primigravida women accounted for 37.9% of first-stage cases and 52.5% of second-stage cases. In terms of parity, 5.1% of women in the first-stage group and 24.7% in the second-stage group were primiparous, while the rest were multiparous. The miscarriage rate during the study was 7.3% and 5.2% for the first and second stages, respectively.

Most women in both groups attended at least one antenatal care (ANC) visit (71.8% in the first stage and 69.5% in the second stage). Among ANC attendees, the majority were booked at health centers (72.4% for the first stage and 70.7% for the second stage). A significant proportion of women in both groups (73.4% vs. 83.1%) had unknown gestational ages (Table 2).

4.3 Intrapartum Characteristics

The most common fetal presentation was vertex, with 88.7% in the first-stage group and 79.7% in the second-stage group. A majority of women in the first stage (62.7%) were admitted in active labor, while 37.3% of second-stage participants were in active labor. Use of oxytocin for labor augmentation was recorded in 11.9% of first-stage cases and 5.1% of second-stage cases. Meconium-stained amniotic fluid was observed in 20.3% and 25.4% of first- and second-stage deliveries, respectively. The leading indication for first-stage cesarean deliveries was NRFHRP (50.8%), while CPD accounted for 71.2% of second-stage cases. Additionally, 44.1% of women in the second stage underwent cesarean delivery after being fully dilated for more than two hours (Table 3).

4.3 Intraoperative Characteristics

Most first-stage cesarean deliveries (58.8%) were performed by R-3 residents, while 49.2% of second-stage procedures were handled by R-4 residents. General anesthesia was used in 1.7% of first-stage cases and 6.8% of second-stage cases, with spinal anesthesia being the primary method in the remaining cases. The pull and push methods were each employed in 33.9% of second-stage deliveries. The mean duration of surgery was longer in second-stage cases (46.88 ± 11.4 minutes) compared to first-stage cases (38.69 ± 8.93 minutes) (Table 4).

4.4 Maternal Outcomes

4.4.1 Maternal Morbidities

Overall, maternal complication of second stage CD was 54.2% compared to 21.4% of first stage CD. Most common one was prolonged hospital stay(13.6% vs 2.8%), followed by puerperal sepsis(10.2% vs 4%) while uterine incision extension (8.5% vs 3.4%),uterine atony(8.5% vs 4.5%) and need for transfusion (8.5% vs 4.5%) tolled third position with equal shares .

Intra-operatively, 22% of SSCDs had estimated blood loss of greater than or equal to 700 ml while none of first stage group had such documentation. The risk of developing uterine incision extension was 2.5 times more common when CS was done in second stage compared with first stage cesarean deliveries (8.5% vs 3.4%). 8.5% of second stage and 2.3% of first stage cesarean required blood transfusion in the operation theater. One woman in second stage cesarean section sustained iatrogenic bladder injury while there was no such complication in first stage group.

Post operatively, 6.8% of second stage group and 2.3% of first stage cesarean deliveries developed surgical site infection. Relaparatomy and uterine rupture complicated 3.4% of second stage cesarean deliveries each while none of first stage group developed such difficulty. One woman (1.7%) of second stage cesarean deliveries ended in maternal death after hysterectomy was done for uterine rupture and admitted to ICU (table 5).

4.4.2 Associated Factors for Maternal Morbidity

Maternal morbidity was computed as the presence of one or more of intraoperative or postoperative complications.In the bivariate analysis, variables that were independently associated with maternal morbidity at (P-Value < 0.05) were age of the participants, maternal address, level of the surgeon, station of the fetal presenting part, status of liqour and methods of fetal extraction.

Multivariate logistic regression showed mothers whose CS was done with junior residents were 3.9 times more likely to develop maternal complications than those whose birth was attended with year-4 residents (AOR=3.901, 95% CI: AOR 12.773). Odds of having uterine incision extension among women whose fetus was extracted with neither method was 6.34 times more likely when compared to those women whose fetus was extracted with pull method in SSOL (AOR = 6.34: 95% CI: 2.507, 16.031). Women whose fetal presenting part was at station of zero or below were 4 times as likely to develop both intrapartum and postpartum complications as those presented with unengaged fetal head (AOR= 4.012, 95% CI: 1.527-10.546) (table 6).

4.5 Neonatal Outcomes

4.5.1 Neonatal Morbidities and Mortality

Most neonates in both groups had normal birth weights (91.5% vs. 83.1%). First minute Apgar scores below seven were recorded in 44.1% of second-stage neonates compared to 8.5% in first-stage neonates. Resuscitation beyond basic care was required in 50.8% of second-stage cases versus 23.1% in first-stage cases. Early neonatal deaths occurred in 8.5% of second-stage deliveries compared to 2.8% in first-stage deliveries (Table 7).

4.5.2 Associated Factors for Neonatal Morbidities and Mortality

Composite neonatal morbidity was computed as a sum of need of resuscitation, low Apgar score, presence of birth injury and NICU admission. Bivariate logistic regression showed that parity of the respondents, stage of labor at admission, Status of liquor, indication for cesarean delivery and duration of rupture of membrane showed statistically significant association with composite neonatal morbidity at P-value of <0.05. Station of the fetal presenting part and level of the surgeon showed similar association. After multivariate logistic regression was done, status of liquor (AOR= 33.63, 95th CI (1.94-582.84), P<.05), indication for cesarean delivery (AOR= 0 .31, 95th CI (0 .12-0 .77), P<.05), duration of rupture of membrane (AOR= 2.62, 95th CI (1.12- 6.13), P< 0.05) were found to be independent predictors (Table 8).

Table 1 Comparison of Maternal Sociodemographic Characteristics of Women who underwent First Stage and Second Stage C/D at HU-HFCSH, Harar, Ethiopia from September 1 to December 31, 2024.

Variables	Variable categories	Stage of labor at which CS was done			
		FSCD		SSCD	
		Number	Percentage	Number	Percentage
Address	Rural	113	63.8%	48	81.4%
	Urban	64	36.2%	11	18.6%
Age	<= 19 years	12	6.8%	12	20.3%
	20-24 years	52	29.4%	18	30.5%
	25-29 years	64	36.2%	22	37.3%
	30-34 years	31	17.5%	4	6.8%
	>= 35 years	18	10.2%	3	5.1%
Marital status	Married	173	97.7%	58	98.3%
	Not married	4	2.3%	1	1.7%
Educational status	Can't read/write	116	65.5%	42	71.2%
	Read and write	33	18.6%	7	11.9%
	Elementary school	17	9.6%	6	10.2%
	Secondary school	7	4%	4	6.8%
	University	4	2.3%		
Religion	Muslim	144	81.4%	52	88.1%
	Orthodox	20	11.3%	4	6.8%
	Protestant	13	7.3%	3	5.1%
Ethnicity	Oromo	157	88.7%	56	94.9%
	Amhara	13	7.3	2	3.4%
	Harari	3	1.7%	0	0%
	Gurage	4	2.3%	1	1.7
Occupation	Housewife	164	92.7%	56	94.9
	Merchant	8	4.5%	2	3.4%
	Government employee	5	2.8%	1	1.7%
Monthly income (ETB)	<5000	86	48.6%	41	69.5%
	5000-10,000	50	28.2%	10	16.9%
	>10,000	41	23.2%	8	13.6%

Table 2: Comparison of Obstetric Characteristics of Women who underwent First Stage and Second Stage C/D at HU-HFCSH, Harar, Ethiopia from September 1 to December 31, 2024

Variables	Variable categories	Stage of labor at which CS was done			
		FSCD		SSCD	
		Number	Percentage	Number	Percentage
Gravidity	I	67	37.9%	31	52.5%
	II-IV	51	28.8%	14	23.7%
	>= V	59	33.3%	14	23.7%
Parity	I	5	5.1%	7	24.1%
	II-IV	49	50%	11	37.9%
	>= V	44	44.9%	11	37.9%
Abortion	Yes	13	7.3%	3	5.2%
ANC	Booked	127	71.8%	41	69.5%
	Unbooked	50	28.2%	18	30.5%
Place of ANC	Health Center	92	72.4%	29	70.7%
	Hospital	29	22.8%	7	17.1%
	Private Clinic	6	4.7%	5	12.2%
Gestational Age	Unknown date	130	73.4%	49	83.1%
	Early term	20	11.3%	5	8.5%
	Full term	17	9.6%	3	5.1%

Table 3: Comparison of Intrapartum Characteristics of Women who underwent First Stage and Second Stage C/D at HU-HFCSH, Harar, Ethiopia from September 1 to December 31, 2024

Variables	Variable categories	Stage of labor at which CS was done			
		FSCD		SSCD	
		Number	Percentage	Number	Percentage
Fetal presentation	Vertex	157	88.7%	47	79.7%
	Breech	10	5.6%	2	3.4%
	Face	3	1.7%	1	1.7%
	Brow	2	1.1%	3	5.1%
	Shoulder	2	1.1%	1	1.7%
	Parietal bone	3	1.7%	5	8.5%
Stage of labour at admission	No labour/ LFSOL	66	37.3%	17	28.8%
	AFSOL	111	62.7%	22	37.3%
	SSOL	NA		20	33.9%
Oxytocin requirement in labour	Yes	21	11.9%	3	5.1%
	No	156	88.1%	56	94.9%
Status of liqour	Clear	141	79.7%	44	74.6%
	Meconium stained	36	20.3%	15	25.4%
Duration of ROM	<= 12 hours	117	66.1%	38	64.4%
	> 12hours	60	33.9%	21	35.6%
CD indications	NRFHRP	90	50.8%	10	16.9%
	CPD	25	14.1%	42	71.2%
	Arrest/ Protraction disorder	62	35%	0	0
	Obstructed labour	NA	-	7	11.9%
Station of presenting part at decision	-2	57	32.2%	0	0
	-1	72	40.7%	6	10.2%
	0	32	18.1%	33	55.9%
	+1	13	7.3%	14	23.7%
	+2	3	1.7%	6	10.2
Deciding physician	R-3	102	57.6%	6	10.2%
	R-4	75	42.4%	53	89.8%
Position of presenting part	Malposition	42	26.8%	13	27.7%
	No malposition	115	73.2%	34	72.3%
Duration of SSOL	<= 2 hours	NA	-	33	55.9%
	> 2 hours	NA	-	26	44.1%

Table 4: Comparison of Intraoperative Characteristics of Women who underwent First Stage and Second Stage C/D at HU-HFCSH, Harar, Ethiopia from September 1 to December 31, 2024.

Variables	Variable categories	Stage of labor at which CS was done			
		FSCD		SSCD	
		Number	Percentage	Number	Percentage
Level of surgeon	R-2	47	26.6%	5	8.5%
	R-3	104	58.8%	25	42.4%
	R-4	26	14.7%	29	49.2%
Type of anesthesia	Spinal anesthesia	174	98.3%	55	93.2%
	General anesthesia	3	1.7%	4	6.8%
Methods of fetal extraction	Push method	0	0	20	33.9%
	Pull method	0	0	20	33.9%
	Neither	177	100%	19	32.2%
Duration of surgery	<= 30 minutes	42	23.7%	7	11.9%
	30-40 minutes	122	68.9%	32	54.2%
	>40 minutes	13	7.3%	20	33.9%
Mean duration of surgery		38.69 ± 8.93 min		46.88 ±11.4 min	

Table 5: Comparison of Intraoperative Characteristics of Women who underwent First Stage and Second Stage C/D at HU-HFCSH, Harar, Ethiopia from September 1 to December 31, 2024

Variables	Categories	Stage of labor at which CS was done			
		FSCD		SSCD	
		Number	Percentage	Number	Percentage
Uterine extension	Yes	6	3.4%	5	8.5%
	No	171	96.6%	54	91.5%
Bladder injury	Yes	0	0	1	1.7%
	No	177	100%	58	98.3%
Estimated blood loss	350ml	117	66.1%	1	1.7%
	400ml	31	17.5%	6	10.2%
	500ml	16	9%	20	33.9%
	600ml	13	7.3%	19	32.2%
	>= 700ml	0	0%	13	22%
	Mean EBL	564 ml		390 ml	
Uterine atony	Yes	8	4.5%	5	8.5%
	No	169	95.5%	54	91.5%
>10% Hct drop	Yes	5	2.8%	4	6.8%
	No	172	97.2%	55	93.2%
Needed transfusion	Yes	4	2.3%	5	8.5%
	N0	173	97.7%	54	91.5%
Hospital stay	48 hours	143	80.8%	11	18.6%
	72 hours	29	16.4%	40	67.8%
	>72 hours	5	2.8%	8	13.6%
Mean Hospital stay		3.71 ± 1.67		5.24 ± 3.05	P= 0.01
Surgical site infection	Yes	4	2.3%	4	6.8%
	N0	173	97.7%	55	93.2%
Puerperal sepsis	Yes	7	4%	6	10.2%
	No	170	96%	53	89.8%
Uterine rupture	Yes	0	0%	2	3.4%
	No	177	100%	57	96.6%
Relaparatomy	Yes	0	0%	2	3.4%
	No	177	100%	57	96.6%
Maternal death	Yes	0	0%	1	1.7%
	No	177	100%	58	98.3

Table 6: Factors associated with maternal complications of Women who underwent First Stage and Second Stage C/D at HU-HFCSH, Harar, Ethiopia from September 1 to December 31, 2024

Variable	Category	P value	AOR	95% C.I for AOR	
				Lower	Upper
Age	<=19	0.227	1.00		
	19-24	0.215	0.597	0.264	1.349
	25-29	0.614	2.716	0.778	9.732
	30-34	0.556	0.649	0.154	2.736
	35 and above	0.569	1.533	0.352	6.664
Address	Rural	0.017	2.580	1.187	5.606
	Urban	0.417	0.661	0.244	1.794
Status of liqour	Meconium stained	0.857	0.881	0.223	3.491
	Clear	0.554	1.554	0.361	6.698
Level of the surgeon	**Junior**	**0.024**	**3.901**	**1.192**	**12.773**
	R-4	0.465	1.00		
Method of fetal extraction	Pull Method	0.417	0.661	0.244	1.794
	Push Method	0.278	1.00		
	Neither	**<0.001**	**6.34**	**2.507**	**16.031**
Station	Unengaged	0.353	1.00		
	0 and below	**0.004**	**4.012**	**1.527**	**10.546**

Table 7: Comparison of Neonatal Outcomes among Women Who Underwent First Stage and Second Stage C/D at HU-HFCSH, Harar, Ethiopia from September 1 to December 31, 2024

Variables	Categories	Stage of labor at which CS was done			
		FSCD		SSCD	
		Number	Percentage	Number	Percentage
Sex	Male	99	55.9%	34	57.6%
	Female	78	44.1%	25	42.4%
Birthweight	<2500gm	7	4%	2	3.4%
	2500-3999gm	162	91.5%	49	83.1%
	>= 4000gm	8	4.5%	8	13.6%
First minutes Apgar scores	< 7	15	8.5%	26	44.1%
	>= 7	162	91.5%	33	55.9%
Fifth minutes Apgar scores	< 7	6	3.4%	8	13.6%
	>= 7	171	96.6%	51	86.4%
Neonatal resuscitation beyond basic care	Yes	41	23.1%	30	50.8%
	No	136	76.9%	29	49.2%
Admission to NICU	Yes	33	18.6%	19	32.2%
	No	144	81.4%	40	67.8%
Diagnosis at NICU	EONS	12	6.8%	7	11.9%
	MAS	8	4.5%	5	8.5%
	PNA	2	1.1%	2	3.4%
	Birth injury	2	1.1%	5	8.5%
	Observation	11	6.2%	0	0%
Early neonatal death	Yes	5	2.8%	5	8.5%
	No	172	97.2%	54	91.5%

Table 8: Factors associated with Neonatal Outcomes among Women Who Underwent First Stage and Second Stage C/D at HU-HFCSH, Harar, Ethiopia from September 1 to December 31, 2024

Variable	Category	P-Value	AOR	95% CI for AOR	
				Lower	Upper
Parity	Primiparous	0.276	1		
	Multiparous	0.111	0.39	0.123	1.242
Stage of labor at admission	LFSOL/No labor	0.634	0.73	0.200	2.668
	AFSOL	0.31	0.648	0.280	1.498
	SSOL	0.224	0.54	0.200	1.459
Status of liquor	Clear		1.00		
	MSAF	**0.016**	**33.627**	**1.940**	**582.837**
Indication for CD	**NRFHRP**	**0.012**	**2.08**	**1.06**	**4.09**
	CPD	0.698	0.654	0.244	1.752
	Arrest/Protraction	0.522	2.33	0.175	31.034
	OL	**0.019**	**13.263**	**1.178**	**149.306**
Duration of ROM	< 12 hours	0.281	1.8	0.618	5.237
	>=12 hours	**0.026**	**2.62**	**1.12**	**6.127**
Station of the presenting part	Unengaged	0.121	8.025	0.576	111.796
	0 and below	0.224	0.540	0.2000	1.459
Level of the surgeon	R-2	0.242	4.013	0.391	41.194
	R-3	0.490	0.689	0.239	1.985
	R-4	0.014	1.00		

5. Discussions

In this study, the cesarean delivery (C/D) rate was 36.5% (95% CI 4.9 (2.22-13.92)), which is higher than Ethiopia's recent C/D prevalence of 29.55%. Similarly, it exceeds the C/D rate of 30% reported in a study conducted in Addis Ababa across three tertiary hospitals(Belay T, 2014).

A study from Sudan also reported a lower C/D rate of 26.1% in a tertiary hospital (Omer M Handady S., 2018). This disparity can be attributed to the fact that HU-HFCSH is the major referral Hospital in Eastern Ethiopia and most of the cases referred from surrounding hospitals and health centers are complicated cases and already need surgical interventions (Davis, G., et al., 2015).

The rate of C/D at full cervical dilation in this study was 10.5%, comparable to international rates. Retrospective cohort studies conducted in Australia and a maternity unit in Durban, South Africa, showed rates of 10.4% and 9.7%, respectively (Padma Gurung, 2017).

Intraoperative factors were analyzed based on the mean surgery duration, estimated blood loss, and changes in hematocrit levels. The second-stage C/D group had a significantly longer mean surgery duration (46.88 ± 11.4 minutes) compared to the first-stage group (38.69 ± 8.98 minutes) ($P < 0.05$). Studies from Addis Ababa and South Africa indicated a similar trend, though their reported operation times for both groups were lower (37.5 minutes vs. 31.12 minutes) ($P < 0.05$). A study in New Delhi, India, produced similar findings (43.33 ± 6.46 minutes vs. 34.23 ± 5.84 minutes) ($P < 0.001$). This extended duration may be due to intraoperative complications in the second stage and differences in surgical techniques (Belay T, 2014)Davis, G., et al., 2015).

A three-year observation study from Istanbul, Turkey however reported lower rate though second stage C/D delivery group tend to loss more than 10% of hematocrit (37.5% Vs 5.4%). This may be explained again by the relative high incidence of intraoperative complication in the second stage group like incision extension which may lead to more bleeding in our study(AP Betran, 2015).

The mean length of hospital stay was significantly longer for the second stage group (5.24 +3.05 days for second stage group Vs 3.71 + 1.67 days for first stage group)($p<0.05$). This result is significantly lower when compared with a study done in three teaching hospitals in Addis Ababa by Belay et al which reported mean hospital stay of 6 and 9 days for first stage and second stage C/D group respectively, while the South African study reported 4 and 5 days respectively.

A Retrospective study done to compare primary C/D in Turkey however reported no difference in the length of hospital stay; both group stayed less than 3 days in hospital. The difference in

length of hospital stay in this study can be explained by the fact that patients with obstructed labor and postpartum complications (relatively more common in ours) are more common in the second stage group which tend to stay more days in hospital for courses of management(Belay T, 2014).

Overall, the commonest maternal morbidities during second stage cesarean deliveries depicted from this study when compared with first stage cesarean were > 72 hours hospital stay (13.6% vs 2.8% P<0.05), uterine incision extension(8.5% vs 3.4% P 0.018),uterine atony (8.5% vs 4.5% P< 0.05) and need for transfusion(8.5% vs 2.3% P<0.05).

Independently associated factors for maternal complications suggested with this study was level of the surgeon, method of fetal extractions and station of presenting fetal parts.

Cesarean deliveries done with junior residents (R-2 and R-3) were complicated 3.9 times when compared with those done with year-4 residents (P 0.024 AOR 3.901). Until compilation of this paper there was no study that compare this variable but different literature suggests second stage cesarean should be handled with the most senior obstetrician including maternal fetal medicine subspecialist. Explanation is clear since skill and experience is paramount important in handling difficult second stage cesarean delivery(Charmy A.Vahi and Nikita Vijay, 2022).

With regard to methods of fetal extraction, pull method was associated with better maternal outcome when compared with push method and use of neither mothed was associated with more than six times increased morbidity (P< 0.01, AOR 6.34, 95% CI). Our finding is consistent with existing evidences. In a study by Veisi, F., et al, mean operative time and incidence of extension of the uterine incision significantly increased in the group that delivered via the push method (P < 0.001)(Veisi et al,2019).

In this study, station of presenting part at zero or below at time of decision increased the risk of composite maternal morbidity four times when compared to unengaged station (P 0.004). Retrospective cohort study conducted in Zurich, Switzerland uncovered similar finding with deeply engaged head being complicated as uterine incision extension, prolonged duration of surgery and increased blood loss and suggested reverse breech extraction (pull method) as a solution (P <0.01)(Franziska Lenz,Ninna Kimmich,2018).

This study showed the need for neonatal resuscitation beyond basic neonatal care, 5th minute Apgar score <7, and Admission to NICU was higher When C/D was done in second stage of labor than in first stage. The risk of having 5th minutes APGAR score less than seven is about four times

likely when the C/D was done in second stage of compared with the first stage (P-0.003, 95% CI 4.9(2.22-13.92). Sinha S et al also reported similar finding where 7.5% and 33.3% of neonates had 5th minute APGAR score less than seven for first stage C/D group and second stage C/D group respectively (P<0.05).

A study from Turkey also reported 3.2% and 0.2% in second stage and first stage group respectively (p<0.05).However the study done in three teaching hospitals in Addis Ababa showed no difference in rate of NICU admission, perinatal morbidity and mortality.

The indications of C/D in the second stage of labor are usually CPD and Obstructed labor and the risk of intrapartum fetal asphyxia might be there long before C/D(Vasileios Pergialiotis * and Dimitrios Haidopoulos, 2014).

Composite neonatal morbidity was increased in newborns delivered from mothers with prolonged rupture of membranes (P 0.026), mothers with meconium stained liquor (P 0.016) and indications for cesarean section was NRFHRP (P 0.012) and obstructed labor (P 0.019). Retrospective study done at Jordan University hospital, NICU showed strong association of prolonged ROM with neonatal sepsis (P 0.046). A study by Biradar A et al. showed that thick meconium is associated with more complications like increased operative interference, birth asphyxia, meconium aspiration syndrome, low Apgar score, prolonged NICU stay and overall increased perinatal mortality compared to thin meconium stained liquor, supporting our finding here. This is, however, in contrary with a study by Kokanalı, where MSAF was not found as a significant factor for poor perinatal outcome in multivariate regression model (Shweta Bhatia and Vijaya M. Revankar, 2021). I suggest further study for huge differences in these findings.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study revealed that uterine incision extension and uterine atony are the major intraoperative complications while prolonged hospital stay, puerperal sepsis and need for transfusion are the commonest negative consequences happened when CD was conducted in SSOL in comparison with first stage group. It was found that cesarean sections done with junior residents and at fetal station below zero was an associated factor for undesired outcomes. Pull technique of delivery of impacted fetal presenting part has relative advantages over the push method in cases of impacted fetal head at cesarean delivery with regard to maternal intraoperative complications. Meconium stained liquor, prolonged rupture of membrane and NRFHRP and obstructed labour as an indication for CD has shown to cause poor neonatal outcome.

6.2 Recommendations

Therefore, most senior resident should be involved in the handling of second stage cesarean deliveries particularly when the presenting fetal parts are deeply engaged and reverse breech extraction should be a custom of fetal extraction.

As second stage cesarean deliveries also increased poor neonatal outcomes, necessary preparations should be made for neonatal resuscitation including pediatric side communication peculiarly in the background of meconium stained amniotic fluid, prolonged rupture of membrane and NRFHRP.

We believe that further prospective cohort studies with more participants from multiple health facilities are needed to suggest acceptable protocols about this topic. This study did not address the outcomes of all women who reached full dilatation or underwent successful instrumental deliveries.

6.3 Study strength and limitation

6.3.1 Strengths

Our study was rich of maternal obstetric and intrapartum data and its prospective nature with high response rate. It has clearly answered the study objectives and proposed solutions for the identified

problems. Obtained data may be helpful in encouraging obstetricians to modify labor management and cesarean technique.

6.3.2 Limitations

The true incidence of those intraoperative complications are dependent on the documentation of the surgeon that might lead to underreporting.

The study is also done in a single institution and the study design being prospective might not Prevent the recall bias.

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