ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES, SCHOOL OF MEDICINE

DEPARTMENT OF ANATOMY

FETO-MATERNAL COMPLICATIONS OF PLACENTA PRAEVIA AND ITS RISK FACTORS IN TIKUR ANBESSA SPECIALIZED REFERRAL AND GANDHI MEMORIAL HOSPITALS

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ACRONYM AND ABBREVIATIONS

AOR	Adjusted odd ratio
APH	Antepartum hemorrhage
C/S	Caesarean section
D&C	Dilatation and curettage
GA	Gestational age
GMH	Gandhi memorial hospital
ICSI	Intracytoplasmic sperm injection
IRB	Institutional review board
IVF	In vitro fertilization
NICU	Neonatal intensive care unit
PP	Placenta praevia
PPA	Placenta praevia accreta
PPH	Post-partum hemorrhage
SPSS	Statistical package for social sciences
TAS	Trans abdominal sonography
TASH	Tikur Anbessa specialized hospital
TLS	Trans labial sonography
TVS	Trans vaginal sonography

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ABSTRACT

Background: Placenta praevia is a disorder that happens during pregnancy, which is characterized by the presence of placental tissue close or adjacent to the cervix. The magnitude of placenta praevia is 3-5 per 1000 pregnancies worldwide and it is still rising because of increasing caesarean section rates. It is associated with severe maternal and neonatal morbidity and sometimes mortality.

Objective: To assess and identify the risk factors, maternal and neonatal complications associated with placenta praevia.

Method and Materials: Target populations for this study were all women diagnosed with placenta praevia in Tikur Anbessa and Gandhi memorial specialized Hospitals. The study design was hospital based retrospective case control study. Data was carefully extracted from medical records, reviewed and analyzed. SPSS version 25 statistical package for statistical analysis was used. Descriptive statistics was used to summarize categorical variables. Both bivariate and multivariate analysis was performed using logistic regression and adjusted odd ratios (AOR) with 95% confidence intervals. P value <0.05 was considered statistically significant.

Results: Placenta praevia complicated 303 cases of pregnancy and six neonatal deaths were recorded in this study. The magnitude of placenta praevia observed was 7 in 1000 pregnancies. Advanced maternal age (≥35) [AOR 6.3; 95%CI: 3.20, 12.51], Multiparity [AOR 2.2; 95%CI: 1.46, 3.46] and previous history of caesarean section [AOR 2.7; 95%CI: 1.64, 4.58] had an increased odds of placenta praevia.

Major maternal complications associated with placenta praevia were Postpartum anemia [AOR 14.6; 95%CI: 6.48, 32.87], blood transfusion 1-3 units [AOR 2.7; 95%CI: 1.10, 6.53]. Neonates born to women with placenta praevia were at increased risk of respiratory syndrome [AOR 4; 95%CI: 1.24, 13.85], IUGR [AOR 6.3; 95%CI: 1.79, 22.38] and preterm birth [AOR 8; 95%CI: 4.91, 12.90].

Conclusion: Advanced maternal age, multiparity and previous histories of caesarean section were significantly associated risk factors of placenta praevia. Adverse maternal outcomes associated with placenta praevia were postpartum anemia and the need for blood transfusion. Neonates born placenta praevia women were also at risk of being born preterm, intrauterine growth restriction and respiratory distress syndrome.

Key words: Placenta praevia, Neonatal complication, maternal complication

1. INTRODUCTION

1.1 Background

Placenta praevia is a disorder that happens during pregnancy that is characterized by the presence of placental tissue close to or covering the cervix.

The greatest risk of placenta praevia is bleeding. Bleeding often occurs as the lower part of the uterus begins to stretch and lengthen in preparation for delivery. When the cervix begins to efface and dilate, the attachment of the placenta to the uterine wall is detached, resulting in bleeding.[1]

More recently, placenta previa has been consolidated into two definitions: complete and marginal previa. A complete previa is defined as complete coverage of the cervical os by the placenta. If the leading edge of the placenta is less than 2 cm from the internal os, but not fully covering, it is considered as marginal previa. [2]

The incidence of placenta praevia is 3-5 per 1000 pregnancies worldwide and it is still rising because of increasing caesarean section rates. This is because uterine scar in the lower segment may attract a low implantation of the placenta. . The incidence is much higher at mid pregnancy than at 36 weeks and above because of formation of the lower segment of the uterus and possibly due to tropho-tropism resulting in resolution of placenta praevia. [3]

Several studies attempted to define risk factors for placenta praevia, and pointed out an association with advanced maternal age, parity, maternal smoking, infertility treatments, previous cesarean deliveries, previous placenta praevia and recurrent abortions. Among the aforementioned risk factors, several have increased during the past decades including the rate of cesarean sections, advanced maternal age and the number of women undergoing infertility treatments.[4]

Neonates born to mothers with placenta praevia are more likely suffer from preterm birth, perinatal death, congenital malformations, Apgar scores at 1 minute and 5 minute lower than 7[5-11].Perinatal morbidity is also studied that majority of babies require resuscitation and NICU admission[9]. Moreover, the most substantial outcome of this disorder is a small for gestational age and low birth weight.[11, 12]

The complication of placenta praevia is not only limited to the antepartum period but the intrapartum and postpartum course can also be complicated with high rate of cesarean delivery, peripartum hysterectomy, morbid adherence of placenta and postpartum hemmorhage[6, 13-16]. Previous studies have estimated the rate of hysterectomy among women with placenta praevia to be 5%. Pregnancies complicated with placenta previa has also significantly higher rate of postpartum anemia (OR 5.5, 95% CI(4.4–6.9) and delayed discharge from the hospital.[8, 15]

1.2. Statement of the problem

Placenta praevia presenting as APH in third trimester is one of the gravest obstetric emergencies. Even with the best obstetric care, due to dramatic suddenness, a pregnant woman can be exsanguinated due to severe bleeding.

Severe bleeding in placenta praevia is associated with severe maternal morbidity and sometimes mortality. This is especially so in developing countries where few women attend antenatal care, there is shortage of blood for transfusion and delays of operative delivery due to logistical problems. The risk factors for severe bleeding in parturient with placenta praevia are not well documented. [3] Studies have shown that placenta previa also carries greater risks of surgical complications including obstetrics hysterectomy and massive haemorrhage requiring blood transfusion.[15]

Neonates born to them are at a higher risk of premature birth, low Apgar score and increased admission to NICU. [10] Therefore, the purpose of the present study was to determine the magnitude, risk factors and neonatal and maternal outcome of pregnancies complicated with placenta praevia.

1.3. Significance of the study

This study will be helpful in the development of standard management guidelines for the management of placenta praevia in Addis Ababa University Teaching Hospitals; Tikur Anbessa Specialized Referral Hospital, Gandhi Memorial Hospital and Zewditu Memorial Hospital.

Moreover, this study will have the following significances: -

- ✓ It will provide a better understanding regarding the risk factors and maternal and neonatal complications of placenta praevia in the context of Ethiopia.
- ✓ These research findings will be used as baseline data for further studies on placenta praevia and related topics.

2.LITERATURE REVIEW

2.1. Placenta praevia

Placenta praevia exists when the placenta is covering the cervical os completely or partially at or after 28 weeks of gestation. Placenta covering the cervical os completely is considered a major or complete praevia.

The incidence of P.P at term is in the range of 3 to 6 per 1000 pregnancies.[17] Study conducted in siriraj hospital shows that the incidence of placenta praevia reported to be 0.7%.[18]

2.2. Risk factors for development of placenta praevia

2.2.1. Age: advancing maternal age increases the risk of placenta praevia. As indicated in researches, the prevalence of PP is about 1% between the age 12-19, and 0.33% in the age range of 20-29. In the age of 30-39, its prevalence is also about 1% and it will increase to 2% if the women's age is above 40. [19]

Placenta praevia in multiparty and increasing age is thought to be due to atherosclerotic changes in the uterus resulting in under-perfusion and infraction of the placenta, thereby increasing the size of the placenta. [20]

2.2.2. Multiparty: It is more common in women who had previous pregnancies, one for every twenty women who have had 6 or more pregnancies. The reason is not clear but it may be associated with the ageing of vasculature of the uterus. [21] This causes placental hypertrophy. [22]Studies from Kollmann *et al.* and Tuzovic *et al.* reported that women aged 35 or older, and with parity of 2 or more, showed an increased risk of placenta praevia. [23, 24]

2.2.3. Previous Cesarean section: Surgical disruption of the uterine cavity is a potential risk factor for PP. It is much known to cause lasting damage to the myometrium and endometrium. If previous cesarean section is performed, there is a problem of angiogenesis in the previous operation site that may cause partial hypoxia. This hypoxia leads to incomplete decidualization and abnormal trophoblast invasion that can cause placental adhesion. [25]

Cohort study in United Kingdom NHS hospital shows, among 131,731 women who had elective CS, 4,332 women had placenta praevia at term making 32.9 per 1000 elective CS. In

cross sectional survey conducted for 12 months from 1st January 2012 to 31st December 2012 in the Lady Willingdon Hospital, Lahore, out of 114 cases, the frequency of placenta praevia in non-scarred uterus was 32.45% (37 cases), and frequency in previously scarred uterus was 67.54%(77 cases). [13]

In a Meta-analysis of 170,640 pregnant women, a dose related response pattern of risk factors for placenta praevia was found with increasing number of caesarean section deliveries. The odds ratios ranged from (4.5, 95%CI 3.6 to 5.5) for one caesarean section delivery to (44.9, 95%CI 13.5 to 149.5) for four or more caesarean section deliveries. [8]

2.2.4. Dilatation and curettage: Refers to surgical removal of part of the lining of the uterus or contents of the uterus by scraping and scooping (curettage). [7] Dilatation and curettage is also quoted as an additional risk factor. [26]

Based on retrospective study carried out at tertiary referral Centre in North India, among 70 women who had placenta praevia, 39.47% of the sample population had history of dilatation and curettage.[10] with liberalization of abortion practices and easy accessibility, the incidence of pregnancy related evacuation and curettage has increased, thereby, resulting in an increase in incidence of placenta praevia. [23]

2.2.5. Prior placenta praevia: Mothers with placenta praevia have a tenfold risk of recurrence in a subsequent pregnancy. This is associated to defective decidua vascularization. [21]

2.2.6. IVF/ICSI: Several researchers suggested that mechanical placement of embryos causes the release of prostaglandin, which may lead to uterine contractility [27]. This could be the possible explanation for the occurrence of implantation in the lower uterine cavity thus resulting in development of placenta praevia.

2.2.7. Smoking

Smoking triples the risk of placenta praevia, it is theorized that carbon monoxide hypoxemia caused compensatory placental hypertrophy that related to defective decidual vascularization.[28] Another meta-analysis study in 2016 also suggests that smoking is a key risk factor for placenta praevia.[29]

2.2.8. Birth spacing: Is associated with a risk of PP. Rasmussen and co-workers in a recent study found an increased risk of placenta praevia associated with prolonged interpregnancy interval (4 years or more). The authors speculated that the reason for this might be a period of involuntary infertility associated with factors responsible for both the infertility and the abnormal placental attachment. There is also emerging risks of uteroplacental bleeding disorder (placental abruption, PP) in long interval possible longer than 5 years. [30] Another study carried out in Norwegian women also indicates that birth spacing of more than 4 years is associated with PP. [21]

2.2.9. Endometriosis: It has been observed to alter the characteristic of endometrium. It affects the expression of various factors and markers of receptivity during the implantation window. [31] Following ovulation, progesterone plays an important role in mediating the changes in the endometrium during the secretory phase. There has been emerging evidence that suggests endometriosis results in progesterone resistance hence affecting the placentation. [32] A retrospective cohort study conducted in Malaysia shows that women with prior history of endometriosis are more likely to develop placenta praevia (P=0.002). [33]

2.2.10. Previous history of abortion

The role of previous abortions, either spontaneous or induced, proved to be important for placenta praevia development in our population of pregnant women. The percentage of previous abortions was significantly higher among women with placenta praevia, which increases the risk by 2.75.[23] The risk increased with increasing number of previous abortions (1 or more). The mechanism how previous abortions predispose to placenta praevia development could be explained with possible endometrial damage during repeated abortions, which impedes successful fundal implantation of placenta.[23]

2.3 Clinical findings

Placenta praevia is classically characterized by painless vaginal bleeding in the late 2nd or 3rd trimester. However, uterine pain and/or contraction do not exclude the diagnosis in women with vaginal bleeding. The first hemorrhage usually is not severe (the warning hemorrhage), although this is not invariable and sometimes it may be so profuse. [34]

Fortunately, the initial bleeding is rarely so profuse as to prove fatal. Usually it ceases spontaneously, only to recur in some women; particularly those with a placenta implanted

near but not over the cervical os, also can be provoked by digital examination or intercourse. (35)

Hemorrhage from the placental implantation site in the lower uterine segment may continue after delivery of the placenta, because the lower uterine segment contracts poorly compared with the uterine body. PP may be associated with placenta accreta or one of its more advanced forms, placenta inccreta or perccreta, such abnormally firm attachment of the placenta might be anticipated because of poorly developed decidua in the lower uterine segment. (36)

2.4 Diagnosis of placenta praevia

Diagnosis is determined by ultrasonic imaging techniques. Trans abdominal ultrasound scan (TAS) is the conventional but recently transvaginal ultrasound scan (TVS) and Trans labial scan (TLS) are found to be more accurate and reliable. (37)

TVS compared to TAS is more reliable, does not need full bladder and is of special advantage with posterior situated placenta. In the situation of TAS, the ultrasound waves may be rejected back by the culvarum and may be difficult to delineate the lower edge of the placenta. TVS makes visualization of posterior low-lying placenta easy and the relation of the placental edge to internal os can be determined accurately. Additional benefit is reduced scanning time in TVS. (37)

2.5 Management of placenta praevia

Once the diagnosis of placenta praevia is established, management decisions depend on the gestational age of the fetus and the extent of the vaginal bleeding. With a preterm pregnancy, the goal is to attempt to obtain fetal maturation without compromising the mother's health. (18)

- ✓ If bleeding is excessive, delivery must be accomplished by cesarean section regardless of gestational age. When the bleeding episode is not profuse or repetitive, the patient is managed expectantly in the hospital on bed rest. With expectant management, 70% of patients will have recurrent vaginal bleeding prior to completion of 36 weeks' gestation and will require delivery.(18)
- ✓ If the patient reaches 36 weeks, fetal lung maturity should be determined by amniocentesis and the patient deliver by cesarean section if the fetal lungs are mature. Elective delivery is preferable, as spontaneous labor places the mother at greater risk for hemorrhage and the fetus at risk for hypovolemia and anemia.(18)

2.6. Maternal complications

2.6.1.Hemorrhage; massive hemorrhage either antepartum, intrapartum or postpartum associated with PP is a genuine risk and may lead to maternal death. Although complete praevia cases tend to be associated with earlier and more severe bleeding, lesser degree of PP may cause life-threatening hemorrhage thus the degree of placenta is only a factor in the prognosis and management.

Retrospective Study conducted in Abha General Hospital, a central referral teaching hospital in the southern region of Saudi Arabia women with major PP showed a significantly higher incidence of antepartum hemorrhage (OR 3.18; 95% CI 1.58–6.4, $P = 0.001$).[(2)]

In systematic review and meta-analysis to assess the prevalence of APH in pregnant women with placenta praevia that was conducted in 2016, the pooled overall prevalence of APH among pregnant women with placenta praevia was 51.6% (95% CI 42.7–60.6) in a heterogeneous set of studies ($I^2 = 97.9$). [(38)]

From systematic review and meta-analysis of observational studies, estimating PPH in women with placenta praevia was conducted through literature searches in four databases in July 2016, among 1148 obtained studies, 11 included in the meta-analysis, which involved 5146 unique pregnant women with placenta praevia. The overall pooled incidence of PPH is 22.3% (95% CI 15.8±28.7percentage). In the subgroup, the prevalence is 27.4% in placenta previas, and was 14.5% in low-lying placenta praevia; the highest prevalence is estimated in Northern America (26.3%, 95%CI 11.0±41.6%), followed by the Asia (20.7%, 95%CI 12.8±28.6%), Australia (19.2%, 95% CI 17.2±21.1%) and Europe (17.8%, 95% CI, 11.5%-24.0%).[(39)]

2.6.2. Placenta praevia accreta

Placenta praevia accreta should be suspected in all women with PP. Nine to ten percent of cases of PP are associated with PPA. In the majority of cases, PPA remains asymptomatic until delivery. Although bleeding prior to labour is common, it is more likely associated to PP than accreta. A definitive diagnosis of accreta is not possible prior to delivery. However, it may be possible to detect accreta with TVS. In retrospective study that was conducted in the Gynecology and Obstetrics Clinic of Sütcü Imam University Hospital, the complete placenta

praevia was determined to increase the risk of the development of accreta (OR=8.8, 95% CI=4.2-13.4, p=0.001). [40]

Placenta praevia accreta may present as severe intraoperative bleeding due to difficulty in its removal and may necessitate caesarean hysterectomy as a lifesaving procedure. In a retrospective study of 64,359 births, placenta accreta prevalence was reported as 1/533. Of the PA cases in that study, 50% had a history of CS and 31.5% had placenta praevia. [41]

2.6.3. Hysterectomy

Selo *et al* reviewed all emergency peripartum hysterectomies performed at a tertiary hospital in London, UK, and identify the risk factors for emergency peripartum hysterectomy found an incidence of 0.48 per1000. Women who had emergency peripartum hysterectomy were significantly older and multiparous. More of the cases had a history of uterine surgery, placenta praevia, and were delivered by C/S. Hemorrhage due to PP was the main indication for emergency peripartum hysterectomy (47%). [42]

The indication for emergency peripartum hysterectomy in recent years has changed from traditional uterine atony to abnormal placentation. Patients with placenta praevia and scarred uterus had 16% risk of undergoing emergency peripartum hysterectomy compared to 3.6% in-patient with unscarred uterus. [43]

2.6.4. Blood transfusion

The amount of blood transfused was significantly more in women with major PP. This denotes that the increased blood transfusion is due to the increased bleeding caused by placenta accreta and hysterectomy and not due to major PP per se. According to retrospective review, covering a 10-year period from January 1, 1996, to December 31, 2005, of women admitted to the obstetric unit of Abha General Hospital, a central referral teaching hospital in the southern region of Saudi Arabia, total blood transfusion >3 units in major PP was 47 (27.2%), minor PP 14 (10.5%) [3.17 (1.66–6.06) P=0.001]. [2]

In another prospective observational study that carried out at Sri Ramachandra Medical Hospital, Porur,Chennai, between July 1st 2012 to July 31st 2014, among 163 praevia cases, 39.65% (n=69) patients received blood transfusions.[9]

2.7. Neonatal complications

According to Danish national cohort study that conducted on neonatal outcomes in singleton pregnancies with placenta praevia from 2001 to 2006, neonates born after pregnancies with placenta praevia had a higher risk of being born at a gestational age below 37 weeks (OR 8.6; 95%CI 7.5–9.9), Apgar score of ≤7 at five minutes (OR 2.7; 95% CI 2.0–3.7), transfer to a neonatal intensive care unit (OR 4.3; 95% CI 3.8–4.9), stillbirth and neonatal mortality (OR 1.8; 95%CI 1.1–3.0.[44]

Pregnancies complicated with placenta praevia had significantly higher rates of perinatal mortality (OR 2.6, 95% CI 1.1–5.6), Apgar scores at 5 min lower than 7 (OR 4.4, 95% CI 2.3–8.3), delayed infant discharge from the hospital (OR 10.9, 95% CI 7.3–16.1) as compared to pregnancies without placenta praevia [8]and IUGR.[48]

Neonates born in early gestational age (preterm) due to placenta praevia was at risk of respiratory distress syndrome. Study conducted by Crane JM, et al states that neonates born to placenta praevia women were five-fold increased risk of respiratory distress syndrome. [47]
All computerized records of singleton deliveries with placenta praevia at the Soroka University Medical Center between 1990 and 1998 were compared with singleton deliveries without placenta praevia. It indicates that, the rate of preterm birth in patients with placenta praevia in the primary cesarean section pregnancy was 55.9% and these patients had a higher rate of recurrent preterm delivery than the rest of study population ($p < .001$). [47]

Among patients with placenta praevia in the primary cesarean section pregnancy, those who delivered preterm had a higher rate of recurrent spontaneous preterm birth regardless of the location of their placenta in the subsequent delivery [OR 3.09 (95% CI 2.1-4.6)]. In comparison to all patients with who had a primary cesarean section, patients who had placenta praevia and delivered preterm had an independent increased risk for recurrent preterm birth [OR of 3.6 (95% CI 1.5-8.5)]. [8]
Retrospective study conducted in the Department of Obstetrics and Gynecology of Tribhuvan University Teaching Hospital, Nepal from 1st January 2008 to 31st December 2011 shows that out of 82 cases of cesarean sections done for placenta praevia, 45.7% of the babies were preterm and 27% were low birth weight babies. Seven babies had neonatal death. [6]

2.8. Conceptual framework for the study

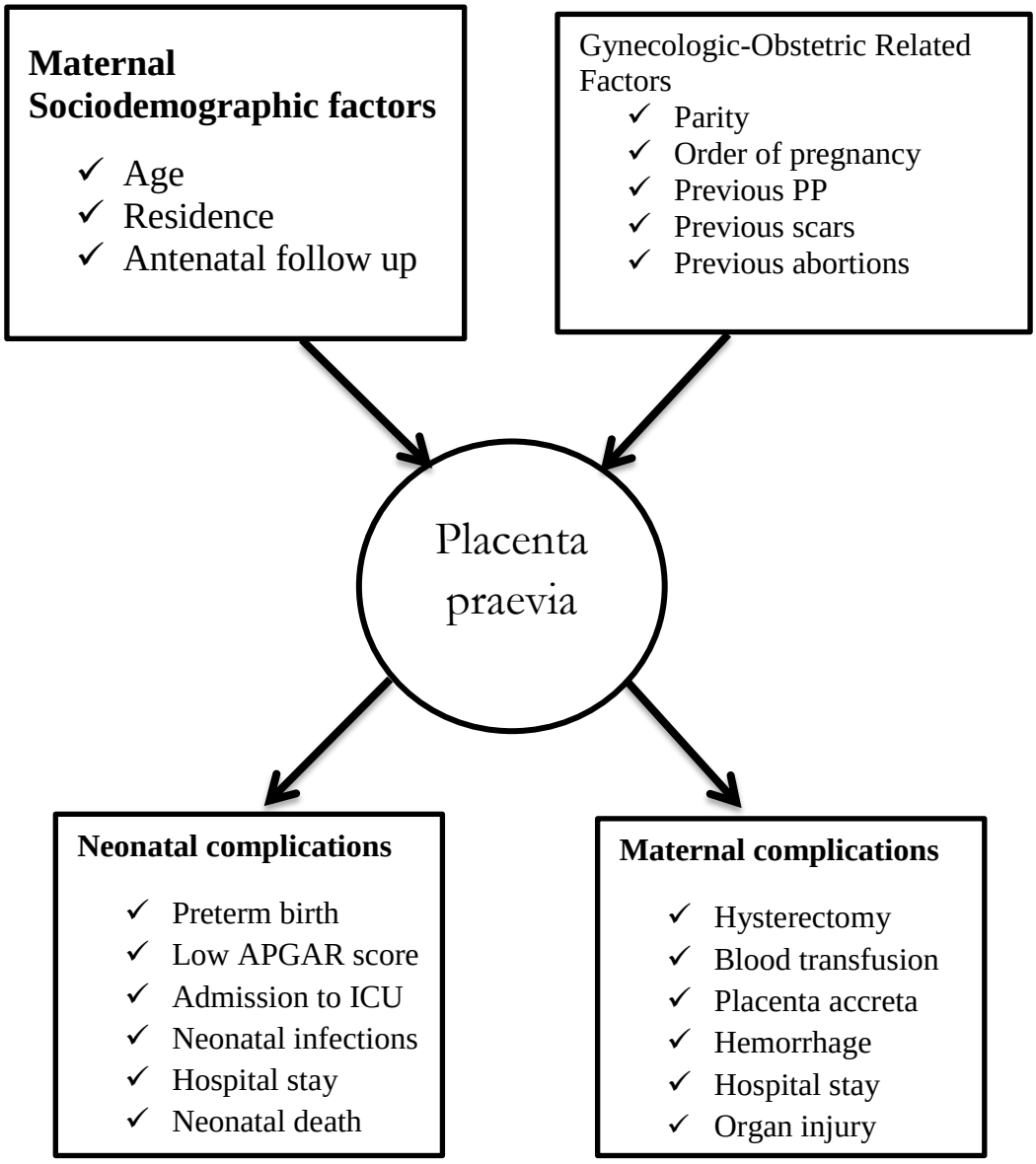

Fig 1**.** Relationships between risk factors for placenta praevia and feto-maternal complications.
Source:-Developed from different published articles. [2, 6, 8, 10, 14, 17, 45]

3. OBJECTIVES OF THE STUDY

3.1. General Objective

- ✓ To assess the magnitude and identify the risk factors, maternal and neonatal complications associated with placenta praevia in Tikur Anbessa Specialized and Gandhi Memorial Hospitals.

3.2. Specific Objectives

- ✓ To assess the magnitude of placenta praevia in Tikur Anbessa Specialized and Gandhi Memorial Hospitals.
- ✓ To identify the risk factors associated with placenta praevia.
- ✓ To evaluate maternal and fetal complications of major placenta praevia.

4. METHODOLOGY

4.1 Study area and period

The study was conducted in Addis Ababa; capital city of Ethiopia. Tikur Anbessa Referral Specialized Hospital and Gandhi Memorial Hospital were selected for this study purposely based on patient load. The study was conducted from March 1 to July 30, 2018.

4.2. Study design

Hospital based retrospective case control study.

4.3. Source and study population

Source population was women medical records in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals from September 2015 to January 2018. Whereas, study population was all delivery medical records with singleton pregnancies complicated with placenta praevia at Tikur Anbessa Specialized Referral and Gandhi Memorial Hospital from September 2015 to January 2018.

4.4. Sample size and Sampling Procedure. All singleton deliveries with placenta praevia that took place at Tikur Anbessa Specialized Referral and Gandhi Memorial Hospital from September 2015 to January 2018 were selected for the study. First cases were identified from HMIS(Health management information system) and their Medical registration number was used to deeply investigate their information. Only Complete registry records was considered.

- TASH = 17,147 ⟺ Total of 44,342 deliveries
- GMH = 27,195

From these all ,303 placenta praevia cases were considered for analysis.

Regarding control selection;

Controls were selected after proportional allocation to each year total number of deliveries in both hospitals. Systematic random sampling using medical registration number and finally 303 controls were regarded for study.

Table 1.Proportional allocation of controls in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018

Year	GMH(No of deliveries)	TASH(No of deliveries)	Remark
2015	8833=60.4	4799=33	
2016	4297=29.4	3977=27	
2017	7365=50.3	5417=37	
2018 (September to January)	6700=45.8	2954=20	
Total	27,192(186 controls)	17,147(117 controls)	

4.5. Inclusion and Exclusion Criteria

4.5.1. Inclusion criteria

For case

- ✓ All singleton pregnancies with antenatal ultrasound diagnosis of placenta praevia or discovered to have placenta praevia intraoperatively.

For control

- ✓ All singleton pregnancies with no diagnosis of placenta praevia

4.5.1. Exclusion Criteria for both case and control

- ✓ Women with missing medical notes.
- ✓ Women with multiple gestation pregnancies excluded to avoid overrepresentation of studying high-risk women.

4.6. Study variables

Independent variables

- ✓ Sociodemographic factors
- ✓ Obstetric factors
- ✓ Placenta praevia

Dependent variables

- ✓ Feto-Maternal complications

4.7. Operational Definitions

Placenta praevia: An obstetric complication characterized by placental implantation into the lower segment of the uterine wall, covering part of or the entire cervix.

Antepartum hemorrhage: Bleeding into and/or from the vaginal canal at any time from the 24th week of gestation up to the second stage of labor.

Postpartum hemorrhage: Excessive loss of blood after completion of the third stage of labor.

4.8. Data collection tools

Checklist was designed to collect data about study participants. Sociodemographic characteristics (age, residence and educational status), obstetric and gynecological history (parity, previous scar, previous miscarriages, endometriosis, previous D and C), history of current pregnancy (GA at delivery, APH, PPH),mode of delivery (emergency, c/s or elective c/s, vaginal delivery), maternal complications and outcome, and neonatal outcomes (weight, sex, Apgar score, neonatal infection, admission to NICU).

4.9. Data quality management

Data collectors and supervisors were trained on data collection procedures. Time taken for completion of the questionnaire and minor questionnaire contents were restructured and modified when any doubt or difficulty appeared. Supervision was conducted strictly and frequently. Completeness of the required type of data was checked on the spot by the principal investigator and supervisors. Data was checked for completeness and consistency before data entry by the principal investigator; the completed questionnaire was coded. For data cleaning, the Coded data was entered into EPI info version 3.5

4.10. Data analysis and processing

Data was entered into EPI info version 3.5.1 for data exploration and cleaning. The cleaned data was exported to SPSS version 20.0 statistical packages for statistical analysis.

Descriptive statistics was used to summarize categorical variables. Both bivariate and multivariable analysis was performed using logistic regression and adjusted odd ratios (AOR) with 95% confidence intervals for risk factors and feto-maternal complications associated with placenta praevia. P value <0.05 was considered statistically significant.

4.11. Ethical consideration

Ethical clearance for the proposed study was obtained from Addis Ababa University IRB and Addis Ababa health bureau. Data was collected from patient's medical record and confidentiality of the information was maintained throughout by excluding names as identification in the study.

5. RESULTS

5.1. Sociodemographic characteristics of the cases and controls.

The number of deliveries that took place from September 2015 to January 2018 in both Gandhi Memorial and Tikur Anbessa hospitals was 27,195 and 17147 respectively making the 44,342 deliveries. Placenta praevia complicated cases account about 303 of all pregnancies and hence, the magnitude was 0.7%. The mean age for case and control was 30.2 ±5.769 and 30.24±5.7 years respectively. The mean length of hospital stay for cases was 14.27±9.862 days which is significantly higher than controls (3.69days±2.25). Most of the women were at age of 25-29 years, residing in urban areas, and having their ANC visit during pregnancy.

Table 2. Sociodemographic characteristics of the cases and controls in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018

Study characteristics		**Case**	**Control**	**Total**
		N=303	N=303	N=606
Age	20-24	41(33.3%)	101(13.5%)	142(23.4%)
	25-29	105(37.6%)	114(34.7%)	219(36.1%)
	30-35	85(23.4%)	71(28.1%)	156(25.7%)
	>35	72(5.6%)	17(23.8%)	89(14.7%)
Residence	Addis Ababa	275(93.7%)	284(90.8%)	559(92.2%)
	Oromia	26(5.9%)	18(8.6%)	44(7.3%)
	Amhara	2(0.3%)	1(0.7%)	3(0.5%)
Antenatal follow up	Yes	291(96.0%)	263(86.8%)	554(91.4%)
	No	12(4%)	40(13.2%)	52(8.6%)

5.2. Types of placenta praevia

Placenta praevia is one of the causes of antepartum hemorrhage. However, the severity of maternal and neonatal complications depends on the type of placenta praevia. Placenta praevia totalis was the commonly occurred types of placenta praevia 227(74.9%) followed by placenta praevia marginalis 38 (12.5%) and placenta praevia partialis 23(7.6%). Whereas, low lying placenta praevia was the least occurred type.

Table 3.Types of placenta praevia in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018. (N=303)

Types of placenta praevia	Hospital		Total
	TASH	GMH	
Placenta praevia totalis	88(80.7%)	139(71.6%)	227(74.9%)
Placenta praevia partialis	6(5.5%)	17(8.8%)	23(7.6%)
Placenta praevia marginalis	11(10.1%)	27(13.9%)	38(12.5%)
Low lying	4(3.7%)	11(5.7%)	15(5%)
Total	109(100%)	194(100%)	303(100%)

5.3. Antenatal characteristics of cases and controls

With regard to parity, 158(52.1%) of cases of placenta praevia were multiparous who gave birth to two or more neonates followed by primiparous 75 (24.8%). Almost half of the cases 151(49.9%) were tend to deliver preterm where, 89(29.4%) was early preterm and 62(20.5%) late preterm. Percentage of cases that delivered at term was 152(50.2%).

Caesarean section was the commonest mode of delivery 285 (94.1%) among placenta praevia cases and 75.5% of them had underwent regional anesthesia (spinal anesthesia) followed by general anesthesia 56(18.5%).

Table 4. Antenatal characteristics of case and controls in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018

Antenatal characteristics		Case(n=303)	control(n=303)	Total(n=606)
Parity	Nulliparous	70(23.1%)	99(32.7%)	169(27.9%)
	Primiparous	75(24.8%)	124(40.9%)	199(32.8%)
	Multiparous	158(52.1%)	80(26.4%)	238(39.3%)
Gestational age at delivery	28-33 weeks	89(29.4%)	0(0.0%)	89(14.7%)
	34-36 weeks	62(20.5%)	25(8.3%)	87(14.4%)
	≥37 weeks	152(50.2%)	278(91.7)	430(71%)
Mode of delivery	C/S	285(94.1%)	79(26.1%)	364(60.1%)
	SVD	18(5.9%)	197(65%)	215(35.5%)
	Instrumental	0(0%)	27(8.9%)	27(4.5%)
Types of Anesthesia	General	56(18.5%)	8(2.6%)	64(10.6%)
	Spinal	229(75.5%)	71(23.4%)	314(51.8%)
	No Anesthesia	18(5.9%)	224(73.9%)	228(37.6%)

5.4. Previous History of cases and controls

About 26.1% of placenta praevia cases had past history of caesarean section, which is higher when compared to controls (8.9%).Ninety four(31%) had past history of abortion,12(4%) had previous molar pregnancy which was significantly higher than controls. Previous history of placenta praevia was 22(7.3%) and women who had previous intrauterine fetal death were 9 (3%).

Table 5. Previous History of cases and controls in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018

Previous history		**Case(n=303)**	**Control(n=303)**	**Total(n=606)**
C/S	Yes	79(26.1%)	27(8.9%)	106(17.5%)
	No	224(73.9%)	276(91.1%)	500(82.5%)
Abortion	Yes	94(31.0%)	56(18.5%)	150(24.8%)
	No	209(69%)	247(81.5%)	456(75.2%)
Molar pregnancy	Yes	12(4%)	5(1.7%)	17(2.8%)
	No	291(96%)	298(98.3%)	589(97.2%)
Placenta praevia	Yes	22(7.3%)	0(0%)	22(3.6%)
	No	281(92.7%)	303(100%)	584(96.4%)
IUFD	Yes	9(3%)	5(1.7%)	14(2.3%)
	No	294(97%)	298(98.3%)	592(97.7%)

5.5. Maternal complications of cases and controls

Women with placenta praevia who had developed post-partum hemorrhage and adherent placenta after delivery were 68(22.4%), 20(6.6%) respectively. Insignificant number of cases had premature rupture of membranes 16(5.3%), surgical site infection 5(1.7%), Hysterectomy 12 (4%), and urinary tract infections 3(0.5%).

Moderate anemia 91 (30%) was commonest among the women with placenta praevia and 29% of the cases had blood transfusion due to large amount of blood loses.

Table 6. Maternal complication of cases and controls in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018.

Maternal complications		**Case(n=303)**	**Control(n=303)**	**Total(n=606)**
PPH	Yes	68(22.4%)	7(2.3%)	75(12.4%)
	No	235(77.6%)	296(97.7%)	531(87.6%)
Adherent placenta	Yes	20(6.6%)	0(0%)	20(3.3%)
	No	283(93.4%)	303(100%)	586(96.7%)
Surgical site infection	Yes	5(1.7%)	5(1.7%)	10(1.7%)
	No	298(98.3%)	298(98.3%)	596(98.3%)
PROM	Yes	16(5.3%)	16(5.3%)	32(5.3%)
	No	287(94.7%)	287(94.7%)	574(94.7%)
Hysterectomy	Yes	12(4%)	0(0%)	12(2%)
	No	291(96%)	303(100%)	594(98%)
UTI	Yes	3(0.5%)	0(0%)	3(1%)
	No	300(50%)	303(50)%	603(100%)
Anemia	Severe Anemia	3(1%)	0(0%)	3(0.5%)
	Moderate Anemia	91(30%)	7(2.3%)	98(16.2%)
	No Anemia	209(69%)	296(97.7%)	505(83.3%)
Blood transfusion	1-3 units	104(34.3%)	14(4.6%)	118(19.5%)
	≥4	18(5.9%)	0(0%)	18(3%)
	No transfusion	181(59.7%)	289(95.4%)	470(77.6%)
Hospital stay	<14 days	188(62%)	303(100%)	491(81%)
	≥14 days	115(38%)	0(0%)	115(19%)

5.6. Co-occurrence of other medical/obstetrics conditions

Medical /obstetrics conditions that occurred along with placenta praevia case were RH incompatibility 11(3.6%), pregnancy induced hypertension 23(7.6%), Oligohydraminos 4(1.3%), and retroviral illness on highly active antiretroviral therapy 8(2.6%).

Table 7. Co-occurring medical/obstetrics conditions of cases and controls in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018

Co-occurring medical condition		Case(n=303)	Control(n=303)	Total (n=606)
RH(unsensitized)	Yes	11(3.6%)	16(5.3%)	27(4.5%)
	No	292(96.4%)	287(94.7%)	579(95.5%)
PIH	Yes	23(7.6%)	17(5.6%)	40(6.6%)
	No	280(92.4%)	286(94.4%)	566(93.4%)
Oligohydraminos	Yes	4(1.3%)	20(6.6%)	24(4%)
	No	299(98.7%)	283(93.4%)	582(96%)
RVI on HAART	Yes	8(2.6%)	5(1.7%)	13(2.1%)
	No	295(97.4%)	298(98.3%)	593(97.9%

5.7. Neonatal outcome and complications of cases and controls

Majority of neonates born to placenta praevia case were male198 (65.3%). Only six (2%) of neonates passed away due to the disease condition. Immediately after delivery neonates assessed of their Apgar score after 1 min and 5 min and found to be 71(23.4%) <7 and 6(2%) <7 respectively where significant numbers were at risk of asphyxia that necessitated resuscitation which was higher than women in control groups.

Birth weight was also evaluated where 166(54.8%) was ≥2500g, 132(43.6%) was 1500-2499g and5(1.7)<1500g. Regarding to neonatal complications; Respiratory distress syndrome 45(14.9%), Intrauterine growth retardation 40(13.2%), Hypothermia 23(7.6%), Major congenital anomaly (spina bifida) 6(2%), Neonatal hyperbilirubinemia (jaundice) 4(1.3%) and admission to neonatal intensive care unit 75(25.7%) for further treatment were the commonest complications. These findings were higher than in women of control groups (table 8).

Table 8. Neonatal outcome and complications of cases and controls in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018

Neonatal outcome and complications		Case(n=303)	Control(n=303)	Total (n=606)
Sex	Male	198(65.3%)	190(62.7%)	388(64%)
	Female	105(34.7%)	113(37.3%)	218(36%)
Birth Outcome	Alive	297(98%)	302(99.7%)	599(98.8%)
	Dead	6(2%)	1(0.3%)	7(1.2%)
APGAR score at 1 min	<7	71(23.4%)	22(7.3%)	93(15.3%)
	7-10	232(76.6%)	281(92.7%)	513(84.7%)
APGAR score at 5 min	<7	6(2%)	0(0%)	6(1%)
	7-10	297(98%)	303(100%)	600(99%)
Birth weight	<1000	2(0.7%)	4(1.3%)	6(1%)
	1000-1499	3(1%)	10(3.3%)	13(2.1%)
	1500-2499	132(43.6%)	57(18.8%)	189(31.2%)
	≥2500	166(54.8%)	232(76.6%)	398(65.7%)
Respiratory distress syndrome	Yes	45(14.9%)	4(1.3%)	49(8.1%)
	No	258(85.1%)	299(98.7%)	557(91.9%)
Spina bifida	Yes	6(2%)	3(1%)	9(1.5%)
	No	297(98%)	300(99%)	597(98.5%)
IUGR	Yes	40(13.2%)	3(1%)	43(7.1%)
	No	263(86.8%)	300(99%)	563(92.9%)
Neonatal jaundice	Yes	4(1.3%)	3(1%)	7(1.2%)
	No	299(98.7%)	300(99%)	599(98.8%)
Hypothermia	Yes	23(7.6%)	2(0.7%)	25(4.1%)
	No	280(92.4%)	301(99.3%)	581(95.9%)
Admission to NICU	Yes	78(25.7%)	12(4%)	90(14.9%)
	No	225(74.3%)	291(96%)	516(85.1%)

5.8. Risk factors associated with placenta praevia

Significant risk factors associated with placenta praevia after adjusting for potential confounder in multivariate logistic regression were high maternal age, multiparity, and women with history of caesarean section as shown in the table 8.Women with advanced maternal age (≥35) [AOR 6.3; 95%CI: 3.20, 12.51] were six fold high risk to develop placenta praevia. Multiparity [AOR 2.2; 95%CI: 1.46, 3.46] and previous history of caesarean section [AOR 2.7; 95%CI: 1.64, 4.58] had an increased odds of placenta praevia. However, after adjusting for confounder, previous history of abortion, IUFD, molar pregnancy had no significant association with placenta praevia.

Table 9. Binary and multivariate logistic regression of risk factors associated with placenta praevia in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018

Risk factors		Case N(303)	Control N(303)	COR(95%CI)	AOR(95%CI)
Maternal age	20-24	41	101	1.0	1.0
	25-34	190	185	2.5(1.67,3.38)**	2(1.26,3.04)*
	≥35	72	17	10.4(5.45,19.80)**	6.3(3.20,12.51)**
Parity	Nulliparous	70	99	1.2(.77,1.78)	1.5(.98,2.40)
	Primiparous	75	124	1.0	1.0
	Multiparous	158	80	3.2(2.20,4.84)**	2.2(1.46,3.46)**
Previous history of C/S	Yes	79	27	3.6(2.25,5.77)**	2.7(1.64,4.58)**
	No	224	276	1.0	1.0
Previous history of Abortion	Yes	94	56	2(1.36,2.90)*	1.5(.98,2.25)
	No	209	247	1.0	1.0
Prev molar pregnancy	Yes	12	5	2.5(.85,7.06)*	2.8(.92,8.49)
	No	291	298	1.0	1.0
Prev IUFD	Yes	9	5	1.8(.604,5.51)*	1.2(.35,4.02)
	No	294	298	1.0	1.0

COR: crude odds ratio. AOR: adjusted odds ratio.CI: Confidence Interval.*Statistically significant variables at p <0.05.**Statistically significant variables at p <0.001.Hosmer-Lemeshow goodness-of-fit =0.63

5.9. Maternal complications associated with placenta praevia

Table 10 depicts maternal complications associated with placenta praevia. After adjusting for confounders with backward elimination model; postpartum hemoglobin<12g/dl and the need for blood transfusion 1-3 units were significantly associated with placenta praevia. Women with placenta praevia had fourteen times more likely to develop anemia [AOR 14.6; 95%CI: 6.48, 32.87] after delivery due to huge blood loss that necessitated blood transfusion 1-3 units [AOR 2.7; 95%CI: 1.10, 6.53] when compared to their counterparts. However, postpartum hemorrhage was not significantly associated after adjusting for confounder.

Table 10. Binary and multivariate logistic regression for maternal complications associated with placenta praevia in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018

Maternal complications		**Case N(303)**	**Control N(303)**	**COR(95%CI)**	**AOR(95%CI)**
Postpartum hemoglobin<12g/dl	Yes	94	7	19(8.65,41.82)**	14.6(6.48,32.87)**
	No	209	296	1.0	1.0
Blood transfusion 1-3 units	Yes	104	14	12(6.58,21.34)**	2.7(1.10,6.53)*
	No	181	289	1.0	1.0
PPH	Yes	68	7	12(5.52,27.14)**	2.2(.71,6.57)
	No	235	296	1.0	1.0

COR: crude odds ratio. AOR: adjusted odds ratio.CI: Confidence Interval.*statistically significant variables at p <0.05. **Statistically significant variables at p <0.001.Hosmer-Lemeshow goodness-of-fit =0.75.

5.10. Neonatal complications associated with placenta praevia

Table 11, depicts neonatal complications associated with placenta praevia. After adjusting for confounders with backward elimination model; Respiratory distress syndrome, intrauterine growth retardation (IUGR) and preterm birth were significantly associated with placenta praevia.

Neonates born to women with placenta praevia were four fold-increased risk of respiratory syndrome [AOR 4; 95%CI: 1.24, 13.85], six fold increased risk of IUGR [AOR 6.3; 95%CI: 1.79, 22.38] and eight fold risk of preterm birth [AOR 8; 95%CI: 4.91, 12.90].

Low birth weight, Apgar at l min <7, hypothermia and admission to NICU were not significantly associated with placenta praevia.

Table 11. Binary and multivariate logistic regression for neonatal complications associated with placenta praevia in Tikur Anbessa Specialized Referral and Gandhi Memorial Hospitals, 2018

Neonatal complications		Case N(303)	Control N(303)	COR(95%CI)	AOR(95%CI)
Low birth weight	Yes	166	232	.37(.26,.53)	1.2(.77,1.96)
	No	137	71	1.0	1.0
APGAR score at 1 min <7	Yes	20	4	4(2.35,6.50)**	1.2(.61,2.45)
	No	283	299	1.0	1.0
Respiratory distress syndrome	Yes	45	4	13(4.63,36.74)**	4(1.24,13.85)*
	No	258	299	1.0	1.0
Hypothermia	Yes	23	2	12.4(2.89,52.92)*	4.451(.843,23.50)
	No	280	301	1.0	1.0
IUGR	Yes	40	3	15.2(4.65,49.74)**	6.3(1.79,22.38)*
	No	263	300	1.0	1.0
Admission to NICU	Yes	78	12	8.4(4.47,15.82)**	.52(.14,1.96)
	No	225	291	1.0	1.0
Preterm birth	Yes	151	25	11(6.92,17.62)**	8(4.91,12.90)**
	No	152	278	1.0	1.0

COR: crude odds ratio. AOR: adjusted odds ratio.CI: Confidence Interval.*statistically significant variables at p <0.05. **Statistically significant variables at p <0.001.Hosmer-Lemeshow goodness-of-fit =0.324.

6. DISCUSSION

This study investigated the association between different risk factors and adverse maternal and neonatal outcomes with placenta praevia. Six neonatal death were recorded in this study. The magnitude of placenta praevia observed in this study was 7 in 1000 pregnancies. This was similar to study conducted in Siriraj Hospital in Thailand (0.7%).[46] However, the magnitude was higher than study conducted at Soroka University Medical Center, Israel which was 0.38%.[8] This might be due to increased risk factors of placenta praevia in developing countries.

Increased maternal age upsurges the risk of placenta praevia. This study found that advanced maternal age ≥35 connoted six-fold increase in risk of placenta praevia. This finding was similar to the retrospective case control study conducted by Lea Tuzovic. It states that advanced maternal age six fold increases the risk of placenta praevia.[23] According to study conducted by Choi et al, prevalence of placenta praevia increases as the maternal age advances.[19] This thought to be due to atherosclerotic changes in the uterus resulting in under-perfusion and infraction of the placenta, thereby increasing the size of the placenta.

Multiparity was two-fold increase the risk of placenta praevia. This result was in congruent with studies from Kollmann and Tuzovic et al that reported women with parity of two or more, showed an increased risk of placenta praevia.[23,24] They show a greater risk of placenta praevia with higher parity. This may be due to endometrial scarring at the site of prior placental attachments resulting in lower placental implantation and, other possibility may be due to atherosclerotic changes of blood vessels, which leads to decreased uteroplacental blood flow, this in turn leads to large placenta encroaching on the cervical os with repeated pregnancies.

According to this study, patients who had previous delivery by caesarean section were about three times increased risk of placenta praevia. Most studies have reported an association between previous caesarean section and placenta praevia. Similarly, In a Meta-analysis of 170,640 pregnant women, a pattern of risk factors for placenta praevia found with increasing number of caesarean section deliveries.[8]

Another Cohort study in United Kingdom NHS hospital also shows among 131,731women who had elective CS, 4,332 women had placenta praevia at term making 32.9 per 1000 elective CS.[13]

This is because of surgical disruption of the uterine cavity is known to cause lasting damage to the myometrium and endometrium. If a previous cesarean section is performed, there is a problem of angiogenesis in the previous operation site that may cause partial hypoxia. This hypoxia leads to incomplete decidualization and abnormal trophoblast invasion that can cause placental adhesion.[25]

This study found that although, significant number of women had previous history of abortion, the known risk factor for placenta praevia, was not significantly associated after adjusted for confounders in multivariate regression. It might be due to the study design and sample size. This was in contrast with study conducted in Croatia that the percentage of previous abortions was significantly higher among women with placenta praevia, which yielded a risk of 2.75. The mechanism how previous abortions predispose to placenta praevia development could be explained with possible endometrial damage during repeated abortions, which impedes successful fundal implantation of placenta.[23]

Massive hemorrhage either antepartum, intrapartum or postpartum associated with placenta praevia may lead to decline in maternal hemoglobin level. According to this study, women with placenta praevia were fourteen times more likely to have decreased postpartum hemoglobin level less than 12 g/dl that led them to postpartum anemia. This result was comparable with previous study done by Sheiner and his colleagues where women with placenta praevia were about six times more likely to postpartum anemia.[8]

The amount of blood transfused was significantly more in women with major placenta praevia. This denotes that the increased blood transfusion is due to the increased bleeding caused by placenta praevia. According to this study, women with placenta praevia were about three-fold necessitated blood transfusion. The finding was similar to retrospective study conducted at obstetric unit of Abha General Hospital, Saudi Arabia, the odds of blood transfusion >3 units in major placenta praevia was three fold higher than their counterparts.[2]

Large number of patients (N=166) had postpartum hemorrhage associated with placenta praevia. However, there was no significance association between postpartum hemorrhage and placenta praevia after adjusted for confounders in multiple logistic regressions. In contrast to this finding, previous studies showed that placenta praevia increases the risk of postpartum hemorrhage. This is explained by the implantation of placenta in a previous scar, which may go deep preventing placental separation. This may provoke severe hemorrhage during and

after delivery because the lower segment does not constrict well the maternal blood supply.[13-16]

Placenta praevia is linked to a number of adverse neonatal outcomes including preterm delivery. In this study, neonates born to women with placenta praevia were eight times more likely to born preterm. This result was comparable to Danish national cohort study on neonatal outcome in singleton pregnancies with placenta praevia from 2001 to 2006; neonates born after pregnancies with placenta praevia had about nine-fold risk of being born at a gestational age below 37 weeks.[44]

Neonates born in early gestational age (preterm) due to placenta praevia was at risk of respiratory distress syndrome. This study found that neonates were eight times more likely to develop respiratory distress syndrome. This finding was consistent with the study conducted by Crane JM,et al., that neonates born to placenta praevia women were five-fold increased risk of developing respiratory distress syndrome.[47] We speculate that placenta praevia was not directly contributing to respiratory distress syndrome, but through other associated risk factors for respiratory distress syndrome.

According to this finding, placenta praevia connoted six-fold risk of developing intrauterine growth restriction in neonates. Similarly, study conducted in Leady reading hospital, Pakistan showed neonates born to placenta praevia mothers were developed intrauterine growth restriction.[48]

One hundred sixty six cases of neonates born to placenta praevia mothers were low birth weight. However, no significant association between placenta praevia and low birth weight of neonate after adjusting for confounders. In contrast, several previous studies found association between them. These discrepancies might be due to difference in study design and sample size.[12, 39]

7. STRENGTH OF THE STUDY

- The study included all placenta praevia cases in the given study time frame and place and thus, minimize selection bias.
- Controls were selected to minimize for possible confounders that affect the results.

8. LIMITATION OF THE STUDY

- Since, the study was retrospective it was difficult to get full information about the patients.
- It was a hospital-based study so, its results may not be applicable on the whole population of Ethiopian pregnant women.

9. CONCLUSION

This study showed that the magnitude of placenta praevia was 7 in 1000 pregnancies. Advanced maternal age, multiparity and previous histories of caesarean section were significantly associated risk factors of placenta praevia. Adverse maternal outcomes associated with placenta praevia were postpartum anemia and the need for blood transfusion after significant amount blood loss due to the disease condition and its complications. Neonates born to women with placenta praevia were also at risk of being born preterm, intrauterine growth restriction and respiratory distress syndrome.

10. RECOMMENDATION

The following recommendations were derived in view of the results of this study:

- Patients with placenta praevia is at high risk of bleeding and compatible blood needs to be available for such cases before considering surgical operation.
- Strategies and protocols should be settled to reduce the rate of caesarean section as its association with subsequent development of placenta praevia was confirmed.
- Further large-scale study should be conducted to figure out nationwide prevalence of placenta praevia and its adverse neonatal and maternal outcomes.
- Family planning should also be emphasized as a strategy towards reduction of parity, caesarean section rate and thereby the incidence of placenta praevia.
- Appropriate and modern documentation of patient's medical information should be kept as it is very important for research purposes.

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12. ANNEXES

12.1 Annex A

Checklists to assess the risk factor of placenta praevia maternal complication and neonatal outcome

Sociodemographic factors

S/N			Remark
1.	Card No	----------	
2.	Age	----------years	
3.	Residence	1. Rural 2. Urban	
4.	Education status	1. Literate 2.Illeterate	
5.	History of smoking	1.Yes 2.No	

Antenatal factors

S/N					Remark
1.	Parity:	**1**. Nulliparous	**2**. 1- 4	**3.** > 4	
2.	Order of pregnancy	1.Single	2.Multiple		
3.	Antenatal follow up:	1. Yes	2. No		
4.	Gestational age at delivery:	_____weeks			
5.	History of APH:	1. Yes	2. No		
6.	History of hypertensive disorder during pregnancy	1.Yes	2.No		
7.	If "Yes" blood loss:	_____ (ml)			
8.	Blood transfusion:	_____ (units)			
9.	Previous diagnosis of placenta praevia:	1. Yes	2.No		
10.	If yes how many times	_____			
11.	Previous C/S:	1. Yes	2. No		
12.	If yes how many times	_____			
13.	Previous miscarriage:	1. Yes	2. No		
14.	Previous D & C:	1. Yes	2. No		
15.	Previous history of endometriosis:	1. Yes	2. No		
16.	Antenatal hemoglobin	_____.mg/dl			

Intrapartum and postpartum factors

S/N					Remark
1.	Mode of delivery:	1. Emergency C/S 2. Elective C/S 3. Spontaneous vaginal delivery 4.others (specify) _____			
2.	History of PPH	1. Yes	2. No		
3.	If "Yes" blood loss	_____(ml)			
4.	Blood transfusion	___(units)			
5.	Type of anesthesia	1. General	2. Spinal	3. Others	
6.	Postpartum Hbg	.___mg/dl			
7.	Postpartum hospital stay)	____ days			
8.	Intra and postoperative complication:	1. Hysterectomy 2. Pelvic organ injury 3. Infection admission to ICU 4. Maternal death 5. Placenta praevia accreta 6. Others (specify)_____			

Neonatal outcomes

S/N					Remark
1.	Birth outcome	1. Alive	2. Stillbirth	3. Death	
2.	Birth-weight	_____(kg)			
3.	Apgar score at	At 1 min___	At 5 min_____		
4.	Sex	1.Male	2. Female		
5.	Neonatal infections	1. Yes (specify)_____ 2. No _____			
6.	Admission to NICU	1.Yes	2. No		
7.	Duration of stay in NICU	_____days			

12.2. Annex B

APGAR score at 1 minute and 5 minute to predict neonatal asphyxia after delivery

S.No	Sign	0	1	2	Remark
1	Heart rate	Absent	<100	>100	
2	Respiratory effort	Absent Slow	Irregular Good	crying	
3	Muscle tone	Flaccid	Some limb flexion	Active movement	
4	Reflex (Response to nasal catheter)	No response	Grimace	Cough/sneeze	
5	Color	Blue or pale	Body pink, limbs blue	Completely pink	

Score

- 7-10 ……. Good
- 4-6……. Moderate asphyxia
- 0-3 ……. Severe asphyxia