Major or minor placenta previa: does it make a difference?

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Abstract

Introduction

Placenta previa is a severe pregnancy complication with considerable maternal and neonatal morbidity. Placenta previa can be defined as major or minor by location. Major placenta previa is associated with higher complication rates. Management of women with minor placenta previa has not been well defined. The primary goal of the study was to evaluate the accuracy of our existing screening protocol for placenta previa. Secondly, we wanted to compare pregnancy and delivery outcomes by the type of placenta previa.

Methods

The study was conducted at the Helsinki University Hospital between June 2010 and September 2014. The study population consisted of all women with the antenatal ultrasound diagnosis of placenta previa during delivery. Data were retrospectively collected and analysed.

Results

Altogether 176 women had placenta previa at delivery (major 129, minor 47). Placenta previa remained undiagnosed at second trimester screening ultrasound in 32 women (18.2%). Twenty (62.5%) of these cases had minor placenta previa and 12 (37.5%) had major placenta previa. Five (15.6%) of the undiagnosed cases developed life-threatening hemorrhage (≥ 2500 ml) during the delivery and two had abnormally invasive placenta followed by hysterectomy. Women with major placenta previa had significantly more blood loss and delivered earlier than women with minor placenta previa. The groups were otherwise similar, including the rate of abnormally invasive placenta.

Discussion

The existing protocol for placenta previa missed almost one fifth of cases. Both major and minor placenta previa are risk factors for abnormally invasive placenta and should be treated as severe conditions.

Keywords: placenta previa; abnormally invasive placenta; postpartum hemorrhage; mid-pregnancy ultrasound screening; major placenta previa; minor placenta previa

Introduction

Placenta previa (PP) occurs in approximately 0.5% of all pregnancies and causes maternal and neonatal morbidity [1-5]. The incidence of PP is increasing due to increasing cesarean section (CS) rates, advanced maternal age, use of artificial reproductive technologies, smoking, and cocaine use during pregnancy [1,3]. PP is also a major risk factor for placenta accreta, which increases the risk of life-threatening hemorrhage, hysterectomy, and surgical complications [1,6-11].

Placenta accreta is a general term for placenta accreta spectrum disorders or for morbidly adherent placenta [8,11]. In this study we decided to use the term abnormally invasive placenta (AIP) introduced by the International Society for AIP [9]. This definition includes both adherent and invasive (increta and percreta) placenta types. Drawing line between these subtypes is not always easy, especially in the clinical situations when the invasiveness of the placenta is not known before the delivery [12].

PP can be defined as major or minor by the location of placental edge [10,13]. In major PP, the placenta overlaps the internal cervical os completely or partially, while minor PP is located <20 mm from the internal cervical os [10,13]. Minor PP is also defined as low-lying or marginal PP [10,11] (Figure 1). Major PP is associated with higher complication rates than minor PP [13-16]. Women with major PP have more antepartum and postpartum hemorrhage, preterm deliveries, AIP, and hysterectomies than women with minor PP [13-16].

The need for follow-up of minor PP is controversial [17-21]. Taipale et al. recommended confirmatory transvaginal ultrasound if PP was suspected by transabdominal ultrasonography in mid-pregnancy and a follow-up scan at 26 to 30 gestational weeks only if the placenta covered cervical os ≥ 15 mm [19]. On the other hand, two more recent studies recommended follow-up also for women with minor PP [20,21].

Our primary goal was to evaluate the performance of our existing screening protocol. Secondly, we wanted to compare pregnancy and delivery outcomes by the type of PP.

Methods

This retrospective cohort study was conducted at the Helsinki University Hospital and included all women who had the diagnosis of PP at the time of delivery between June 2010 and September 2014. The total number of deliveries annually during the study period varied between 4500 and 5500. The participants were identified from the hospital database by using specific ICD-10 diagnosis codes (O44.0 and O44.1). The study was approved by the Ethics Committee of the Helsinki University Hospital (number140/13/03/03/2012).

Finnish law guarantees (since year 2007) to each woman two voluntary and free-of-charge prenatal screening examinations for fetal aneuploidies and structural anomalies. Most screening examinations are performed by trained midwives and only high-risk pregnancies are followed by a maternal and fetal medicine specialist [22]. The uptake of the screening program is approximately 95% in the Helsinki metropolitan area (personal communication, Vedran Stefanovic, corresponding author, unpublished).

At the time of the screening for fetal structural anomalies, the placental position is also determined. The screening protocol for PP (Figure 2) in our unit is based on the study of Taipale et al. [19]. Therefore, only a proportion of the women with major PP and none of the women with minor PP have been offered a follow-up scan after the second trimester screening ultrasound.

PP diagnosis code was set when the obstetrician first time confirmed the existence of PP by ultrasound examination (usually at 28-30 gestational weeks´ follow-up visit), or at any time when a woman was admitted to hospital due to bleeding and PP was diagnosed in women without the previously suspected PP.

Data on maternal baseline characteristics and pregnancy outcomes were collected retrospectively. The type of PP was determined by the most recent ultrasound examination before delivery. Additionally, the

occurrence of hemorrhage and other complications related to PP and the treatment modalities used for these complications were recorded.

The main outcome measure was the accuracy of the mid-pregnancy ultrasound screening protocol to predict PP at the time of the delivery. The outcomes of major and minor PP were compared.

For this study, AIP cases were identified according to EW-AIP (European Working Group on Abnormally Invasive Placenta) recommendations [9]. Clinical diagnosis of AIP was set if the placenta could not be removed without massive hemorrhage. All the women with hysterectomy had a histopathological examination performed. The management protocol of PP cases with or without suspected AIP is shown below.

Treatment protocol for women with PP without suspected AIP

Antenatal diagnosis of PP was established by ultrasound either at the time of the second trimester fetal structural anomaly screening performed between 18+0 and 21+6 gestational weeks or at any time later in pregnancy upon admission to hospital. Most of the screening ultrasounds were performed transabdominally. Transvaginal ultrasound was performed if PP was suspected. No follow-up visits after screening were offered if the placenta overlapped the internal cervical os ≤ 14 mm. For women with placenta overlapping the cervix ≥ 15 mm, a follow-up visit was scheduled at 28 to 30 gestational weeks. If PP still persisted, further follow-up visits were scheduled at 34 and 36 gestational weeks.

In the absence of bleeding episodes, the time and the mode of delivery were determined during the follow-up visit at 36 gestational weeks. If the placental edge was 1 to 20 mm above the internal cervical os, vaginal delivery was recommended. Otherwise, the preferred mode of delivery was elective CS. At the beginning of the study period (until the end of 2011), elective CS was planned at 38 to 39 gestational

weeks and at 37 gestational weeks from the beginning of 2012. If a woman did not have bleeding episodes after follow-up visit at 36 gestational weeks, ultrasound was not routinely repeated.

If a woman was admitted to hospital due to hemorrhage, a detailed assessment of the fetal biophysical profile and an assessment of placental function and position were performed by ultrasound. Antenatal steroids were administered upon admission if bleeding was severe and gestational age was < 35+0 weeks. If bleeding did not require immediate delivery and had ceased within a few days, women were treated as outpatients. Hospitalization was considered necessary with recurrent bleeding episodes.

Treatment protocol for women with PP and antenatally suspected AIP

The presence of AIP was estimated at the follow-up visit at 28 to 30 gestational weeks. MRI imaging was performed if AIP was suspected by ultrasound. Follow-up visits were scheduled in every two weeks. Corticosteroids were administrated routinely at 33 gestational weeks or earlier if bleeding occurred. Elective CS was planned at 34 to 35 gestational weeks in an operating room equipped with interventional radiology capabilities. Occlusion balloons were placed in the iliac arteries and ureter stents were also placed before the CS. After delivery a gentle attempt of manual placental removal was performed. If this failed, placenta was either left in situ or emergency hysterectomy was performed. Embolization was performed in selected cases. A histopathological examination of hysterectomy specimens was performed.

Statistics

Statistical analysis was performed using SPSS statistical package (SPSS Inc., Chicago, IL, USA). The chi-squared test or Fisher's exact test was used for comparison of categorical variables between groups. Continuous variables were analysed by Mann-Whitney *U* test after Shapiro-Wilk test evaluation of data normality. A test value $p < 0.05$ was considered statistically significant.

Results

PP was diagnosed in 176 women at the time of the delivery. Major PP was diagnosed in 129 (73.3%) women and minor PP in 47 (26.7%) women (Figure 3).

The baseline characteristics by the type of PP are shown in Table 1. Sixty-three women were primiparous (35.8%) and 45 (71.4%) had one or more risk factor for PP.

Overall, 32 women (18.2%) with PP at the time of delivery were not identified at 18 to 22 gestational weeks by our second trimester screening protocol (Table 2). Their PP was diagnosed later in pregnancy upon admission to hospital due to contractions or hemorrhage. Twenty (62.5%) women had minor PP and 12 (37.5%) women had major PP. Twenty-nine (90.6%) of the 32 women whose PP was undiagnosed at second trimester screening had bleeding episodes during the pregnancy. Seven (21.9%) of the 32 had the first bleeding episode ≥ 37 gestational weeks. Five women (15.6%) had life-threatening hemorrhage (≥ 2500 ml) at the time of the delivery. Emergency CS was performed in 13 women (40.6%). Two women with undiagnosed PP at second trimester screening had hysterectomy performed. Both women had AIP and a history of previous CS.

AIP was confirmed in 26 women at the time of the delivery either clinically or by a histopathological examination of a hysterectomy specimen (Table 3). Twenty-five cases of placenta accreta and one case of placenta precreta were found. Sixteen (61.5%) of the AIP cases were diagnosed antenatally. One women with AIP was primiparous and had no risk factors. Six of the ten women whose AIP remained undiagnosed antenatally had minor PP. Thirteen (50%) of the 26 women had life-threatening hemorrhage (≥ 2500 ml). Altogether 15 hysterectomies were performed. All these women had AIP confirmed by a histopathological examination of a hysterectomy specimen and 13 had history of CS.

The comparison of the outcomes of women with major and minor PP is shown in Table 4. At the time of delivery, women with major PP had significantly more blood loss than women with minor PP (median 1310 ml vs. 850 ml). Women with major PP also delivered earlier than women with minor PP. There were otherwise no differences between the groups. AIP was equally common (minor PP 14.9% vs. major PP 14.7%).

Discussion

There are three important findings in this study. First, almost one fifth of women with major or minor PP remained undiagnosed during the second trimester screening ultrasound. Second, we observed that although the blood loss was heavier and preterm birth was slightly more common among women with major PP, the rate of other adverse pregnancy outcomes and postpartum complications was similar regardless of the type of PP. The third important finding was that the rate of AIP was similar in cases with major or minor PP.

PP was often missed in our study and almost 40% of the undiagnosed cases were major PPs. This suggests that a substantial proportion of women with placenta overlapping cervical os (1-14 mm) at mid-pregnancy have major PP at term. In the study of Taipale et al., the positive predictive value for PP at delivery was 19% with 100% sensitivity if the placental edge was ≥ 15 mm over cervical os at 18 to 23 weeks of gestation [19]. Additionally, Heller et al. reported the placental resolution rate to be as high as 98.4% in minor PP [18].

Lal et al. demonstrated that women with prior CS and major PP diagnosed at the mid-pregnancy screening are less likely to show resolution of PP [23]. In their study, resolution occurred in 61% of women with a prior CS and in 90% of women who did not have prior CS [23]. Laughon et al. reported that a history of CS was associated with a three-fold increased risk for PP at the time of the delivery [24]. Prior CS is an independent risk factor both in women with major or minor PP [23,24]. These women are

also at increased risk for AIP [8]. Two women whose pregnancy resulted in hysterectomy due to AIP had no follow-up scheduled after mid-pregnancy screening ultrasound even though they both also had a history of CS.

In our study, the rate of AIP was similar in cases with major PP and in cases with minor PP. There was also no difference in the hysterectomy rate between the groups. This finding differs from previous studies [13,15]. Tuzovic et al. reported that the rate of AIP was 15.2% among women with complete (or major) PP and 2.9% among women with incomplete (or minor) PP [15]; most hysterectomies were performed in women with major PP (10.6% vs. 0.7%) [15]. Bahar et al. reported similar results [13]. They showed a significant association with major PP, placenta accreta (OR 3.2), and hysterectomy (OR 5.1) [13]. We found no difference in AIP rates between major or minor PP which will have a major impact on screening strategy.

The rates of major PP and minor PP were consistent with previous studies [13-16]. In fact, the only significant difference between these groups was the intrapartum blood loss and the gestational age at the time of delivery. Women with major PP had more bleeding and delivered earlier than women with minor PP. A few previous studies have shown that women with major PP have a higher incidence of PPH and more often require blood transfusions [13-16]. Results from studies that assessed the risk for preterm delivery associated with PP vary [13-16]. Sekiguchi et al. found a higher incidence of preterm deliveries among women with major PP compared to minor PP (45.1 % versus 8.8 %) [16]. Dola et al. also reported an increased incidence of preterm deliveries [14]. On the other hand, Bahar et al. reported that antepartum hemorrhage predicted preterm delivery but the rates of preterm delivery between minor PP and major PP groups did not differ [13]. Tuzovic et al. also reported no difference in preterm delivery rates [15]. In our study, women with antenatally suspected AIP were included and these women had planned CS at 34 to 35 gestational weeks, which had an effect on the mean gestational age of the whole group.

Pivano et al. established a score to predict the risk of emergency CS after the first bleeding episode [25]. Major PP seemed to be a major contributor [25]. In our study, women with minor PP had a higher rate of emergency CS than women with major PP. One explanation might be that some patients with minor PP attempted a vaginal delivery, followed by bleeding and emergency CS. Another explanation is missed PP diagnosis and lack of follow-up.

One weakness of our study was that we had follow-up only for women with placenta overlapping the cervix by ≥ 15mm. Women who had minor PP or major PP overlapping the cervix by less than 15 mm at 18 to 22 gestational weeks had no follow-up after the second trimester screening. Thus, only those cases who had bleeding or other symptoms such as contractions could be identified. However, if woman with previously undiagnosed PP was admitted to hospital because of bleeding, vaginal US was performed and the diagnosis of PP was registered.

In conclusion, our results show that regardless of the type, PP is always a serious condition. Both types of PP have significant risk for massive postpartum hemorrhage and AIP, especially among women with prior CS. We have now revised our protocol with recommendation that all women who have either major or minor PP at mid-pregnancy screening are scheduled for follow up ultrasound scan at 32 gestational weeks.

Author's contributions and declarations of interest

All the authors have participated to study design and manuscript writing/editing. Data collection was made by Maiju Grönvall and statistical analysis by Mikko Loukovaara. All the authors have seen and approved the final version of the manuscript.

Declaration of interest: none.

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Table 1. Baseline characteristics of women with major or minor placenta previa

	Major PP n=129 (%)	**Minor PP n=47 (%)**	***p*-value**	**OR (95% CI)**
Age (years; mean)	34.3 (range 22-49)	34.6 (range 27-47)	0.792	
<35	68 (52.7)	21 (44.7)	0.346	0.73 (0.37-1.4)
≥35	61 (47.3)	26 (55.3)		
Parity (mean)	1.32 (range 0-14)	1.06 (range 0-5)	0.902	
0	49 (40.0)	14 (29.8)	0.069	
1-2	59 (45.7)	30 (63.8)		
≥3	21 (16.3)	3 (6.4)		
Risk factors for PP				
History of cesarean section	31 (24.0)	16 (34.0)	0.184	1.6 (0.79-3.4)
History of curettage	32 (24.0)	16 (34.0)	0.224	1.6 (0.76-3.2)
History of other uterine procedures[1]	6 (4.7)	3 (6.4)	0.702	1.4 (0.34-5.8)
PP in previous pregnancy	5 (3.9)	2 (4.3)	1.0	1.1 (0.21-5.9)
ART pregnancy	32 (24.8)	6 (12.8)	0.086	0.44 (0.17-1.1)
Multiple pregnancy	5 (3.9)	1 (2.1)	1.0	0.54 (0.061-4.7)
Smoking during pregnancy	9 (7.0)[2]	6 (12.8)	0.224	2.0 (0.66-5.8)

PP=placenta previa; ART=artificial reproductive technology; OR=odds ratio; CI=confidence interval

[1]Other uterine procedures: hysteroscopy (polyp) n=2, manual removal of placenta n=4, hysteroscopy and manual removal of placenta n=1, second trimester termination of pregnancy by cesarean section n=1, re-laparotomy and uterine scar revision after cesarean section n=1

[2]Data not available for five women

Table 2. Comparison of pregnancy outcomes with placenta previa diagnosed or undiagnosed at mid-trimester ultrasound screening

	PP diagnosed[1] n=144 (%)	**PP undiagnosed[1] n=32 (%)**	***p*-value[4]**	**OR (95% CI)**
Type of PP				
Minor Major	27 (18.8) 117 (81.3)	20 (62.5) 12 (37.5)	<0.0001	7.2 (3.2-17)
Gestational age at delivery (d) [Median (IQR)]	258 (245-266)	261 (252-267)	0.088	
<32 32^{+0}-36^{+6} ≥37	9 (6.3) 67 (46.5) 68 (47.2)	0 13 (40.6) 19 (59.4)	0.225	
Blood loss (ml) [Median (IQR)]	1250 (710-2000)	1050 (650-1763)	0.343	
Abnormally invasive placenta	24 (16.7)	2 (6.3)	0.173	0.33 (0.075-1.5)
Need for any additional treatment[2]	53 (36.8)	6 (18.8)	0.050	0.40 (0.15-1.0)
Hysterectomy	13 (9.0)	2 (6.3)	1.0	0.67 (0.14-3.1)
Postpartum complication[3]	22 (15.3)	1 (3.1)	0.082	0.18 (0.023-1.4)

PP=placenta previa; IQR=interquartile range; OR=odds ratio; CI=confidence interval

[1]Placenta previa was diagnosed in the mid-pregnancy screening ultrasound if placenta was overlapping cervix ≥ 15 mm

[2]Additional treatment: uterine balloon tamponade, uterine artery ligation, uterine compression sutures, interventional radiology procedures, peripartum hysterectomy

[3]Postpartum complication: wound/uterine/pelvic/urinary bladder infections, urinary bladder laceration, thrombosis, disseminated intravascular coagulation, ileus, re-laparotomy, hysteroscopy due to tamponade balloon rupture

[4]The chi-squared test or Fisher's exact test was used for comparison of categorical variables between groups; continuous variables were analysed by Mann-Whitney U test after Shapiro-Wilk test evaluation of data normality

Table 3. Women with placenta previa and abnormally invasive placenta

	Women with abnormally invasive placenta n=26 (%)
Age (years; mean)	36.1 (range 28-43)
Parity (mean)	2.6
0	2 (7.7)
1	9 (34.6)
≥2	15 (57.7)
Risk factors for placenta previa	
History of cesarean section	19 (73.1)
History of curettage	12 (46.2)
History of miscarriage	12 (46.2)
History of induced abortion	9 (34.6)
History of other uterine procedures[1]	2 (7.7)
Placenta previa in previous pregnancy	2 (7.7)
ART pregnancy	1 (3.8)
Multiple pregnancy	0
Smoking during pregnancy	0
Type of PP	
Minor	7 (26.9)
Major	19 (73.1)
Gestational age at delivery (weeks)	34^{+6} (range 22^{+3} -39^{+5})
<32	4 (15.4)
32^{+0} - 36^{+6}	14 (53.8)
≥37	8 (30.8)
Mode of delivery	
Vaginal	0
Cesarean Section	26 (100)
Elective	22
Emergency	4
Blood loss (ml; mean)	3249 (range 150-12 000)
<1500ml	6 (23.1)
1500-2499ml	7 (26.9)
2500-4999ml	4 (15.4)
≥5000ml	9 (34.6)
Any additional treatment modality	26 (100)
Hysterectomy	15 (57.7)
Postpartum complication	9 (34.6)

ART=artificial reproductive technology; PP=placenta previa

[1]Other uterine procedures: manual removal of placenta (n=1), manual removal of placenta and hysteroscopy (n=1)

Table 4. Selected pregnancy- and delivery- associated characteristics of women with major or minor placenta previa

	Major PP n=129 (%)	**Minor PP n=47 (%)**	***p*-value[3]**	**OR (95% CI)**
Antepartum bleeding	89 (69.0)	38 (80.9)	0.120	1.9 (0.84-4.3)
Gestational age at delivery (d) [median (IQR)]	257 (245-266)	260 (253-268)	0.035	
<32	8 (6.2)	1 (2.1)	0.430	
32^{+0}-36^{+6}	60 (46.5)	20 (42.6)		
≥37	61 (47.3)	26 (55.3)		
Mode of delivery			0.061	
Vaginal	0	1 (2.1)		
Cesarean section				
Elective	88 (68.2)	25 (53.2)		
Emergency	41 (31.8)	21 (44.7)	0.113[4]	1.7 (0.88-3.4)
Abnormally invasive placenta	19 (14.7)	7 (14.9)	0.978	1.0 (0.40-2.6)
Blood loss (ml) [median (IQR)]	1310 (730-2000)	850 (610-1550)	0.032	
<1500ml	68 (52.7)	35 (74.5)	0.081	
1500-2499ml	36 (27.9)	7 (14.9)		
2500-4999ml	16 (12.4)	3 (6.4)		
≥5000ml	9 (7.0)	2 (4.3)		
Red blood cell transfusion (units; mean)	1.5 (0-15)	1.0 (0-10)	0.210	
Yes	48 (37.2)	13 (27.7)	0.239	0.65 (0.31-1.3)
No	81 (62.8)	34 (72.3)		
Need for any additional treatment[1]	47 (36.4)	12 (25.5)	0.175	0.60 (0.28-1.3)
Peripartum hysterectomy	12 (9.3)	3 (6.4)	0.762	0.67 (0.18-2.5)
Other	49 (38.0)	12 (25.5)	0.125	0.56 (0.27-1.2)
Uterine balloon tamponade	34 (26.4)	9 (19.1)		
Uterine artery ligation	0 (0)	1 (2.1)		
Uterine compression sutures	3 (2.3)	1 (2.1)		
Interventional radiology procedure	12 (9.3)	1 (2.1)		
Any postpartum complication[2]	20 (15.5)	3 (6.4)	0.135	0.37 (0.11-1.3)

PP=placenta previa; IQR=interquartile range; OR=odds ratio; CI=confidence interval

[1] Altogether 44 patients had one additional treatment modality and 15 patients had several additional treatment modalities

[2]Postpartum complication: wound/uterine/pelvic/urinary bladder infection, urinary bladder laceration, thrombosis, disseminated intravascular coagulation, ileus, re-laparotomy, hysteroscopy due to tamponade balloon rupture

[3]The chi-squared test or Fisher's exact test was used for comparison of categorical variables between groups; continuous variables were analysed by Mann-Whitney U test

[4]Comparison between emergency cesarean sections and other modes of delivery

Figure 1. Different types of placenta previa.

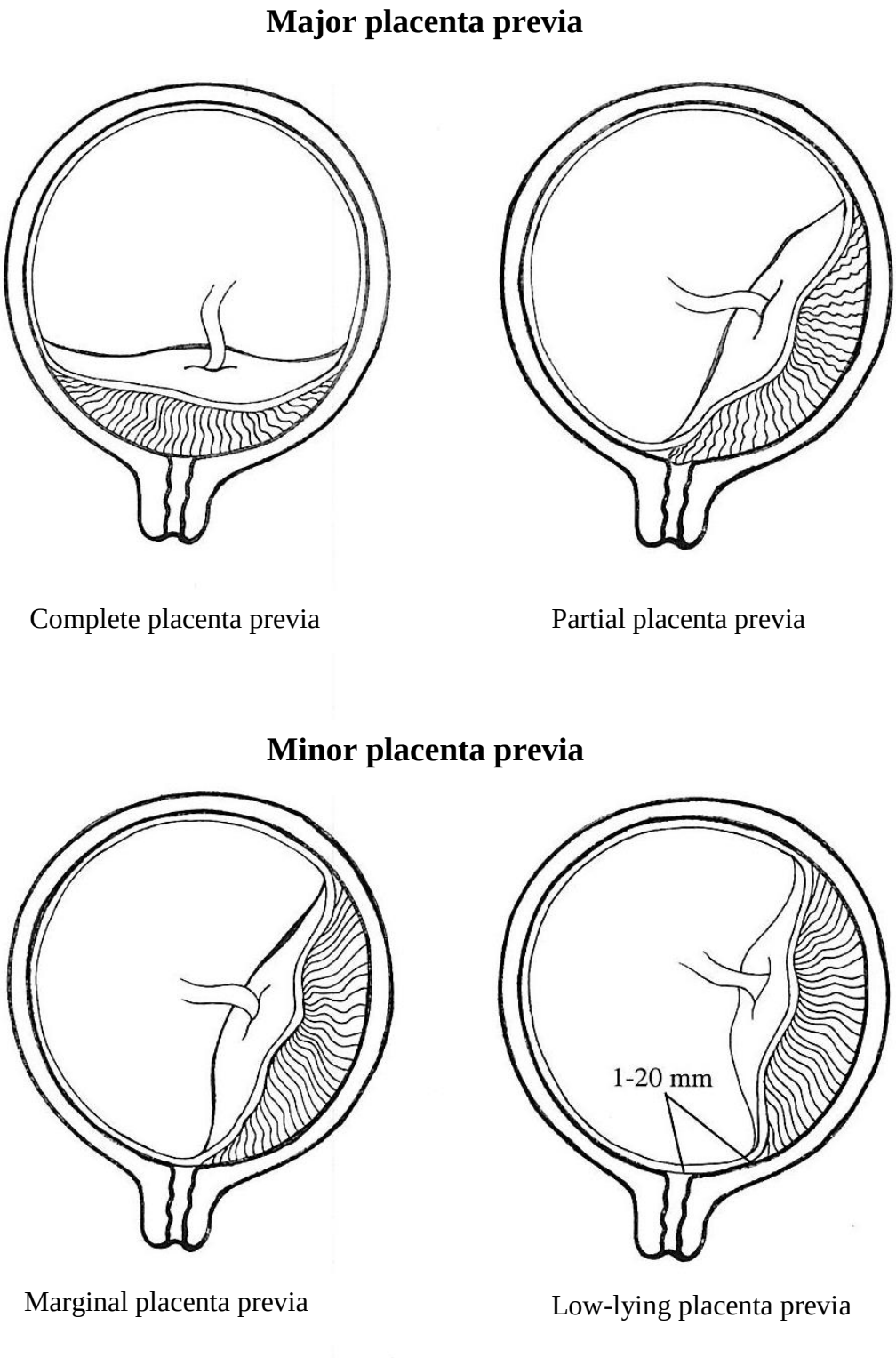


Figure 2. Screening protocol and follow-up for placenta previa (PP).

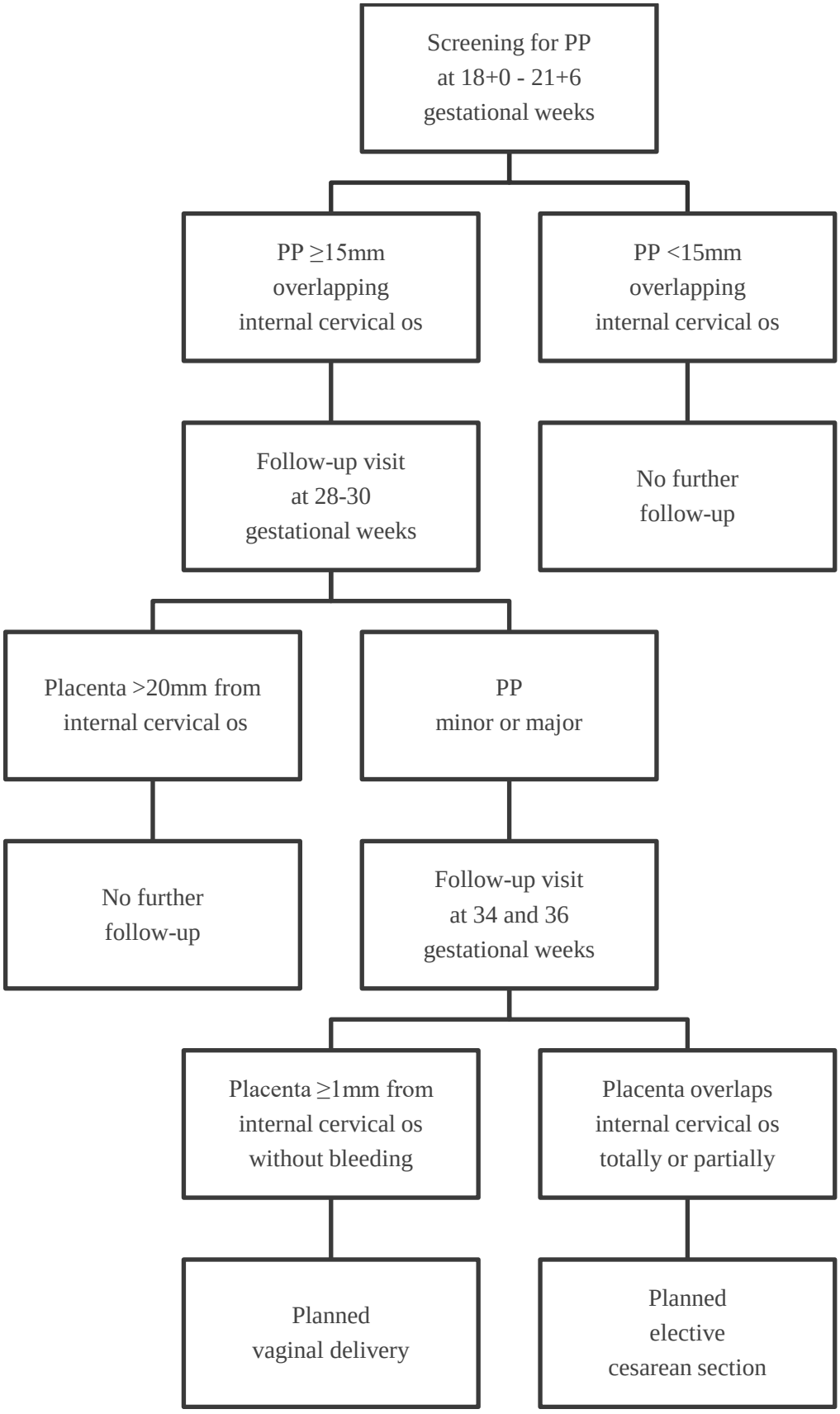
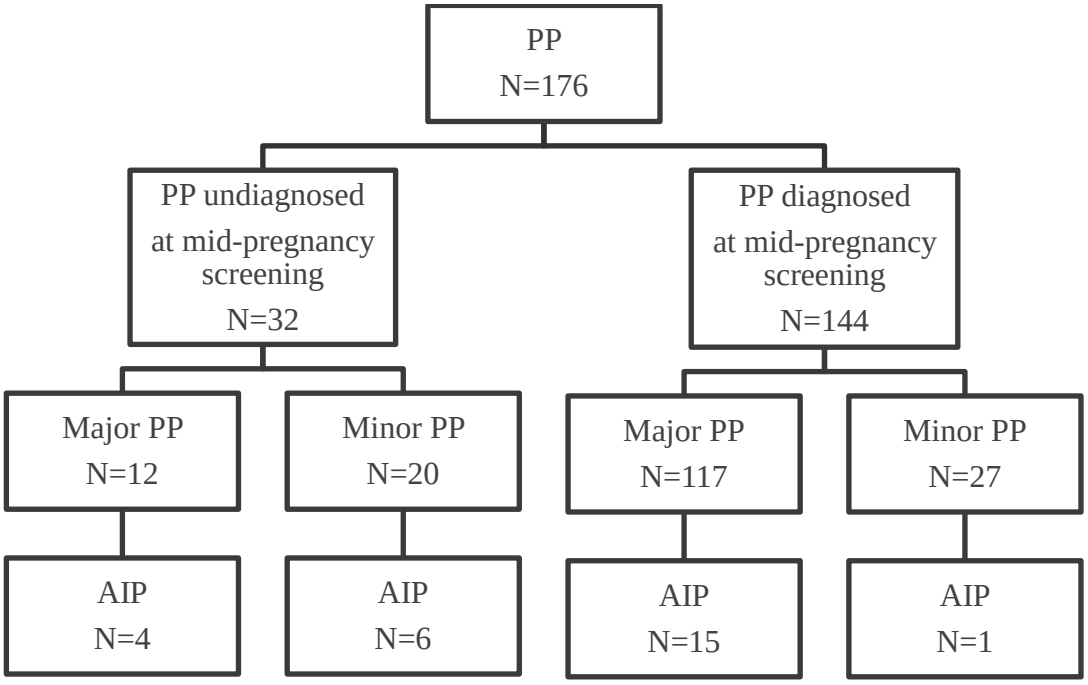


Figure 3. Flow-chart of the study population.



PP=placenta previa; AIP=abnormally invasive placenta