

Management of Abnormally Invasive Placenta: One-center Experience

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ABSTRACT

Aim: To present one-center experience of the management of abnormally invasive placenta (AIP).

Materials and methods: This was a retrospective cohort study of clinical cases of abnormally invasive placenta (the AIP) in Perinatal Center (PC), which is part of General Hospital—Regional Clinical Hospital N2 of Krasnodar city, in the period from 2014 to August 2016.

Results: The total number of childbirth for the period was 24 078, and AIP was diagnosed in 0.17%. The average age of women was 31.5 ± 0.8 years. About 97.5% were multiparous women and 85% women in the previous pregnancy had childbirth by cesarean section (CS): One CS—41.18%, two—32.35%, and three—23.53%. An AIP was first diagnosed in pregnancy at 11 to 39 weeks of pregnancy by ultrasound or magnetic resonance imaging (MRI). Cesarean section performed in the conditions of the X-ray operating of the endovascular department. The relative risk (RR) for accurate diagnosis of AIP by ultrasound was 1.789 ± 0.709 [95% confidence interval (CI) 0.446–7.186], and for MRI RR was 0.944 ± 0.142 (95% CI 0.715–1.246). At CS, in 85% of women balloon dilatation of the iliac vessels was performed, in 15%, uterine artery embolization (UAE), and in 72.5%, metroplasty. In 15% of women with AIP were the cause of hysterectomy without adnexa. The total blood loss was 1152.56 ± 107.67 (4,000–35,000) mL or 15.539 ± 1.7374 (5,000–58,330) mL/kg. Maximum blood loss was in women with placenta previa and its localization in the area of the scar on the uterus that required a hysterectomy.

Conclusion: Despite increasing incidence of AIP, it is possible to prevent massive blood loss during delivery by combined treatment using radiological endovascular procedures for devascularization of the lower pelvis. Early diagnosis of placental abnormalities with regionalized approach in perinatal health makes it possible not only to preserve the women's reproductive health and fertility but also to minimize postpartum hemorrhage.

Keywords: Abnormally invasive placenta, Balloon dilatation of the iliac vessels, Massive blood loss, Uterine artery embolization.

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INTRODUCTION

Abnormally invasive placenta was first described in 1880.¹ According to Wu et al, the prevalence of AIP was 1 in 553 pregnancies,² much higher than reported rates in the 1970s (1 in 4,027) and 1980s (1 in 2,510) in the United States.²⁻⁴ The same tendency has been reported in Hong Kong comparing 24-year period (from 1999 to 2003, prevalence was 0.17 per 1,000 births, and from 2009 to 2013, it increased to 0.79 per 1,000 births).⁵ The same study revealed that AIP prevalence is higher in the women with uterine scar (0.13 to 0.53 per 1,000 births) than in the women with absence of the scar (0.04 and 0.26 per 1,000 births respectively).⁵ Terminology for abnormal placental invasion is different including the following terms: Placenta adhaerens, placenta accreta, placenta increta, and placenta percreta, often described as “an abnormal attachment of the placenta” and “placental anomalies,” morbidly adherent placenta, or AIP.⁶⁻⁸

Besides massive maternal blood loss as the main problem, AIP can increase the risk for fetus as well.⁹ The timing of delivery in the pregnancy with AIP is important in order to decrease the risk of massive intrapartum blood loss for the mother and the risk of premature babies.⁹ Other risk factors for the mother, such as development of choriocarcinoma from the residual placental tissue after AIP, have been published.¹⁰

Risk factors for AIP are uterine scar after CS, or other surgical procedures on the uterus, the multiparity, age over 30 years, and living in rural areas.^{5,11-14} The risk of uterine rupture, hysterectomy, and massive blood loss requiring transfusion is increased with AIP.¹²

Modern diagnostic imaging methods, such as different modes of conventional and three- and four-dimensional ultrasound and MRI enabled diagnosis of AIP as early as in the first trimester of pregnancy.^{1,15}

Timely diagnosis of AIP enables appropriate treatment with the implementation of organ-preserving techniques including a gradual surgical hemostasis at CS, uterine balloon tamponade, ligation of the uterine vessels, application of compression sutures on the uterus (B-lynch and other modalities), UAE, and ligation of internal iliac

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arteries.¹⁶⁻¹⁹ There is a need to create specialized centers for the implementation and application of the most modern methods for the diagnosis and treatment of AIP in order to prevent massive blood loss and increase the experience and workload of health care teams resulting in more frequent uterine preservations.^{9,20}

The aim is to present retrospectively our experience with the treatment of the women with AIP in our center in the 32-month period.

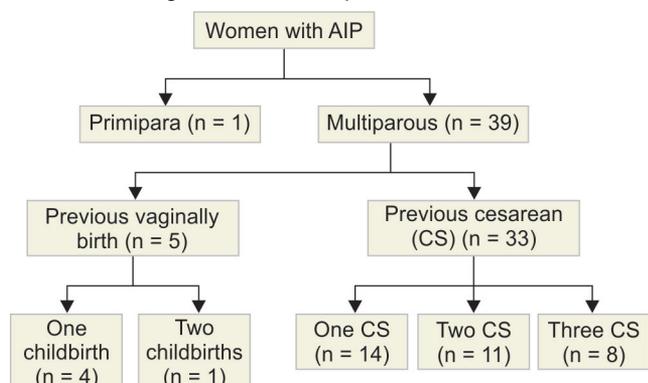
MATERIALS AND METHODS

Patients with AIP were retrospectively analyzed at PC of the Second Regional Clinical Hospital in Krasnodar, Russia in a period of 32 months (January 2014 to August 2016). The total number of deliveries for the mentioned period was 24,078, of which 227 (0.94%) women had blood loss more than 1,000 mL, out of which 40 women (17.6%) had been diagnosed with AIP, which is 0.17% out of 24,078 deliveries. According to the regional organization of perinatal health, patients with AIP diagnosed by ultrasound and/or MRI from the entire Krasnodar region were referred only to our PC. The number of AIP patients was increasing from the year 2014 (n = 9) and 2015 (n = 11), and 2016 (n = 20). The characteristics of the patients are shown in Flow Chart 1.

The AIP was diagnosed in 0.17% (n = 40) women. The obvious trend of increasing frequency of AIP due to organized targeted routing pregnant women with this disorder from all Krasnodar Krai exclusively in this PC – in this Perinatal Center. Diagnosis of AIP was based on the ultrasound data, uteroplacental Doppler, and MRI.

The average age of women was 31.5 ± 0.8 (20–41) years. The number of pregnancies, not including present, was 2.8 ± 2.3 (0–9). Only one out of 40 women was primigravida, 10 were with one, 7 with two, 12 with three, 6 with four, 2 with five, and 2 with more than five pregnancies. History of CS was present in 34 out of 40 women (85%) with the following distribution: One previous CS present in 14, two CS in 12, and three CS in 8 patients.

Flow Chart 1: Characteristics of the patients with AIP treated at second regional clinical hospital PC from 2014 to 2016



Previous history of artificial abortion was present in 15 out of 40 patients with the range from one to six.

RESULTS

Risk Factors for the AIP besides Previous CS

Two women had curettage after artificial abortion with the previous CS due to postabortion inflammatory complications and two patients after CS and one after spontaneous labor, there was a history of curettage in puerperium due to the subinvolution of the uterus. Uterine scar was present in two women due to surgery other than CS. The interval between previous instrumental delivery and actual pregnancy was between 23 and 60 months. All pregnancies in women diagnosed with AIP were in natural menstrual cycle and natural fertilization.

Diagnosis of AIP

The AIP was first diagnosed in pregnancy at 35.1 ± 0.8 (11–39) weeks of gestation, mostly in the third trimester of pregnancy (in 36 out of 40 women).

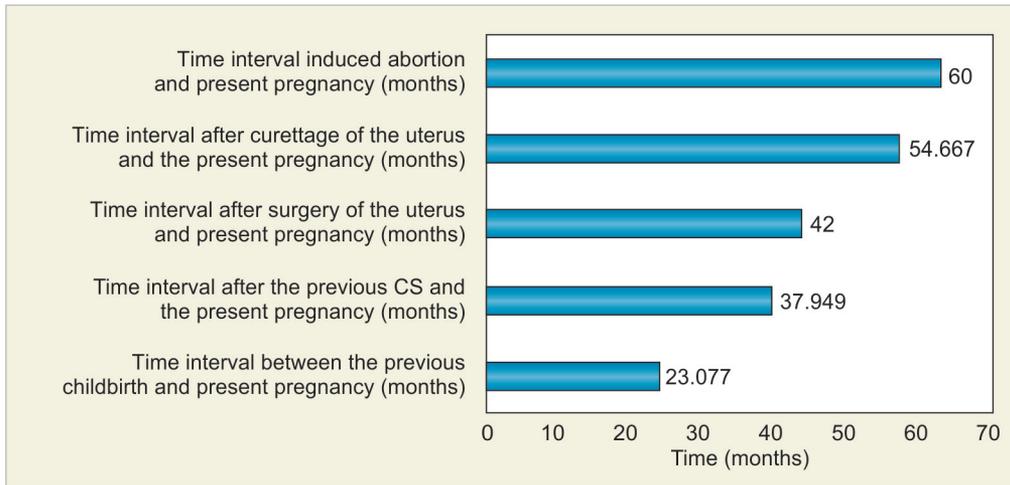
The diagnosis of AIP based on ultrasound and MRI findings was confirmed intraoperatively and histologically in 26 (65%) out of 40 patients. Discrepancy between ultrasound and MRI finding was found in 8 (5%) out of 40 patients in whom diagnosis of AIP was made by ultrasound not confirmed by MRI. In 5 (12.5%) patients with positive ultrasound and/or MRI diagnosis of AIP, it was not confirmed neither intraoperatively nor histologically. The data on the diagnosis of AIP are shown in Table 1. Sensitivity, specificity, and positive and negative predictive values of ultrasound and MRI in the detection of AIP are presented in Table 1.

Childbirth Method in Previous Pregnancy

The medical history of uterus curettage was investigated. About 10.26% of women (n = 4/ of 39 women with a history of pregnancy) carried out of abortion in terms 15.5 ± 7.79 (4–26) weeks with curettage of the uterus. About 38.46% (n = 15) of women had artificial abortion: 40% (n = 6/15)—1, 46.67% (n = 7/15)—2, 6.67% (n = 1/15)—5, and 6.67% (n = 1/15)—6 abortions. Complicated postabortion

Table 1: Sensitivity, specificity, positive and negative predictive values of ultrasound and MRI in the detection of AIP

| Parameter | Ultrasound | | MRI | |
|---------------------------|------------|------------|-----------|------------|
| | Value (%) | 95% CI (%) | Value (%) | 95% CI (%) |
| Sensitivity | 100 | 89.7–100 | 76.5 | 58.8–89.3 |
| Specificity | 16.7 | 0.42–64.1 | 16.7 | 0.42–64.1 |
| Positive predictive value | 87.2 | 82.6–90.7 | 83.9 | 77.7–88.6 |
| Negative predictive value | 100 | – | 11.1 | 1.9–45.3 |



Graph 1: Time interval between the previous delivery and instrumental intrauterine surgery

(inflammatory nature) required at 5.13% (n = 2) women recurettage of the uterus who previously had a CS.

Postnatal inflammatory processes in the uterus (sub-involution of the uterus) demanded uterine curettage in 7.69% (n = 3) women: In 66.67% (n = 2/3) after spontaneous labor and in 33.33% (n = 1/3) after CS.

Two women had a scar on the uterus due to metroplasty by Strassmann (n = 1) and the removal of the fallopian tube with the excision of the uterus angle (n = 1). The time interval between the previous instrumental delivery and intrauterine manipulations is reflected in Graph 1.

In absolute numbers of women (n = 40), pregnancies occurred spontaneously in a natural menstrual cycle.

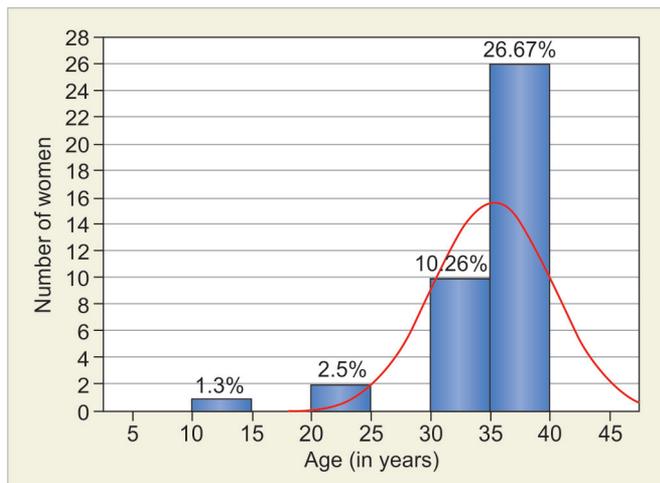
The AIP was first diagnosed in 35.05 ± 0.8 (11–39) weeks of pregnancy (Graph 2). In the majority of women (93%), primary diagnosis of AIP was made in the third trimester of pregnancy.

Anemia during pregnancy was detected in 15 women. The average level of hemoglobin (Hb) in all women before delivery was 11.13 ± 0.20 (8.9–13.8) g/dL.

The delivery was performed in the X-ray operating room if AIP was previously diagnosed by ultrasound and/or MRI. It turned out that AIP was confirmed intraoperatively and histologically in 85% (n = 34) women.

Suspicion of the AIP, based on ultrasound and MRI, has been fully confirmed in 65% (n = 26) women. In 5% (n = 8) women in the presence of ultrasonic characteristics, AIP method with MRI showed no symptoms. In 1% (n = 4) of the women in the presence of compelling evidence of AIP with ultrasound and MRI intraoperative and histomorphological diagnosis was not confirmed. Also 2.5% (n = 1) had the signs of AIP with ultrasound or MRI, but the true confirmation of the diagnosis of intraoperative and histomorphological was not.

The RR for accurate diagnosis of AIP by ultrasound was 1.789 ± 0.709 (95% CI 0.446–7.186), the number-needed-to-treat (NNT)—2.533, the sensitivity (Se)—0.971, and specificity (Sp)—0.200. For MRI, RR was 0.944 ± 0.142 (95% CI 0.715–1.246), the NNT—19.929, the Se—0.765, and Sp—0.167. Thus, the ultrasonic diagnosis was more informative than MRI, which has a much greater sensitivity.



Graph 2: Gestational age first diagnosed with AIP

Treatment of AIP and Mode of Delivery of Patients with AIP

The approach to the treatment of the patients consisted of triple-P procedure which involves perioperative placental localization and delivery of the fetus via transverse uterine incision above the upper border of the placenta, pelvic devascularization, and placental nonseparation with myometrial excision and reconstruction of the uterine wall.¹⁶ It is considered a safe and effective alternative to conservative management or peripartum hysterectomy.¹⁶

Most of the patients were delivered by CS (34 out of 40–85%) at the gestational age of 37 weeks. Placenta previa was present in 3 (7.5%) out of 40 patients. In 27

(72.9%) of women, placenta was located at the uterine scar after CS, in 6 (15%) on the uterine front wall, in 2 (5%) on the left side, and in 3 (7.5%) on the back side of the uterus. Localization of placenta dictated the CS operative approach and localization of hysterotomy. Bottom CS was made in 33 while lower uterine segment horizontal section was performed in 7 patients. The length of abnormally attached placenta measured ultrasonographically was between 20 and 110 mm with average value and standard deviation of 73.8 ± 21.2 mm, while the thickness of myometrium at the site of placental attachment was from 0.3 to 2.0 mm (average 1.2 ± 0.10 mm).

In all patients, intervention radiology methods of treatment for local pelvic devascularization were performed. The balloon dilatation of iliac arteries was performed in 34 (85%) patients, while 6 (15%) patients underwent UAE. In 29 (72.5%) women, reconstruction of uterine wall after resection of the site of the placental attachment was successful. In 6 (15%) of the women, hysterectomy was indicated due to the failure of other treatment options.

Blood Loss in Our Patients with AIP

The blood loss was dependent on the localization of placenta. The most severe blood loss occurred in patients with placenta previa and when placenta was located at the scar after previous CS. In all patients with such localization of the placenta, hysterectomy was indicated as the only option of treatment. Blood loss was as follows: In 4 (10%), blood loss was estimated to be less than 500 mL; in 21 (53%) patients, it was from 500 to 1,000 mL, in 9 (23%) from 1,000 to 1,500 mL, while in 2 patients it was 2,000 mL and more. On average, blood loss was $1,153 \pm 108$ mL (400–3500 mL), which was also counted as the blood loss on the weight of the body of patients from 5.0 to 58.3 (average 15.5 ± 1.7) mL/kg. The average level of Hb before delivery in all women was 11.1 ± 0.2 (8.9–13.8) g/dL, while in 15 out of 40 women anemia was detected prenatally. After delivery, the average level of Hb was 10.0 ± 0.2 (6.3–13.2) g/dL.

Cesarean section was made in the gestational age of 37 weeks, calculated on the first day of the last menstrual period. Placenta previa was in 7.5% ($n = 3$) women. In 82.5% ($n = 33$) women bottom CS was made, and the rest in the lower uterine segment. Operating access caused the placental localization on the front wall of the uterus and/or in the area of the scar after CS. In 72.5% ($n = 29$) women, placenta was localized on the uterine scar after CS, 15% ($n = 6$) on the front wall of the uterus, 5% ($n = 2$) on the left side wall of the uterus, and 7.5% ($n = 3$) at the rear wall of the uterus. The length of the abnormal attachment of the placenta was 73.750 ± 21.15 (20.0–110.0) mm, and the minimum thickness of the myometrium was 1.184 ± 0.10 (0.3–2.0) mm.

During caesarean section in a X-ray operating room 85% of women underwent the balloon dilatation of the iliac vessels, 15% ($n = 6$) embolization of uterine artery, and 72.5% ($n = 29$) metroplasty. In 15% ($n = 6$) AIP women were the cause hysterectomy without adnexa.

DISCUSSION

Indeed, according to world trends, in our center in recent years, there has been a trend toward an increase in the frequency of AIP.

However, in the studies of Eshkoli et al,¹² the frequency of AIP was 0.4%, in the studies of Cheng and Lee 0.048%,⁵ and in our study 0.17%. This fact requires further study, since our center is specialized in AIP, in particular. And as already stated, all women with antenatally diagnosed AIP are routed to it.

The average age of women (31.5 ± 0.8) was comparable to the data of Rizvi and Fayaz, 31.8 years,¹⁴ Cheng and Lee⁵, 32.64 to 34.64,⁵ and was more than 30 years old, as in the studies of Wu et al.²

In this study, well-known evidence confirmed that AIP is associated with known risk factors, and the scar on the uterus after CS multiplies the risk of AIP by many times. Of the 39 women with recurrent childbirth, 33 had a history of CS.

In our study, placenta previa was present only in 7.5% of the AIP, which is different from the information available in the literature. For example, Eshkoli et al¹² indicate that placenta previa [adjusted odds ratio (OR), 50.75; 95% CI, 35.57–72.45; $p < 0.001$] was found to be independently associated with placenta accreta.¹² According to Bailit et al,⁷ the frequency of placenta previa may vary depending on the depth of its invasion, but is found in 27.7% of cases with placenta accreta, 33.3% with placenta increta, and 41.2% with placenta percreta.

It is noteworthy that, unlike studies, for example Bailit et al,⁷ where 18.4% were nulliparous and 37.3% had no prior cesarean delivery, in our study the first born was only 1 in 40 women.

In our study, 97% were diagnosed after 30 weeks of gestation. Studies of Cheng and Lee⁵ also indicate the diagnosis of AIP in the presence of scar on the uterus after the previous caesarean section at 35.49 weeks, and in its absence at 36.73 weeks.

We note that our study confirms the necessity of using various noninvasive techniques for antenatal diagnosis of AIP. So, Shetty and Dryden¹⁵ emphasize the supplemental role of MRI in ultrasound. In our study, the risks of a diagnosis of AIP are presented when using only ultrasound or only an MRI. Unfortunately, neither for ultrasound nor for MRI, positive predictive value was 100%. Thus, it is very important to introduce into the routine practice pro forma

for ultrasound reporting in suspected AIP, to maximize the diagnosis of AIP in the first trimester of pregnancy.

Nevertheless, the diagnosis of AIP allowed the use of methods of balloon dilatation of the iliac vessels, UAE, and metroplasty.

Unfortunately, until now, AIP can cause postpartum hemorrhage. According to Sheiner et al,¹¹ postpartum hemorrhage complicated 0.4% of all deliveries and placenta accreta has significant risk factors for postpartum hemorrhage, identified using a multivariable analysis (OR 3.3, 95% CI 1.7–6.4). However, in our study, it is demonstrated that the use of endovascular technology allows 63% of women to avoid blood loss of more than 100 mL. Moreover, hysterectomy was performed only in 15% (n = 6) women, when according to Cheng and Lee⁵ hysterectomy was required in 50 to 91% of cases with AIP.

CONCLUSION

Despite increasing incidence of AIP in our PC due to increasing prevalence of CS, we tried to prevent massive blood loss during delivery by combined treatment using radiological endovascular procedures for devascularization of the lower pelvis with triple-P approach. Despite this accepted mode of treatment, hysterectomy is sometimes unavoidable, as well as the massive life-threatening blood loss. It seems that early diagnosis of placental abnormalities, with regionalized approach in perinatal health, makes it possible not only to preserve the women's reproductive health and fertility but also to minimize postpartum hemorrhage.

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