

CASE STUDY

CURRENT STATE OF THE PROBLEM OF ABNORMAL INVASION OF THE PLACENTA IN OBSTETRICS

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Liudmyla A. Vygyvska^{1,3}, Olena A. Yakovenko², Evgen V. Blagoveschenskiy^{1,3}, Yevheniia M. Babadzhanian², Lesia A. Rudenko⁴, Kyrylo V. Yakovenko⁵

¹ KHARKIV NATIONAL MEDICAL UNIVERSITY, KHARKIV, UKRAINE

² KHARKIV MEDICAL ACADEMY OF POSTGRADUATE EDUCATION, KHARKIV, UKRAINE

³ COMMUNAL NON-PROFIT ENTERPRISE "CITY MATERNITY HOSPITAL No. 1" OF KHARKIV CITY COUNCIL, KHARKIV, UKRAINE

⁴ ALUNA PUBLISHING HOUSE, KONSTANCIN-JEZIORNA, POLAND

⁵ COMMUNAL NON-PROFIT ENTERPRISE "CITY MATERNITY HOSPITAL No. 3" OF KHARKIV CITY COUNCIL, KHARKIV, UKRAINE

ABSTRACT

The aim: On the basis of literature data, as well as a clinical case study, to assess the state of the problem of abnormal invasion of the placenta in obstetrics at the present stage.

Materials and methods: Based on the materials of the world's leading citation databases (MEDLINE, EMBASE, Cochrane), a brief review of the literature data over the past 5 years is presented, dedicated to the issues of abnormal placental invasion. The possibilities of a complex of diagnostic studies and clinical management of women with an anomaly of placenta attachment are considered. A clinical case study of abnormal placental invasion is presented.

Conclusions: AIP is an extremely serious condition with not fully understood etiological and pathogenic mechanisms. Correct and timely verification of this pathological condition, based on the simultaneous use of a whole complex of diagnostic studies (history taking, 2D, 3D, energy and color Doppler mapping, MRI), contributes to the development of individual tactics for the management and delivery in women with AIP, making it possible to reduce maternal morbidity and mortality and improve perinatal outcomes.

KEY WORDS: abnormal placental invasion, ultrasound examination, magnetic resonance imaging, hysterectomy

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INTRODUCTION

Abnormal invasion of the placenta is one of the rare obstetric disorders that endangers the life of the mother and the fetus.

The placenta accreta spectrum (PAS) was first described in 1937 and is characterized by abnormal penetration of the placental trophoblast into the myometrium and beyond [1].

In the past, abnormal placental invasion (AIP) was recorded extremely rarely and was comparable to a disaster in obstetrics. In recent decades, the incidence has been steadily increasing. The epidemiological situation of this problem is determined by the high maternal and fetal morbidity and mortality, as well as the resulting medico-legal consequences.

It is important to diagnose this disorder as early as possible and plan further optimal patient care in order to minimize life-threatening complications [2].

THE AIM

On the basis of literature data, as well as a description of a clinical case, to assess the state of the problem of abnormal invasion of the placenta in obstetrics at the present stage.

MATERIAL AND METHODS

Based on the materials of the world's leading citation databases (MEDLINE, EMBASE, Cochrane), a brief review of the literature data over the past 5 years is presented, dedicated to the issues of abnormal placental invasion. The possibilities of a complex of diagnostic studies and clinical management of women with an anomaly of placenta attachment are considered. A clinical case study of abnormal placental invasion is presented.

REVIEW AND DISCUSSION

AIP is a problem that has long attracted scientists around the world and poses a significant threat to the life of the mother and fetus.

The main risk factors for ingrown placenta include placenta previa and a previous cesarean section, a specific increase in risk is noted with a combination of these factors, as well as if the placenta is located in the area of the scar on the uterus after a previous cesarean section. In addition, AIP can result from a damage to the endometrium due to curettage of the walls of the uterus, endometrial ablation, embolization of the uterine arteries and manual removal of the placenta in previous labor [3]. AIP can occur as a result of changes in the ovum itself, the implantation of

which is provided by a complex mechanism of interrelation of morphological structures in the trophoblast. Other common risk factors for AIP include prior myomectomy or other uterine surgery and maternal late reproductive age [4]. And a certain part of the reasons for AIP currently remain unclear. This form of placental abnormality can lead to dangerous conditions for a woman's life: severe bleeding requiring hysterectomy, and even serious pelvic injuries.

Chistyakova G.N. et al., 2019, revealed a correlation between immunohistochemical and morphological changes in the tissue of the placenta with anomalies of its attachment, which also confirms the participation of these factors in the formation of the abnormality [5]. AIP into the uterine wall is a rather rare complication of pregnancy, although in recent decades there has been an increase in its incidence: from 1:2500–1:7000 pregnancies in 2007 to 1:533 births in 2017 [6] in parallel with an increase in the number of deliveries by caesarean section [7–8]. So, for example, from 2010 to 2012 in New Zealand and Australia, studies showed one AIP case per 2262 births [9]. Such a different incidence and interest of scientists from all over the world indicates the relevance and complexity of this problem.

Placenta accreta spectrum disorder (PASD) is the current terminology recommended by the International Federation of Obstetrics and Gynecology (FIGO) [10] and at the present stage replaces terms such as abnormally adherent/invasive placenta or morbidly adherent placenta. The term PASD refers to the many potential clinical complications that can result from improper placental implantation.

Patients with PASD require accurate antenatal diagnosis in order to plan an appropriate delivery strategy to reduce maternal morbidity and mortality, as well as perinatal morbidity and fetal mortality. The ultrasound and clinical data at the first suspicion of PASD can play a significant role in the development of patient management tactics. Depending on clinical risk factors and primary imaging findings, transabdominal ultrasound of the pregnant uterus with duplex Doppler and transvaginal ultrasound is the most appropriate imaging procedure.

The American College of Radiology has developed criteria for the diagnosis of this pathological condition [7]. These criteria are based on evidence used in specific clinical conditions, which are reviewed annually by a multidisciplinary team of experts. Development and revision of recommendations includes extensive analysis of current medical literature, journals, etc. (RAND/UCLA Appropriateness Method and Grading of Recommendations Assessment, Development, and Evaluation or GRADE). These data help to clearly assess the condition of the placenta and develop a treatment tactics for each specific clinical case.

The term “pathologically invasive (attached) placenta” describes a placenta that is not naturally separated after the birth of a child and cannot be separated without abnormal blood loss [11]. The range of placental attachment disorders is a multifactorial process that encompasses a heterogeneous group of conditions characterized by pathological invasion of trophoblast tissue into the myometrium and the serous membrane of the uterus [1].

AIP, depending on ingrowth into the muscular layer of the uterus, is divided into several degrees: firm attachment of the placenta (*placenta adhaerens*) in which the chorionic villi do not grow beyond the compact layer of the shedding layer; “placenta accreta”, accretion (*placenta accreta*), or “in-growing”, incretion (*placenta increta*) in which chorionic villi grow into the muscular layer of the uterus; “germinating placenta” or germination (*placenta percreta*) in which villi grow through all layers of the uterine wall and affect the surrounding tissues [12].

Berthold Huppertz carried out a study in which only trophoblast of a certain phenotype is able to grow into arteries, veins, glands and lymphatic vessels of the myometrium [13]. A.A. Lukashevich et al., 2019, in their studies, determined the role of matrix metalloproteinase (MMP-9) and its tissue inhibitor (Timp-1) as serum markers of placental attachment, which makes it possible to use them to predict one of the most serious conditions in obstetrics [14].

Until recently, this abnormal condition could be identified during childbirth or during histological examination of the removed uterus. At the present stage, AIP diagnostic methods have significantly expanded and include ultrasound scanning, color Doppler mapping, and magnetic resonance imaging. However, no diagnostic method provides complete confidence in the diagnosis of AIP. Based on the literature data, the diagnostic accuracy increases with the combined use of these methods [15].

Two-dimensional (2D) ultrasound is the gold standard in the diagnosis of AIP, but the important impact of this abnormality on the fetus and mother suggests the ability to use all available radiation diagnostic methods, such as three-dimensional (3D) ultrasound and three-dimensional power Doppler. The latter method has become frequently used in the study of the development of the placenta and its vascularization, which allows not only a qualitative assessment, but also a quantitative analysis.

3D power Doppler facilitates multiplanar imaging in the coronary, axial and sagittal planes, and the use of rotary technique allows for more accurate visualization of the vesicouterine cavity. As a consequence, this makes it possible to better study the degree of vascular invasion into the bladder. This information determines the tactics of counseling and patient management. Three-dimensional power Doppler allows for quantitative analysis: to reveal the level of neovascularization of the placenta, supplementing the data obtained with 2D ultrasound. In 2009, Shih et al., in 2017 Giuseppe Cali et al., conducted a prospective study and evaluated the comprehensive diagnosis of AIP using 3D power Doppler, 2D ultrasound and color Doppler mapping. Based on the data obtained, it is believed that the most informative diagnostic sign is the presence of chaotic vascularization with convoluted and merging vessels [15–16]. The diagnostic ability is significantly improved with the combined use of ultrasound and MRI.

However, despite this, studies conducted by Thurn L. et al. 2016, Bailit J. L., et al. 2015, showed that invasive placental disorders still remain undiagnosed before delivery in 50%, and sometimes in 2/3 of cases [17–19].

For these reasons and their consequences in terms of reducing the burden of maternal morbidity and mortality, it is important to accurately diagnose the extent of placental invasion. In most cases, optimal outcomes in AIP are achieved due to timely antenatal diagnosis [20]. However, in a number of studies it is reported that in about 70% of all cases, complications are first diagnosed during childbirth [21].

An important method for diagnosing abnormal placental invasion is ultrasound (US). According to many authors, this non-invasive and affordable diagnostic method is highly sensitive and specific [22-23]. A systematic review has shown that this imaging technique has good diagnostic accuracy in determining depth and placental topography [24]. Unified descriptive criteria have been proposed for ultrasound findings with varying degrees of placental attachment [8]. An international standardized protocol for ultrasound examination in abnormal placental attachment has been developed, taking into account a number of risk factors [3]. Since abnormal invasion of the placenta is more common when the ovum is localized in the area of the scar after a previous cesarean section, some researchers suggest conducting early ultrasound screening for patients at risk, and if the diagnosis is confirmed, termination of pregnancy in early terms to prevent severe complications for the mother and fetus [25].

The main elaborated ultrasound markers of abnormal invasion of the placenta are the presence of vascular lacunae, widened areas of the intervillous space in the suprabasal region, uneven contour of the maternal surface of the placenta, the absence of a hypoechoic zone between it and the myometrium, thinning of the myometrium and disruption of the normal vascular architectonics of the placental site [26]. However, ultrasound is an extremely subjective assessment method and mainly depends on the experience of the specialist.

Magnetic resonance imaging (MRI) is gaining importance in the differential diagnosis of various types of abnormal placental invasion. The method helps to determine the location, level, depth and blood flow in the area of invasion, with maternal obesity and posterior placentation, in doubtful cases, based on the results of ultrasound [11, 27]. To date, the main significant markers of MRI have been identified. These markers are: placental heterogeneity, increased vascular pattern, thinning of the myometrium, bulging of the uterine wall, the presence of a retroplacental "shadow", cervicotrigonal hyperplasia, the presence of vascular lacunae and dark "ribbons", as well as an assessment of the involvement of adjacent organs [28].

In recent years, to improve diagnostic accuracy, it has been recommended to use a comprehensive assessment that combines history, ultrasound and MRI data.

The main treatment for AIP is hysterectomy. This is one of the most traumatic operations, which leads to a lot of blood loss. According to V.I. Kulakov et al., 2019, this operation not only reduces the reproductive potential of a woman, but also disrupts the anatomy of the pelvic floor, and as a consequence, this is the cause of the polysystemic

syndrome. The authors analyzed the average total blood loss during hysterectomy for ingrown placenta and found that blood loss varies in a wide range, from 2000 to 7800 ml, in 90% of cases exceeding 3000 ml [29].

Hsiu-Wei Su et al., Jelena Boekhoff et al. presented their experience of conservative management of pregnant women with AIP, involving planned caesarean section in gestation term of up to 35 weeks, subject to timely diagnosis of this abnormal condition during pregnancy. Hysterectomy was performed as needed at the next stage. And those women who wanted to preserve the uterus, after adequate hemostasis, were transferred to the radiological department for further management. In the department, women underwent embolization of the uterine arteries, as well as collateral vessels, and antibiotic therapy was prescribed. Despite the fact that part of the uterus was preserved, attention is drawn to a large percentage of complications after conservative management: severe maternal morbidity, including sepsis, coagulopathy, early and late bleeding, bladder trauma, fistulas, and maternal death [30].

CASE STUDY

A 40-year-old patient L. was admitted to the Communal non-profit enterprise "City Maternity Hospital No. 1" of Kharkiv City Council (CNPE "CMH No. 1" KCC) at 38 weeks of gestation with burdened obstetric history, scar on the uterus after caesarean section, 3rd degree obesity. From the obstetric history, it is known that in 2019 she gave birth at 40 weeks by caesarean section, this was the third pregnancy of the patient. According to history data, menarche at the age of 12 years, lasting to 5 days, in 28 days, moderate, painless, regular. Somatic diseases: 1st degree hypertensive disease since 2010. Past gynecological diseases: chronic adnexitis.

She is registered with the antenatal clinic since 10 weeks of pregnancy. Pregnancy is uncomplicated. Indicators of clinical and biochemical studies are within normal limits.

During pregnancy, ultrasound examination was performed three times: at the 12th, 19th, 34th weeks.

An ultrasound scan at 12 weeks revealed the localization of the placenta along the anterior wall of the uterus without ultrasound signs of AIP. The lower edge of the placenta reached the level of the internal os of the cervix. The structure of the myometrium in the area of the postoperative scar was unremarkable.

Ultrasound examination of the placenta, located on the anterior wall of the uterus at the term of 19 weeks showed that its lower edge also reached the level of the internal os of the cervix. Placenta thickness was 19 mm, 0 degree of maturity according to the classification of Grannum P. et al., 1979. Along the anterior wall of the uterus at a distance of 39 mm above the postoperative scar, a site was visualized similar to abnormal invasion of the placenta in the form of deep penetration of chorionic villi into the myometrium up to the serous membrane (placenta increta). Of the main, elaborated US markers of abnormal placental invasion, our observation noted the absence of a hypoechoic zone

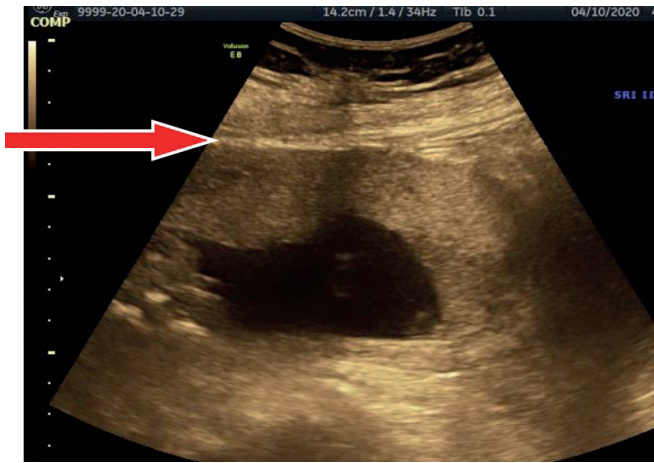


Fig. 1. Marginal placenta previa, ultrasound AIP markers: absence of a hypoechoic zone between the placenta and myometrium (left arrow)



Fig. 2. Marginal placenta previa, US AIP markers are absent: presence of a hypoechoic zone between the placenta and myometrium (arrow on the right)

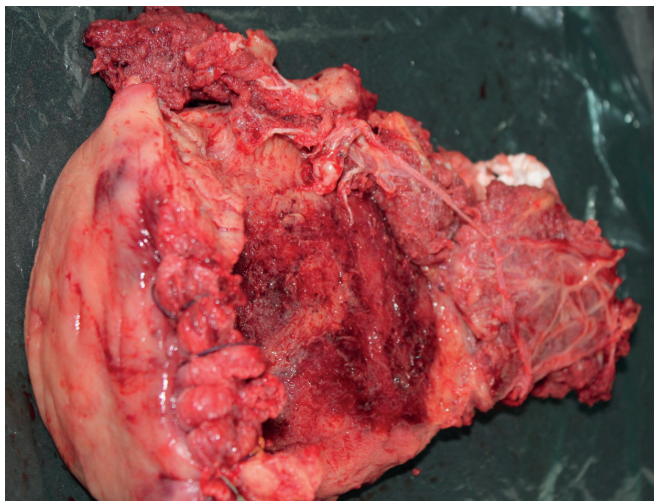


Fig. 3 Product after surgery. Anterior wall of the uterus with a site of germination of placental tissue

between the placenta and the myometrium (thinning of the myometrium) and an impairment of the normal architectonics of the vessels of the placental site. The presence of vascular lacunae, the expansion of the areas

of intervillous spaces in the suprabasal region, an uneven contour of the maternal surface of the placenta, was not revealed in our study.

For an objective comparison of ultrasound signs of the presence and absence of visualization of the presence of AIP, we present the following ultrasound scans of our patient (Fig. 1) and a 36-year-old patient M., at the same term with a marginal placenta previa, but without ultrasound signs of AIP (Fig. 2).

On ultrasound at the term of 34 weeks US signs of AIP corresponded to those at 19 weeks.

On examination at admission: the uterus is enlarged, respectively to 38 weeks of pregnancy. The position of the fetus is longitudinal, head. The presenting part is located high above the entrance to the small pelvis. The area of the postoperative scar on the uterus is painless.

Diagnosis on admission: Pregnancy of 38 weeks. Burdened obstetric history. A scar on the uterus after a cesarean section. Third degree obesity. Given the full-term pregnancy, the woman's refusal to give birth through the vaginal birth canal, it was consultatively decided to manage labor by caesarean section in a planned manner.

Pregnant L. underwent the following surgery: Laparotomy. Cesarean section. A live full-term boy weighing 4100 g, 58 cm, 8-8 points on the Apgar scale. During the operation, an area of placental ingrowth with dimensions of 8×10 cm along the anterior wall of the uterus was found. Due to confirmed true ingrowth of the placenta, the uterus was removed without adnexa. The total blood loss was 2 liters. Transfusion of erythrocyte mass and fresh frozen plasma was performed.

Description of the macro-preparation: the uterus of 25×15 cm in size, pale pink, along the anterior surface, a site of placental tissue with ingrowth is determined (Fig. 3).

Histological examination data: uterine wall with edema of muscle fibers, areas of germination of placental tissue in the myometrium.

Final diagnosis: Pregnancy at 38 weeks. Burdened obstetric history. A scar on the uterus after a cesarean section. True ingrowth of the placenta. Third degree obesity. Laparotomy. Caesarean section in the lower segment of the uterus. Removal of the uterus without adnexa. Drainage of the abdominal cavity. Excision of the old postoperative scar on the skin. Blood transfusion. Further, the puerpera L. received infusion-transfusion therapy, prevention of thromboembolic complications, antibiotic therapy in order to prevent purulent-septic complications. On the sixth day, patient L., together with the child, was discharged from the hospital in a satisfactory condition with recommendations to continue the prevention of thromboembolic complications.

CONCLUSIONS

AIP is an extremely serious condition with not fully understood etiological and pathogenic mechanisms. Correct and timely diagnosis of this abnormal condition, based on the simultaneous use of a whole complex of diagnostic studies (history, 2D, 3D, energy and color Doppler map-

ping, MRI) contributes to the development of individual tactics for the management and delivery in women with AIP, which makes it possible to reduce maternal morbidity and mortality, as well as to improve perinatal outcomes.

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ORCID and contributionship:

Liudmyla A. Vygivska: 0000-0002-9389-4845 ^{A,B,D}

Evgen V. Blagoveschenskiy: 0000-0002-0735-6515 ^{B,D,F}

Olena A. Yakovenko: 0000-0001-6604-6077 ^{B,F}

Yevheniia M. Babadzhanian: 0000-0001-7113-3917 ^{D,F}

Lesia A. Rudenko: 0000-0003-0556-8263 ^{B,E}

Kyrylo V. Yakovenko: 0000-0001-7237-8078 ^{B,E}

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CORRESPONDING AUTHOR

Liudmyla A. Vygivska

Kharkiv National Medical University

4 Prospekt Nauki, 61000 Kharkiv, Ukraine

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