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Diagnostic results of prenatal ultrasonography and placenta previa accreta following caesarean delivery: Systematic review

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ABSTRACT

This study's aim is to assess the diagnostic accuracy of ultrasound imaging in detecting placenta previa accreta in expectant mothers who already had a caesarean section. We conducted searches of Pubmed, Embase, and the Cochrane Library with the goal of gathering studies published between 2008 and 2022 that meet our eligability criteria. All authors thoroughly reviewed and assessed eight studies. The final selection consisted of three retrospective and five prospective cohort studies. These cohort studies comprised a total of 1251 pregnancies with either placenta previa or a low-lying placenta. Two authors included both low-lying and placenta previa in their screening group of women who had previously undergone a caesarean delivery. The distribution of previous caesarean deliveries among women who presented with a confirmed placenta previa accreta at delivery was described by five authors. In order to bolster the ultrasound diagnosis of accreta placentation, four authors used magnetic resonance imaging. For the diagnosis, the other authors used colour Doppler imaging. Only one author reported utilising translabial ultrasonography, compared to three who reported transvaginal ultrasound use.

Keywords: Placenta previa, placenta accreta, cesarean delivery, ultrasound, prenatal diagnosis

1. INTRODUCTION

Irving and Hertig originally described placenta accreta as the "abnormal adherence of the afterbirth in whole or in parts to the underlying uterine wall" in 1937. It is a complication of human placentation (Quinlivan, 1961). Placental villi adhere to or invade the scarred myometrium beneath when decidua basalis is absent, which is the current global histopathological

definition of placenta accreta (Jauniaux and Jurkovic, 2012). Placenta accreta is classified as placenta creta or vera when the villi adhere to the myometrium without invading it, placenta increta when the villi invade the myometrium, and placenta percreta when the villi invade through the uterine serosa (Jauniaux and Jurkovic, 2012). This classification is based on the depth of villous invasiveness into each of these three places. At delivery, the placenta fails to detach from the uterine wall normally due to abnormal adhesion or invasion. Attempts to physically remove a placenta accreta usually result in substantial haemorrhage, which raises the risk of maternal morbidity and fatality when done unnoticed at the time of birth.

There's growing evidence that traditional obstetric care is inferior to multidisciplinary intervention for patients with suspected placenta accreta (Silver, 2015). The diagnosis needs to be made before delivery in order for such care to be scheduled (Hall et al., 2014). According to recent demographic surveys, between half and two thirds of cases of accreta placentation are undetected before delivery. Thirteen Up to one-third of placenta accreta instances are not detected during pregnancy, even in cases from specialized centres (Bowman et al., 2014). A rise in caesarean deliveries is directly correlated with the occurrence of placenta accreta (Bowman et al., 2014). Placenta previa is the primary risk factor for placenta accreta following a prior caesarean delivery. The number of prior caesarean deliveries correlates with an increased risk of placenta previa and placenta accreta in subsequent pregnancies, and is higher in women who have had a previous classical caesarean delivery (Li et al., 2020). This review's primary goal is to assess how well ultrasound imaging can diagnose placenta previa accreta in pregnant women who have had a caesarean delivery in the past. We did not include in our evaluation and analysis any cases of placenta accreta that occurred after other types of uterine operations.

2. METHOD

Eligibility criteria

Articles that linked prenatal ultrasound imaging to pregnancy outcomes in women who had previously had caesarean deliveries and who presented with a placenta previa or low-lying placenta met the main eligibility requirements. Both prospective and retrospective cohort studies were included. The index test was a minimum of one ultrasound examination done during pregnancy with the express purpose of identifying placenta accreta. Histopathological inspection of placental villi directly adhering to the myometrium or infiltrating the uterine wall, or direct observation by the operating surgeon at delivery, served as the reference standard for confirmation of accreta placentation after delivery.

Search strategy and studies included

We conducted searches of Pubmed, Embase, and the Cochrane Library with the goal of gathering studies published between 2008 and 2022 that meet our eligability criteria. Overall, we collected 116 records and after removal of duplication 114 remained (Figure 1). 63 of the 114 examined records were removed because they lacked information on placenta accreta ultrasonography imaging during pregnancy. Case reports and letters that did not provide a case description were eliminated following another screening. Eight studies from the second selection were read in full, and evaluated by all authors.

Review analysis

One reviewer completed the preliminary screening to clear out duplicates and irrelevant publications. Potential papers were then chosen again after carefully assessing their abstracts and titles. At this stage, a sample of a study was assessed by each reviewer to ensure consistency and identify any instances in which the selection criteria were imprecise or confusing. Following this screening, the studies' complete texts that were still available were collected, and they were carefully assessed in comparison to the standards. All reviewers assessed each full-text manuscript. From each included study, we took the author, the year of publication, the findings, the purpose, the population characteristics, the sample size, and the outcomes.

3. RESULTS

Three retrospective and five prospective cohort studies were included in the final selection. Demonstrating the eight studies' main outcome characteristics. A total of 1251 pregnancies with PP or a low-lying placenta screen for placenta accreta were included in these cohort studies. The largest cohort study was conducted by Maher et al., (2013) including a total of 577 total PP cases. There were 220 pregnancies overall where placenta accreta caused complications. In both the retrospective and prospective cohort investigations, the incidence of placenta accreta was 17.5%. In their screening population of women who had previously had a caesarean delivery, Rac et al., (2015) and Maher et al., (2013) included both low-lying and PP. Rac et al., (2015) is the only study the placental edge being two centimetres away from the cervical os without covering it. Placenta accreta was less common in Rac et al.,

(2015) and Maher et al., (2013) where the authors distinguished between PP and low-lying placental position. Table 1 demonstrate the important characteristics of the records included in our review.

Five authors reported on the distribution of prior caesarean births among women presenting with a confirmed PPA at delivery (Calí et al., 2013; Maher et al., 2013; Mansour and Elkhyat, 2011; Fishman and Chasen, 2011; Rac et al., 2015). Four authors Fishman and Chasen, (2011), Masselli et al., (2008), Mansour and Elkhyat, (2011), Calí et al., (2013) employed magnetic resonance imaging to support the ultrasound diagnosis of accreta placentation. The other authors employed colour Doppler imaging for the diagnosis. Three authors Rac et al., (2015), Calí et al., (2013), Maher et al., (2013) reported using transvaginal ultrasound, while only one author reported using translabial ultrasound (Mansour and Elkhyat, 2011). Just one research Maher et al., (2013) with the following distribution, offered comprehensive data on the correlation between the number of prior caesarean births and the degree of villous invasion: After two caesarean deliveries, there are seven placenta increta, seven placenta creta, and eleven placenta percreta; while after more than two caesarean deliveries, there are three placenta increta, six placenta creta, and eight placenta percreta. Table 2 demonstrate the outcome characteristics of 8 cohort studies included in our review.

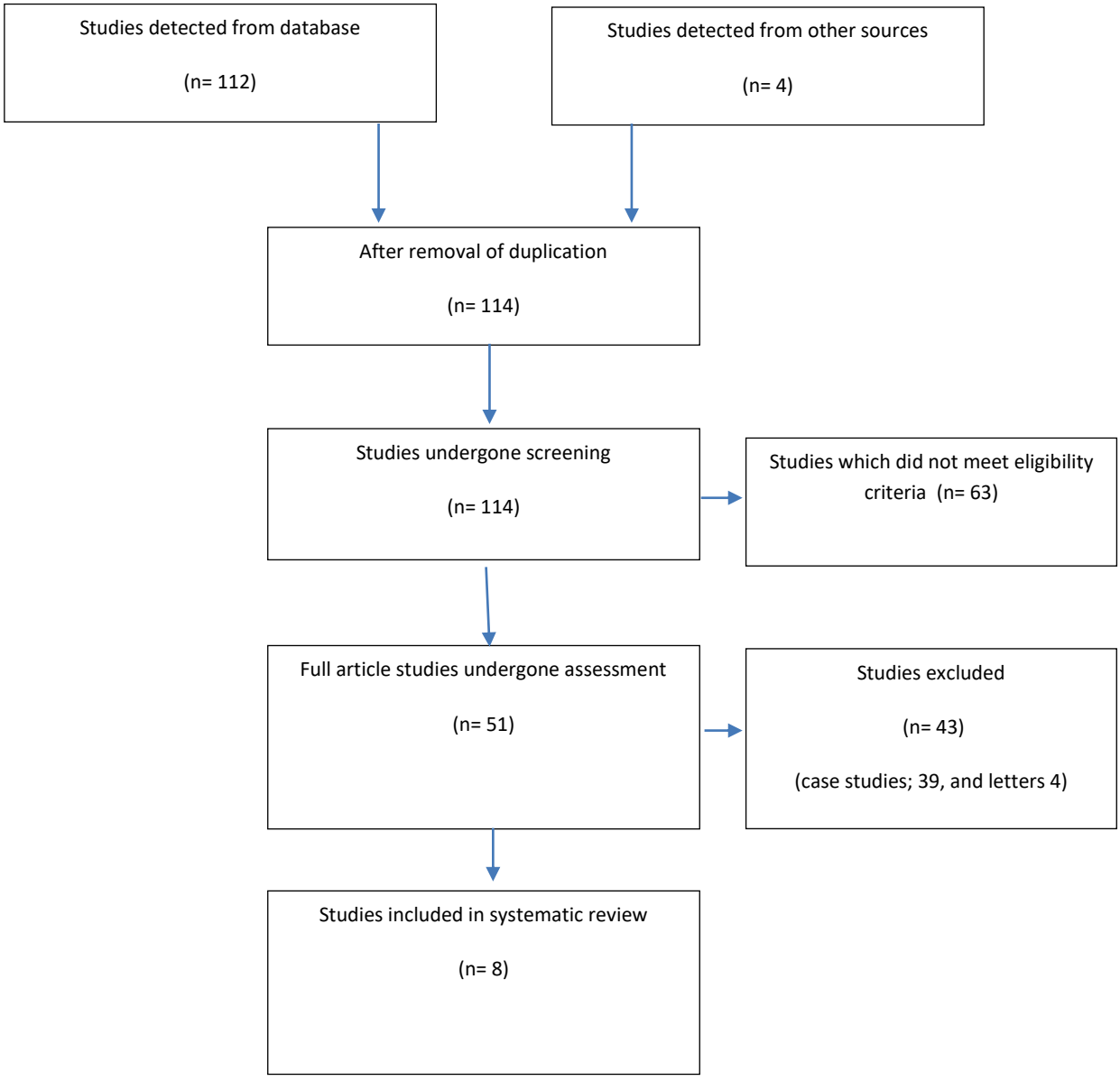

Figure 1 Consort chart of selection process

Table 1 Characteristic of included studies

Author, publication year	Study type	Study population characteristics	Study aim	Main results	Other information's
Rac et al., 2015	Retrospective	184 gravidas with at least one previous caesarean delivery who were diagnosed as PP or a low-lying placenta in the third trimester by ultrasound were included.	To use a standardized assessment of ultrasonography characteristics in a high-risk group to predict placental invasion.	Every sonographic metric was linked to placental invasion. The combination of the least lacunae, sagittal myometrial thickness, and bridging vessels, along with the frequency of caesarean births and placental placement, produced an area under the curve of 0.87 (95% CI, 0.80-0.95) when constructing a receiver operating characteristic curve.	The uterine-bladder interface's irregularity and width, the absence of the retro placental clear zone, the thinnest myometrial layer, bridging vessels, and the existence of lacunar spaces were among the parameters that were evaluated. Histologic confirmation was used to make the diagnosis of placental invasion.
Alchalabi et al., 2014	Retrospective	28.4% of the 81 PP that were found had poor adherence PP. Every morbidity adherence PP patient had a lower segment C-section performed earlier.	The purpose of the study was to evaluate the maternal morbidity and prediction of morbidly adherent PP.	The following factors are linked to higher risks of MAPP vs PP: age ≥ 35 years OR 4.3, and lower segment caesarian section (OR for each additional LSCS was 2.9). Placenta, anterior or central (OR = 11.6). Women who had had prior PP were vulnerable. Using ultrasound, fifteen women received a diagnosis (sensitivity 0.65).	The authors advise that PP patients and prior LSCS be treated in centres with the necessary resources because the diagnosis is frequently uncertain before to delivery.
Calì et al., 2013	Prospective	The study comprised 87 PP patients, a history of transabdominal and transvaginal ultrasound examinations and uterine surgery, with the purpose of early MAP identification.	To determine criteria to differentiate distinguish placenta percreta from placenta accreta, and chech the diagnostic accuracy of US for morbidly adherent placenta.	MAP was found in 41 patients' CS. Each of them had an anterior PP and undergone to previous CS at least one time (seven mild and 34 major). The sonographic criteria that were analysed demonstrated favorable diagnostic accuracy; in patients with MAP, at least two of the five criteria were identified, while in non-MAP patients, at most one of the criteria was present.	
Maher et al., 2013	Prospective	PP women or low-lying placentas. A PP diagnosis or low-lying placenta was made for 577 women. Of them, 39 were diagnosed prenatally, and 42 had placenta accreta.	To evaluate the effectiveness of MRI after ultrasonography in cases of doubt for the prenatal placenta accreta detection.	With sensitivity of 95.1% and specificity of 95.5%, ultrasound was able to predict placenta accreta in 33 out of 39 women and properly rule out placenta accreta in 512 out of 514 women who did not diagnosed as having placenta accreta. Twenty women had MRIs after ultrasonography revealed a possible placenta accreta. MRI (sensitivity of 85.7% and specificity of 76.9%) in six out of the twenty cases, in placenta accreta diagnosis.	The authors came to the conclusion that prenatal ultrasound imaging can effectively identify placenta accreta. In questionable situations, an MRI might offer more details.
Mansour	Prospective	35 gravid ladies	To ascertain	86.6% of the cases had an	Results from the caesarean

and Elkhyat, 2011		with PP underwent MRI and ultrasound before delivery.	whether MRI significantly influences the evaluation of prenatal suspicions regarding placenta accreta.	ultrasound-suggested true-positive diagnosis of accreta, while 93.3% had an MRI. In the cohort under study, 75% of the negative instances and 80% of the positive cases with placenta accreta had matching US and MRI findings. MRI and ultrasound had sensitivity and specificity of 86.6% and 80%, respectively.	section were regarded as the most reliable source of information.
Fishman and Chasen, 2011	Retrospective	The study screened 154 PP cases	To determine the risk factors for emergent preterm delivery in women who may have suspected accreta and PP.	A median of 34 weeks was delivered to 21 individuals with PP and suspected of accreta. Ten bled at less than 32 weeks, and fourteen bled before delivery. 57 percent of scheduled deliveries occurred at a median gestational age of 36.5 weeks, while emergent deliveries occurred at a gestational age of 32 weeks (P value 0.001).	The authors came to the conclusion that for women without antepartum bleeding who had ultrasound findings worrisome for placenta accreta and PP, a planned late perterm delivery is feasible and likely.
Shih et al., 2009	Prospective	This study included a prospective enrollment of 170 pregnant women who had chronic PP totalis.	To detect the diagnostic efficacy of three-dimensional Doppler in relation to gray-scale and colour Doppler ultrasonography for the placenta accreta prenatal diagnosis.	At the time of caesarean delivery, 39 patients had confirmed cases of placenta accreta and its variations. Placenta accreta diagnosis has a 97% sensitivity and a 92% specificity. On ultrasound imaging, the majority of individuals with placenta accreta displayed several distinctive characteristics. On the other hand, patients who received a false-positive diagnosis typically displayed solitary ultrasonography indicators of the illness.	The final diagnosis established during the Caesarean delivery was taken into consideration while analysing the ultrasonography results.
Masselli et al., 2008	Prospective	MRI and color Doppler ultrasonography were performed on fifty third-trimester pregnant patients who had been previously caesarean sectioned and had a PP diagnosis.	This study tried to evaluate the usefulness of magnetic resonance imaging and color Doppler pelvic ultrasonography.	While there was no statistically significant difference between MR and US Doppler in terms of identifying patients with placental adhesive disorders (P = 0.74), MRI outperformed US Doppler in terms of statistically assessing the depth of placenta infiltration (P < 0.001). In all cases, MRI accurately described the topography of invasion; in comparison, US only accurately described the topography of invasion in 75% of cases.	Authors concluded that MRI is a great tool for the staging and topographic evaluation of PAD and that pelvic US is a highly reliable method for diagnosing or ruling out the presence of PAD.

Abbreviations; CI; confidence interval, MAPP; morbidity adherence PP, ICU; intensive care unit, PP; Placenta previa, LSCS; lower segment caesarian section, DIC; disseminated intravascular coagulation, MAP; morbidity adherence placenta, CS; caesarian section, US; ultrasound, PAD; placental adhesive disorders, PPA; PP accreta

Table 2 The outcome characteristics of 8 cohort studies included in our review

Author, year of publication	Placenta accreta diagnosed at delivery	Placenta accreta diagnosed prenatally	Total PP cases included in the study	Number of Placenta accreta diagnosed at delivery	Mean or median Gestational age at diagnosis
29 Rac et al., 2015	54	49	184	54	Mean 33
28 Alchalabi et al., 2014	23	15	81	15	Not available
37 Calì et al., 2013	41	41	118	41	(16 to 36)
38 Maher et al., 2013	42	33	577	42	Mean 30
36 Mansour and Elkhyat, 2011	15	13	35	Not available	(34 to 37)
27 Fishman and Chasen, 2011	22	20	154	22	Median 34
35 Shih et al., 2009	34	34	72	34	Mean 30
34 Masselli et al., 2008	4	4	50	12	Mean 28

4. DISCUSSION

Because of the placenta's anterior position, access to the foetus during caesarean birth is frequently problematic for women with PP accreta, making an accurate prenatal diagnosis imperative. A standard low transverse uterine incision will result in dangerous blood loss even before the foetus is delivered in cases of false-negative prenatal diagnosis, making it possible for the surgeon to miss accreta placentation during delivery. Additionally false positive diagnosis of accreta placentation will result in an unneeded fundal uterine incision and midline vertical skin incision, raising uterine rupture risk and intraoperative and postoperative complications as well as placenta accreta in future pregnancies. Prenatal diagnosis of PPA must be made accurately for a multidisciplinary team to regionalize care for women in centers of specialty (Eller et al., 2011). Planning the individualized care of women diagnosed with accreta placentation can benefit from prenatal assessment of the depth of placental invasion (Chantraine et al., 2012).

Specifically, the consent procedure depends on assessing the extent of accreta invasion before to delivery, selecting the best gestational age for delivery, and organising the necessary multidisciplinary team skills for delivery. In Chantraine et al., (2012) systematic review, we discovered that certain ultrasound signs, such as placental bulge and lacunae and an exophytic focal placental mass, were more frequently linked to deeper myometrium invasion, but that no single ultrasound sign or combination of ultrasound indicators was specific of the accreta placentation depth (Chantraine et al., 2012). Eight of the nine prospective studies in the current evaluation included comprehensive data on the ultrasonography results and invasion depth, but none on the correlation between the grade of accreta placentation and the result. According to recent research by Thurn et al., (2016) hysterectomies are more frequently carried out to treat placenta accreta when the diagnosis is obtained before birth as opposed to after delivery.

According to the current analysis, approximately 90% of pregnant women with PPA undergo an elective or emergency caesarean hysterectomy. The risks of an emergency peripartum hysterectomy are closely connected to a prior caesarean delivery and are associated with significant morbidity and mortality (Van-den-Akker et al., 2016). High-risk cases are progressively being referred to tertiary care hospitals, according to recent data from the Perspective database on the risks of peripartum hysterectomy based on PP and prior caesarean delivery given in the United States between 2006 and 2014. The possible advantages of prenatal screening and PPA diagnosis on clinical outcome are also highlighted by these studies (Govindappagari et al., 2016). To increase the detection rate of PPA during the second trimester of pregnancy, the obstetric risk factors of accreta placentation should be identified and incorporated into the clinical assessment at the first antenatal visit and at the midgestation routine ultrasound screening for fetal anomalies (Saifi et al., 2023).

5. CONCLUSION

To improve the outcome of this increasingly common serious obstetric complication at the national and international levels, guidelines for screening for placenta previa accreta in women who have had past caesarean deliveries and present with either a low-lying placenta or a placenta previa must be developed. Sonographers doing standard midtrimester detailed foetal anatomy

ultrasound examinations should get general training that includes skills and expertise in identifying the key ultrasonography indicators of accreta placentation.

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Ethical approval
Not applicable.

Conflict of interest
The authors declare that there is no conflict of interests.

Data and materials availability
All data sets collected during this study are available upon reasonable request from the corresponding author.

REFERENCES AND NOTES

1. Alchalabi H, Lataifeh I, Obeidat B, Zayed F, Khader YS, Obeidat N. Morbidly adherent placenta previa in current practice: prediction and maternal morbidity in a series of 23 women who underwent hysterectomy. J Matern Fetal Neonatal Med 2014; 27(17):1734-7. doi: 10.3109/14767058.2013.879700
2. Bowman ZS, Eller AG, Bardsley TR, Greene T, Varner MW, Silver RM. Risk factors for placenta accreta: a large prospective cohort. Am J Perinatol 2014; 31(9):799-804. doi: 10.1055/s-0033-1361833
3. Calì G, Giambanco L, Puccio G, Forlani F. Morbidly adherent placenta: evaluation of ultrasound diagnostic criteria and differentiation of placenta accreta from percreta. Ultrasound Obstet Gynecol 2013; 41(4):406-12. doi: 10.1002/uog.12385
4. Chantraine F, Nisolle M, Petit P, Schaaps JP, Foidart JM. Individual decisions in placenta increta and percreta: a case series. J Perinat Med 2012; 40(3):265-70. doi: 10.1515/jpm-2011-0156
5. Eller AG, Bennett MA, Sharshiner M, Masheter C, Soisson AP, Dodson M, Silver RM. Maternal morbidity in cases of placenta accreta managed by a multidisciplinary care team compared with standard obstetric care. Obstet Gynecol 2011; 117(2 Pt 1):331-337. doi: 10.1097/AOG.0b013e3182051db2
6. Fishman SG, Chasen ST. Risk factors for emergent preterm delivery in women with placenta previa and ultrasound findings suspicious for placenta accreta. J Perinat Med 2011; 39(6):693-6. doi: 10.1515/jpm.2011.086
7. Govindappagari S, Wright JD, Ananth CV, Huang Y, D'Alton ME, Friedman AM. Risk of Peripartum Hysterectomy and Center Hysterectomy and Delivery Volume. Obstet Gynecol 2016; 128(6):1215-1224. doi: 10.1097/AOG.0000000000001722
8. Hall T, Wax JR, Lucas FL, Cartin A, Jones M, Pinette MG. Prenatal sonographic diagnosis of placenta accreta--impact on maternal and neonatal outcomes. J Clin Ultrasound 2014; 42(8):449-55. doi: 10.1002/jcu.22186
9. Jauniaux E, Jurkovic D. Placenta accreta: pathogenesis of a 20th century iatrogenic uterine disease. Placenta 2012; 33(4):244-51. doi: 10.1016/j.placenta.2011.11.010
10. Li XF, Wu J, Zhou Y, Zhao XL. [Clinical analysis of 12 cases of spontaneous uterine rupture caused by placenta percreta]. Zhonghua Fu Chan Ke Za Zhi 2020; 55(10):691-696. Chinese. doi: 10.3760/cma.j.cn112141-20200430-00373
11. Maher MA, Abdelaziz A, Bazeed MF. Diagnostic accuracy of ultrasound and MRI in the prenatal diagnosis of placenta accreta. Acta Obstet Gynecol Scand 2013; 92(9):1017-22. doi: 10.1111/aogs.12187
12. Mansour M, Elkhyat W. Placenta previa – accreta: Do we need MR imaging. EJRNM 2011; 42:433-442. doi: 10.1016/j.ejrnm.2011.09.002
13. Masselli G, Brunelli R, Casciani E, Polettini E, Piccioni MG, Anceschi M, Gualdi G. Magnetic resonance imaging in the evaluation of placental adhesive disorders: correlation with color Doppler ultrasound. Eur Radiol 2008; 18(6):1292-9. doi: 10.1007/s00330-008-0862-8
14. Quinlivan WL. Placenta previa accreta. JAMA 1961; 176(12):1035–1036. doi: 10.1001/jama.1961.63040250018020
15. Rac MW, Dashe JS, Wells CE, Moschos E, McIntire DD, Twickler DM. Ultrasound predictors of placental invasion: the Placenta Accreta Index. Am J Obstet Gynecol 2015; 212(3):343.e1-7. doi: 10.1016/j.ajog.2014.10.022
16. Saifi I, Gupta RG, Kashikar SV, Reddy GN, Nagendra V. Early antenatal sonographic assessment of Type III Congenital Pulmonary Airway Malformation. Medical Science 2023; 27: e312ms2982. doi: 10.54905/disssi/v27i137/e312ms2982

17. Shih JC, Palacios Jaraquemada JM, Su YN, Shyu MK, Lin CH, Lin SY, Lee CN. Role of three-dimensional power Doppler in the antenatal diagnosis of placenta accreta: comparison with gray-scale and color Doppler techniques. Ultrasound Obstet Gynecol 2009; 33(2):193-203. doi: 10.1002/uog.6284
18. Silver RM, Fox KA, Barton JR, Abuhamad AZ, Simhan H, Huls CK, Belfort MA, Wright JD. Center of excellence for placenta accreta. Am J Obstet Gynecol 2015; 212(5):561-8. doi: 10.1016/j.ajog.2014.11.018
19. Thurn L, Lindqvist PG, Jakobsson M, Colmorn LB, Klungsoyr K, Bjarnadóttir RI, Tapper AM, Børdahl PE, Gottvall K, Petersen KB, Krebs L, Gissler M, Langhoff-Roos J, Källen K. Abnormally invasive placenta-prevalence, risk factors and antenatal suspicion: results from a large population-based pregnancy cohort study in the Nordic countries. BJOG 2016; 123(8):1348-55. doi: 10.1111/1471-0528.13547
20. Van-den-Akker T, Brobbel C, Dekkers OM, Bloemenkamp KWM. Prevalence, Indications, Risk Indicators, and Outcomes of Emergency Peripartum Hysterectomy Worldwide: A Systematic Review and Meta-analysis. Obstet Gynecol 2016; 128(6):1281-1294. doi: 10.1097/AOG.0000000000001736