

Role of Placenta Accreta Index in Patients with Placenta Previa with Previous Cesarean: A Prospective Study

Ankita Mathur¹, Lata Rajoria², Aditi Bansal³, Sunita Hemani⁴, Jyotsna Vyas⁵

ABSTRACT

Objective: This study intends to assess the role of placenta accreta index (PAI) score as a prenatal diagnostic tool for abnormally invasive placenta in cases of placenta previa with a history of prior cesarean.

Study design: This is a prospective, noninvasive, and observational study.

Setting: This study was conducted in a hospital based in Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur, Rajasthan (India).

Sample size and population: Eighty pregnant females presenting at or above 28 weeks of gestation with placenta previa and a history of one or more prior cesarean.

Materials and methods: Cases underwent ultrasonography to find out PAI score (published in *American Journal of Obstetrics and Gynecology* 2014), and findings were analyzed statistically to find out appropriate cutoff value of PAI score. They were correlated with magnetic resonance imaging (MRI) and operative finding, while confirming the diagnosis histopathologically.

Main outcome measures: Primary outcome was the cutoff value and diagnostic efficacy of PAI score. Secondary outcomes were fetomaternal outcomes in cases.

Results: Severity of placenta accreta increased with increasing value of PAI score. On plotting receiver operating characteristic (ROC) curve, the area under curve (AUC) was found to be 0.958 with a cutoff value of >2. The sensitivity, specificity, positive predictive value, and negative predictive value of PAI score were found to be 92.86, 94.74, 95.10, and 92.30%, respectively.

Conclusion: Placenta accreta index score can be a useful tool to anticipate individual patient risk, and a higher PAI score is a strong indicator of placenta accreta.

Tweetable abstract: Placenta accreta index score can be used as an ultrasonographic prenatal diagnostic tool for placenta accreta.

Keywords: Accreta, Adherent placenta, High risk pregnancy, Increta, Obstetric emergency, Placenta accreta index score, Percreta, Postpartum hemorrhage, Previous cesarean, Ultrasound score.

Journal of South Asian Federation of Obstetrics and Gynaecology (2019); 10.5005/jp-journals-10006-1738

INTRODUCTION

Placenta accreta is a clinical condition when part of the placenta or the entire placenta invades the uterine wall and is inseparable from it.¹ Patients with placenta previa and prior cesarean sections have been shown to have an increased risk of placenta accreta based on a retrospective data analysis.² The types of placenta accreta based on the depth of invasion are placenta accreta vera (a partial but not full-thickness invasion into the myometrial layer), placenta increta (full-thickness myometrial invasion without penetration through the serosa layer), and placenta percreta (placental invasion through the uterine serosa). It is the commonest causes of peripartum emergency hysterectomy (51.1%)^{3,4} and has been reported to cause 60% maternal morbidity and 7% mortality.^{5,6} The current widespread use of imaging modalities in obstetrics has greatly advanced our ability to diagnose and manage abnormal obstetric bleeding. Considering the importance of antenatal diagnosis of abnormally invasive placenta, Rac et al.⁷ derived the placenta accreta index (PAI) score which was a 9-point score to improve the accuracy of accreta diagnosis. Ultrasound factors were developed using a linear regression modeling, multiparametric analysis, and receiver operating characteristic (ROC) curve modeling to improve the prediction of abnormal placental invasion (Table 1).

The objectives of the study were to assess PAI score among cases of placenta previa with prior cesarean delivery and identification of cases of placenta accreta so as to find out appropriate cutoff of

¹Department of Obstetrics and Gynecology, SMS Medical College and Attached Hospital, Jaipur, Rajasthan, India

²⁻⁵Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur, Rajasthan, India

Corresponding Author: Ankita Mathur, Department of Obstetrics and Gynecology, SMS Medical College and Attached Hospital, Jaipur, Rajasthan, India, Phone: +91 9929371006, e-mail: 1992anki@gmail.com

How to cite this article: Mathur A, Rajoria L, Bansal A, et al. Role of Placenta Accreta Index in Patients with Placenta Previa with Previous Cesarean: A Prospective Study. *J South Asian Feder Obst Gynae* 2019;11(6):363–367.

Source of support: Nil

Conflict of interest: None

PAI score for early diagnosis of placenta accreta and its utility in predicting fetomaternal outcomes.

MATERIALS AND METHODS

It was a hospital-based descriptive type of observational study conducted prospectively in the Department of Obstetrics and Gynaecology in collaboration with the Department of Radiology and Department of Pathology, SMS Medical College, Jaipur, from

Table 1: Placenta accreta index* (*American Journal of Obstetrics and Gynecology*—October 2014)

Parameter	Value
(1) 2 or more cesarean deliveries	3.0
(2) Lacunae**	
Grade II	1.0
Grade III	3.5
(3) Smallest SMT	
<1 mm	1.0
>1 to ≤3 mm	0.5
>3 to ≤6 mm	0.25
(4) Anterior placenta previa	1.0
(5) Bridging vessels	0.5

*If a parameter is absent, value is 0, and maximum score is 9

**Lacunar grading (according to Finberg and Williams¹¹)

0, none seen; 1–1 to 3 small lacunae; 2–4 to 6 large irregular lacunae; 3, multiple bizarre diffuse lacunae

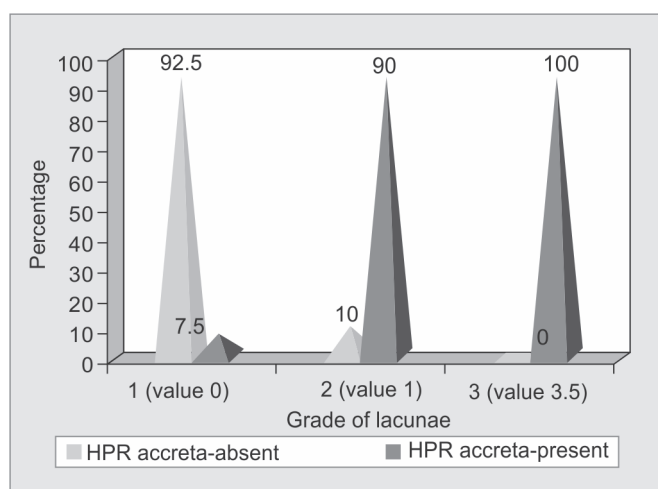


Fig. 1: Distribution of cases according to the number of previous cesarean

April 2017 to November 2018. Eighty pregnant females with a period of gestation ≥ 28 weeks and a history of previous one or more cesarean arriving at the antenatal clinic or presenting with bleeding per vaginam underwent transabdominal sonography (TAS). Pregnant women with multifetal gestation, known coagulation disorders, and fetal distress requiring immediate emergency cesarean were excluded from the study. A thorough history was taken. General physical and obstetric examinations were performed. After taking a written informed consent to participate in the study, the pregnant females underwent ultrasonography to find out factors in favor of placenta accreta and to calculate the PAI score. Follow-up was done till 37 weeks of gestation (asymptomatic) or till termination (symptomatic). All patients underwent magnetic resonance imaging (MRI). Findings were correlated with that of ultrasonography (USG) and later with the operative findings. Basis of confirmation of placenta accreta cases was histopathological report. Findings were analyzed statistically to find out an appropriate cutoff value of PAI score, and fetomaternal outcomes were observed (Flowchart 1).

Flowchart 1: Flow diagram of the study

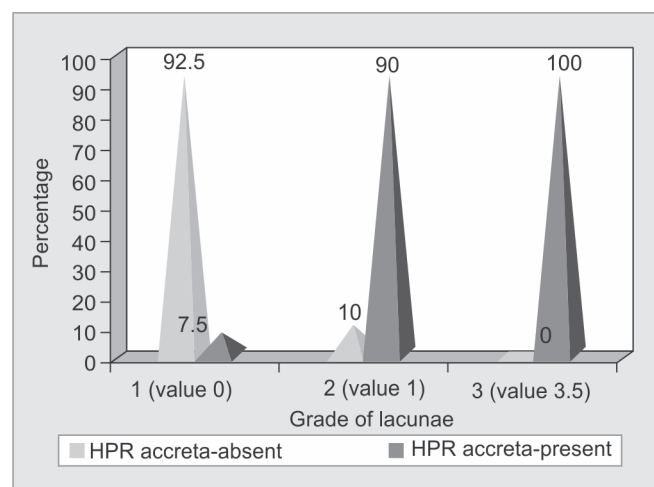
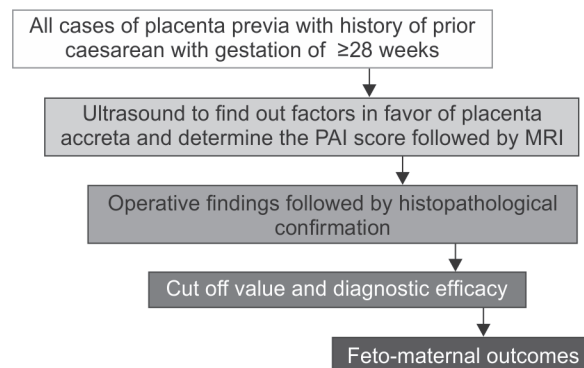


Fig. 2: Distribution of cases according to the grade of lacunae

RESULTS

Figure 1 suggests that as the number of prior cesarean increases, the risk of placenta accreta also increases. All cases with previous three and previous four cesareans were diagnosed with placenta accreta in this study ($p < 0.05$, significant).

Figure 2 suggests that the presence of lacunae acts as a risk factor for placenta accreta as increasing grade of lacunae is associated with more risk. In our study, all 30 patients with grade III lacunae were diagnosed with placenta accreta ($p < 0.05$, significant).

Figure 3 shows that sonographic finding of low retroplacental sagittal myometrial thickness (SMT) is a risk factor for placenta accreta. In our study, mean retroplacental SMT in cases with placenta accreta and without accreta was 2.82 ± 2.99 mm and 4.69 ± 1.34 mm, respectively. All those with $SMT \leq 1$ mm were diagnosed with placenta accreta ($p < 0.05$, significant).

Figure 4 suggests that there is a positive association of placenta accreta with anterior placenta previa as 60% of such cases showed placenta accreta, while 30% with posterior placenta previa were diagnosed as accreta ($p < 0.05$, significant).

Figure 5 suggests that the presence of bridging vessels acts as a sonographic marker of placenta accreta, and in our study, all those with the presence of bridging vessels were confirmed with placenta accreta ($p < 0.05$, significant).

Figure 6 shows that on plotting ROC curve for different values of PAI score to predict placenta accreta, the area under curve (AUC)

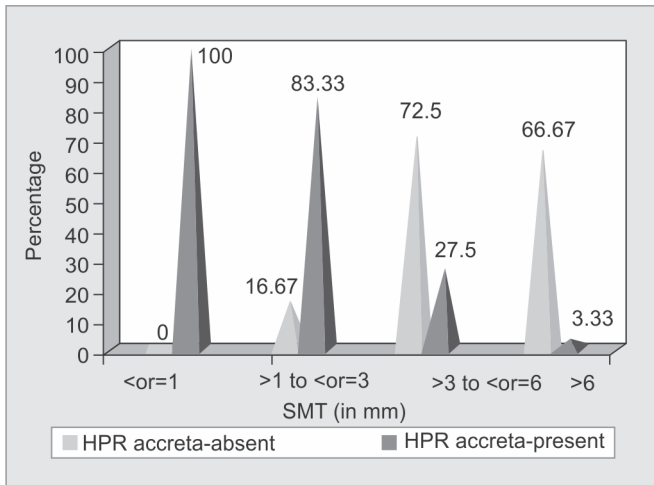


Fig. 3: Distribution of cases according to the retroplacental smallest sagittal myometrial thickness

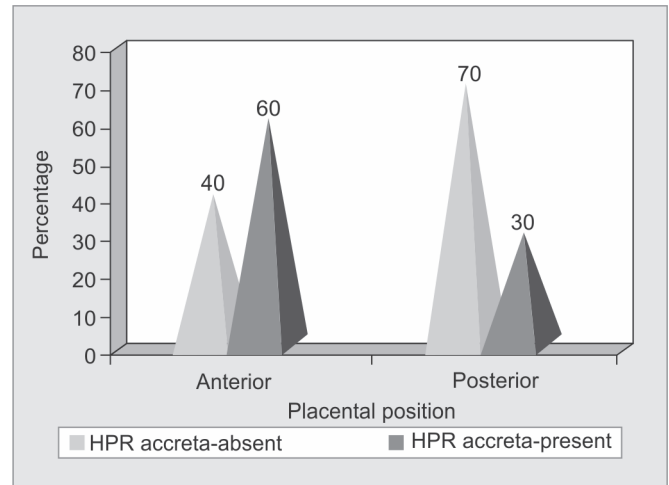


Fig. 4: Distribution of cases according to the placental position

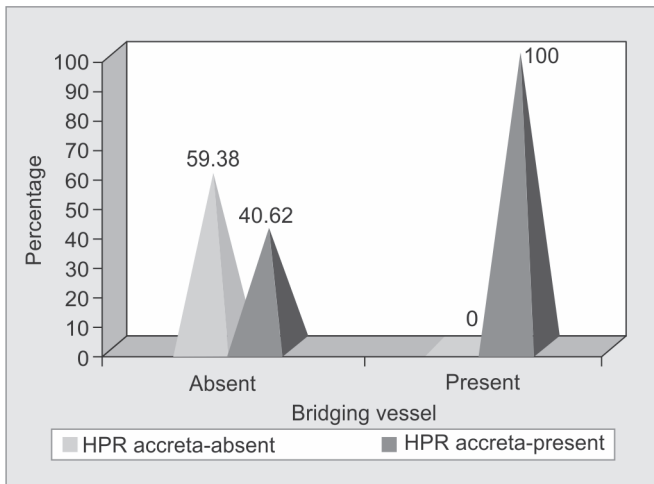


Fig. 5: Distribution of cases according to the presence of bridging vessel

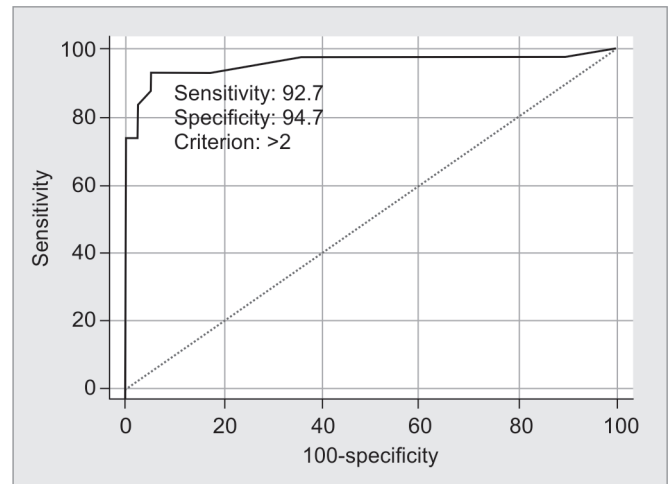


Fig. 6: Receiver operating characteristic curve for the prediction of placental invasion using different values of placenta accreta index score

Table 2: Diagnostic efficacy of placenta accreta index score, clinical suspicion, and magnetic resonance imaging

Diagnostic modality	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
PAI score (>2)	92.86	94.74	95.12	92.31
95% CI	80.52–98.50	82.25–99.36	83.47–99.40	79.13–98.38
MRI	66.67	100.00	100.00	73.08
95% CI	50.45–80.43	90.75–100.00	87.66–100.00	58.98–84.43
Operative	100.00	100.00	100.00	100.00
95% CI	91.59–100.00	90.75–100.00	91.59–100.00	90.75–100.00

CI, confidence interval

was found to be 0.958 with a cutoff value of >2 (value with maximum sensitivity and specificity).

Table 2 suggests that more cases with placenta accreta were diagnosed by PAI score as compared with MRI *per se*.

Figure 7 shows that as the depth of invasion increases, the value of PAI score also increases, and higher scores are predictive of severity of invasion.

Figure 8 shows that as the number of previous cesarean increases, the value of PAI score also increases proportionately increasing the risk of placenta accreta.

Figure 9 shows that with increasing number of cesareans, probability and severity of invasion of placenta also increase.

Table 3 shows that on comparing the intraoperative findings, it was found that mean operative time, amount of blood loss, bladder injury or involvement, and requirement of hysterectomy was found more in cases of accreta with a PAI score of more than two.

On comparing the maternal outcomes, it was found that mean fall in hemoglobin, packed red cell transfusion, days of hospital stay, and maternal deaths were found more in cases of accreta with a PAI

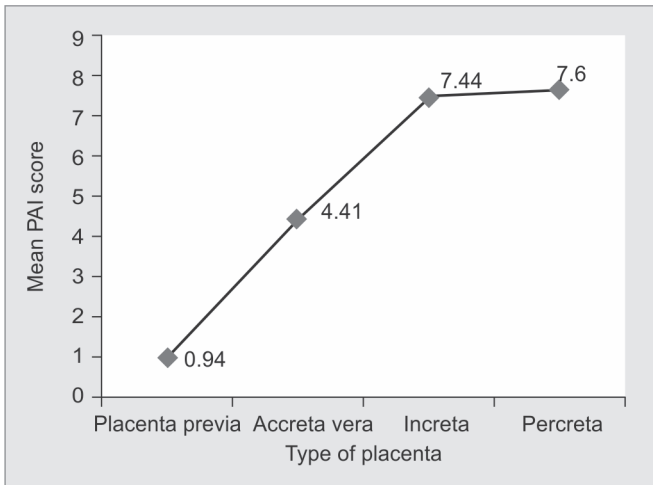


Fig. 7: Mean placenta accreta index score in different types of placenta

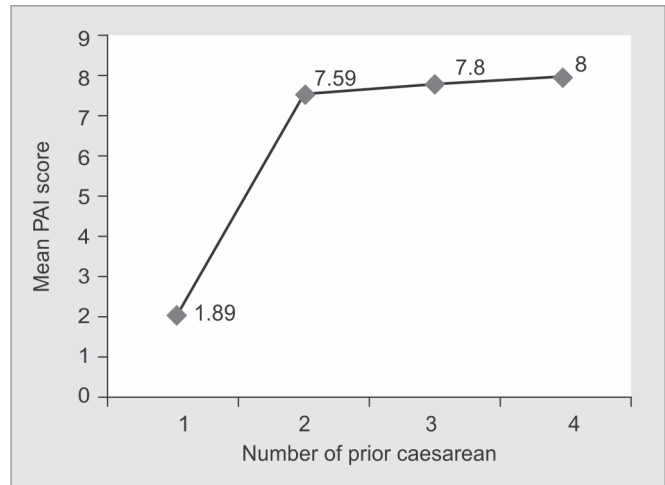


Fig. 8: Mean placenta accreta index score with respect to the number of prior caesarean

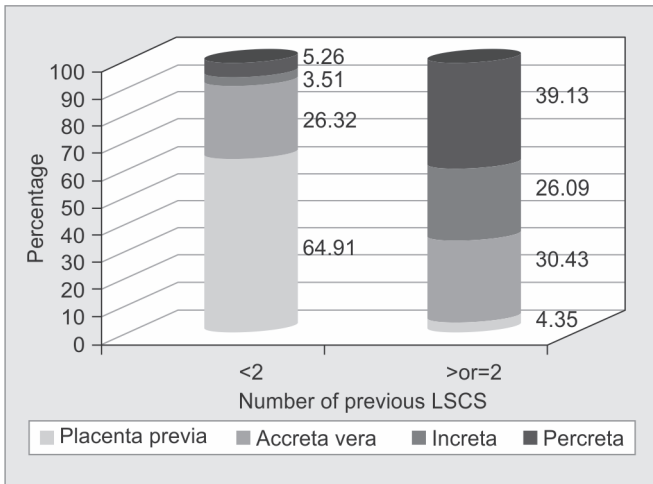


Fig. 9: Association of number of previous lower segment caesarean section and type of placenta

score more than two. Two cases died out of 42 cases of placenta accreta due to catastrophic hemorrhage.

However, neonatal outcomes were comparably equal in both the groups, suggesting that most of the neonatal morbidity is due to iatrogenic prematurity and not placenta accreta *per se*.

DISCUSSION

Findings

Our study shows that parameters used in PAI score are predictive of placenta accreta (Figs 1 to 5). The risk of placenta accreta increases with the number of prior cesareans, lacunar grading, decreasing SMT, anterior placenta previa, and presence of bridging vessels. In a study conducted by Rac et al.,⁷ individual predictive value of each ultrasound parameter of morbidly adherent placenta was derived. Grade III lacunae and >1 prior caesarean delivery were weighted the highest as estimated by the regression equation.

On plotting ROC in our study, the AUC was found to be 0.958 with a cutoff value of >2. Rac et al.⁷ derived PAI but did not give any cutoff value of PAI score. In a study conducted by Samosir et al.,⁸ AUC was found to be 0.9, and a cutoff value of ≥ 3.125 was given. Also, in a study conducted by Nelson et al.,⁹ AUC was found to be 0.794, and a cutoff value of ≥ 4 was given for PAI score.

Table 3: Intraoperative findings and fetomaternal outcomes

Outcomes	PAI < 2	PAI > 2
Mean operative time (min)	59.21 ± 6.93	113.93 ± 22.73
Mean blood loss (mL)	1210.53 ± 172.09	2459.52 ± 925.53
Bladder injury/involvement	1	13
Hysterectomy	0	20
Mean preoperative vs post-operative hemoglobin (g/dL)	9.9 ± 0.75 vs 8.98 ± 0.8	10.02 ± 0.9 vs 7.51 ± 1.33
Mean units of packed red cell transfused	0.24 ± 0.59	3.43 ± 1.5
Postoperative hospital stay (in days)	6.1 ± 3.98	9.02 ± 4.53
Maternal deaths	0	2
Preterm births (%)	89.47%	85.71%
IUFD	2.63%	2.38%
Mean APGAR score	6.13 ± 1.46	6.33 ± 1.66
Mean birth weight (kg)	2.23 ± 0.56	2.34 ± 0.55
NICU admission	23.68%	26.19%

IUFD, intrauterine fetal death; NICU, neonatal intensive care unit

The sensitivity, specificity, positive predictive value, and negative predictive value of PAI score were found to be 92.86, 94.74, 95.10, and 92.30%, respectively. In the study conducted by Nelson et al.,⁹ sensitivity, specificity, positive predictive value, and negative predictive value of PAI score were found to be 60, 100, 100, and 55%, respectively. Samosir et al.⁸ found that the sensitivity, specificity, positive predictive value, and negative predictive value of PAI score were found to be 70, 81.80, 77.8, and 75%, respectively.

Satija et al.¹⁰ concluded that MRI and sonography are complementary, and none of them is superior to other in diagnosing placenta accreta. Our study shows that PAI score is superior to MRI.

Strength of This Study

Most of the studies on placenta accreta are retrospective, but our study is prospective. Also, myth regarding MRI being the modality of choice for placenta accreta is challenged. Our study has concluded that PAI score is an ultrasonography-based multiparametric score which is time-saving, cost-effective, and more accurate than MRI.

Limitation of this Study

Pregnant females underwent transabdominal instead of transvaginal sonography in our study. However, no other study directly compares the diagnostic efficacy of both modalities in setting of suspected placental invasion, but transvaginal sonography allows more complete evaluation of lower uterine segment. Transabdominal sonography as done in our study may theoretically affect the predictive value of PAI score.

According to various studies, anomaly scan at 18–20 weeks is the ideal time to screen for placenta accreta. Our study included women at a later gestation, i.e., term pregnancy.

Interpretation

Placenta accreta index score can be a useful tool to anticipate individual patient risk, and a higher PAI score is a strong indicator of placenta accreta. It has been found to be more effective than MRI.

CONCLUSION

Placenta accreta is an obstetric emergency, and there is a strong association between placenta previa, placenta accreta, and prior cesarean section. Prenatal diagnosis is essential in planning the delivery to reduce the risk of bleeding and possible complications.

Thus, using PAI score as a predictive score will allow multi-disciplinary planning and timely intervention to reduce overall morbidity and mortality associated with abnormally invasive placenta.

CONTRIBUTION TO AUTHORSHIP

Ankita Mathur, Lata Rajoria, and Aditi Bansal contributed to study concept, design, and defining intellectual concept. Literature was searched by Ankita Mathur, Aditi Bansal, and Sunita Hemani. Clinical study and data acquisition were done by Ankita Mathur and Jyotsna Vyas. Statistical analysis was done by Ankita Mathur, Aditi Bansal, and Jyotsna Vyas with the help of statistician. Manuscript preparation and editing were done by Ankita Mathur, Lata Rajoria, and Sunita Hemani.

DETAILS OF ETHICS APPROVAL

This study was approved by Ethical Committee, SMS Medical College, and Attached Hospitals, Jaipur (No. 184/MC/EC/2019), on July 7, 2018.

REFERENCES

1. Hughes EC, ed. *Obstetric-gynecologic terminology: with section on neonatology and glossary on congenital anomalies*. Philadelphia (PA): F.A. Davis; 1972.
2. Silver RM, Landon MB, Rouse DJ, et al. Maternal morbidity associated with multiple repeat cesarean deliveries. *Obstet Gynecol* 2006;107(6):1226–1232. DOI: 10.1097/01.AOG.0000219750.79480.84.
3. Daskalakis G, Anastasakis E, Papantoniou N, et al. Emergency obstetric hysterectomy. *Acta Obstet Gynecol Scand* 2007;86(2):223–227. DOI: 10.1080/00016340601088448.
4. Orbach A, Levy A, Wiznitzer A, et al. Peripartum cesarean hysterectomy: critical analysis of risk factors and trends over the years. *J Matern Fetal Neonatal Med* 2011;24(3):480–484. DOI: 10.3109/14767058.2010.501128.
5. Sumigama S, Itakura A, Ota T, et al. Placenta previa increta/percreta in Japan: a retrospective study of ultrasound findings, management and clinical course. *J Obstet Gynaecol Res* 2007;33(5):606–611. DOI: 10.1111/j.1447-0756.2007.00619.x.
6. Eller AG, Porter TF, Soisson P, et al. Optimal management strategies for placenta accreta. *BJOG* 2009;116(5):648–654. DOI: 10.1111/j.1471-0528.2008.02037.x.
7. Rac MWF, Dashe JS, Wells CE, et al. Ultrasound predictors of placental invasion: the placenta accreta index. *Am J Obstet Gynecol* 2015;212(3):343.e1–343.e7. DOI: 10.1016/j.ajog.2014.10.022.
8. Samosir SM, Irianti S, Tjahyadi D. Diagnostic tests of placenta accreta index score (PAIS) as supporting prenatal diagnosis and outcomes of maternal neonatal in abnormally invasive placenta management at general hospital of Hasan Sadikin Bandung. *Int J Reprod Contracept Obstet Gynecol* 2017;6(9):3765–3769. DOI: 10.18203/2320-1770.ijrcog20173666.
9. Nelson T, Chang E, Goodier C, et al. Validation of the placenta accreta index (PAI): improving the antenatal diagnosis of the morbidly adherent placenta. *AJOG* 2017;216(1):S133–S134. DOI: 10.1016/j.ajog.2016.11.114.
10. Satija B, Kumar S, Wadhwa L, et al. Utility of ultrasound and magnetic resonance imaging in prenatal diagnosis of placenta accreta: a prospective study. *Indian J Radiol Imaging* 2015;25(4):464–470. DOI: 10.4103/0971-3026.169456.
11. Finberg HJ, Williams JW. Placenta accreta: prospective sonographic diagnosis in patients with placenta previa and prior cesarean section. *J Ultrasound Med* 1992;11(7):333–343. DOI: 10.7863/jum.1992.11.7.333.