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THE DIAGNOSTIC METHODS OF PLACENTA ACCRETA SPECTRUM DISORDERS

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ABSTRACT

Placenta Accreta Spectrum Disorder (PASD) is abnormal trophoblast invasion of part or all the placenta into the myometrium of the uterine wall. Magnetic resonance imaging (MRI) examination is one of the tools that can help diagnosing PASD earlier, so that maternal morbidity and mortality can be reduced. This study aims to determine the prevalence, risk factors of PASD and the accuracy of Placenta Accreta Index Score (PAIS) and MRI, with histopathological examination in diagnosing PASD at dr. Mohammad Hoesin General Hospital (RSMH) Palembang during the 2018–2021. A descriptive study with a survey design on pregnant and intrapartum women with suspected PASD was performed at Department of Obstetrics and Gynecology at RSMH Palembang from 2018 until 2021. The association between the independent and dependent variables was analyzed using Chi Square and Fisher Exact. The cut-off point of the PAIS scores was analyzed using the Receiver Operating Curve (ROC). From 72 subjects, 60 subjects (83.3%) were PASD and 12 subjects (16.7%) were not PASD. The risk factors of PASD in this study was surgical history more than once (PR = 4.600 (95% CI 1.261–16.781); p = 0.037). Youden Index values and PAIS accuracy were 0.782 and 0.953 while Youden Index values and MRI accuracy were 0.333 and 0.886.
Conclusion: PAIS and MRI could be considered as diagnostic tools for PASD. However, overall, PAIS had a better diagnostic value than MRI.

Keywords: Placenta accreta spectrum disorder, MRI, PAIS

1. INTRODUCTION

Placenta Accreta Spectrum Disorder (PASD) is abnormal trophoblast invasion of part or all the placenta into the myometrium from the uterine wall. PASD itself refers to abnormal placental implantation in which the placenta is abnormally attached to the uterus and the chorionic villi is in direct contact with the myometrium without a decidua.[1-4] Maternal morbidity and mortality can occur due to severe and sometimes life-threatening bleeding, requiring blood transfusion. The mortality rate increased in mothers with PASD. In addition, patients with PASD are more likely to require procedures such as hysterectomy at the time

of delivery or during the postpartum period and the hospital stay becomes longer. Other additional examinations, such as ultrasound (USG) and magnetic resonance imaging (MRI), are one of the tools which can be used to diagnose PASD. With an earlier diagnosis, maternal morbidity and mortality can decrease.[1,5-7]

Patients at high risk of PASD should be screened by ultrasound and referred to a specialist for observation. The findings on ultrasound should be followed by an MRI examination. MRI can help to establish the diagnosis, especially to determine the stage of placental invasion which helps doctors in considering surgery.[5,8] One of the indicators to assess PASD is using the Placenta Accreta Index Score. PASD cannot be spontaneously delivered and is often accompanied by uncontrolled bleeding. The deeper the invasion of the placenta and the larger the area of accreta within the uterine wall is, the higher the risk of bleeding is. It is directly proportional to the risk of an emergency hysterectomy. The probability of invasion increases with increasing Placenta Accreta Index Score (PAIS), so a score of more than 8 increases the probability of histological placental invasion as many as 96%.[9-12] This study aims to determine the incidence and risk factors for PASD and analyze the accuracy of PAIS and MRI, with histopathological results to diagnose PASD at RSMH Palembang during the 2018–2021 period.

2. METHOD

This study is a descriptive study with a survey design. The independent variables in the study were residence, education, maternal age, occupation, history of uterine surgery, comorbid, gravid, gestational age, surgical complications, or maternal outcomes, while the dependent variables were PAIS and MRI examination. Primary data were taken from pregnant women who did antenatal care at the Maternal-Fetal-Medicine outpatient clinic and emergency room of RSMH Palembang. Moreover, secondary data were taken from medical records. PAIS was obtained by assessing the number of Caesarean sections, intraplacental lacunae, myometrial thickness, placental location, and bridging vessels. The total parameter score is 0–9 and gives a predictive value of 2–96%.

The research was conducted at Department of Obstetrics and Gynecology RSMH Palembang during 2018–2021. There were 72 study subjects who met the inclusion criteria. The association between the independent and the dependent variables was analyzed using Chi Square and Fisher Exact. The cut-off point of the PAIS scores was analyzed using the Receiver Operating Curve (ROC).

3. RESULT

PASD Prevalence

In this study, the prevalence of accreta from all pregnant women in 2018–2021 was 0.08%, respectively (2 of 2,424 pregnant women); 0.21% (4 of 1,910 pregnant women); 1.72% (23 of 1,336 pregnant women) and 2.8% (36 of 1,285 pregnant women). In addition, the prevalence of PASD from all pregnant women who were delivered by cesarean section (CS) in 2018–2021 was 0.19% in a row (2 of 1,043 pregnant women with CS); 0.46% (4 of 872 pregnant women with CS); 2.38% (23 of 966 pregnant women with CS) and 4.18% (36 of 861 pregnant women with CS). There was an increase in the prevalence of PASD every year both in pregnant women as a whole or pregnant women who were delivered by CS.

Table 1. The Characteristics of Study Subjects

Characteristic	PASD		p value
	Yes (n = 60)	No (n = 12)	
Age, n (%)			
• 20–30 years old	10 (16.7)	1 (8.3)	0.586[a]
• 31–40 years old	48 (80.0)	10 (83.3)	
• > 40 years old	2 (3.3)	1 (3.3)	
Age, Mean ± SD	33.88 ± 4.22	35.9 ± 3.60	0.149[b]
Residence, n (%)			
• Outside Palembang	26 (43.3)	3 (25.0)	0.338[c]
• Palembang	34 (56.7)	9 (75.0)	
Education, n (%)			
• Primary School	2 (3.3)	0 (0)	0.809[a]
• Junior High School	2 (3.3)	0 (0)	
• Senior High School	31 (51.7)	6 (50.0)	
• College	25 (41.7)	6 (50.0)	
Occupation, n (%)			
• Private employee	54 (90.0)	10 (83.3)	0.613[c]
• Civil servant	6 (10.0)	2 (16.7)	
Surgical History, n (%)			
• No history	0 (0)	2 (16.7)	
• Caesarean section once	11 (18.3)	4 (33.3)	0.013[a]
• Caesarean section twice	32 (53.3)	2 (16.7)	
• Caesarean section thrice	13 (21.7)	3 (25.0)	
• Curettage	3 (5.0)	1 (8.3)	
• Myomectomy	1 (1.7)	0 (0)	
Comorbid, n (%)			
• Yes	5 (8.3)	1 (8.3)	1.000[c]
• No	55 (91.7)	11 (91.7)	
Surgical Type, n (%)			
• Elective	48 (80.0)	9 (75.0)	0.705[c]
• Emergency	12 (20.0)	3 (25.0)	
Gravid, n (%)			
• Primigravid	1 (1.7)	0 (0)	0.903[a]
• Multigravid	44 (73.3)	9 (75.0)	
• Grandemultigravid	15 (25.0)	3 (25.0)	
Gestational Age, n (%)			
• Third trimester (> 28 weeks)	57 (95.0)	11 (91.7)	0.526[c]
• Second trimester (13–28 weeks)	3 (5.0)	1 (8.3)	
Complication, n (%)			
• No complication	6 (10.0)	1 (8.3)	0.462[a]
• Uterine atony	3 (5.0)	2 (16.7)	
• Bladder injury	5 (8.3)	0 (0)	
• Bleeding	43 (71.7)	9 (75.0)	
• Bleeding + bladder injury	3 (5.0)	0 (0)	

[a]*Pearson Chi Square*, $p < 0.05$; [b]*Mann-Whitney Test*, $p < 0.05$; [c]*Fisher Exact Test*, $p < 0.05$

Characteristics of Research Subjects

Of the 72 subjects, 60 subjects (83.3%) had PASD and 12 subjects (16.7%) were not. The majority of PASD patients in this study were aged 31–40 years (80%) with a mean age of 33.88 ± 4.22 years (range 23–44 years). Most of them lived in Palembang (56.7%), graduated from Senior High School (51.7%) and worked as a private employee (90%). Statistically, there was no difference in the characteristics of age, residence, education, and occupation between patients with and without PASD histopathologically (Table 1).

In addition, the results showed that there was no difference in comorbidities (p = 1.000), surgical type (p = 0.705), gravid (p = 0.903), gestational age (p = 0.526), and complications (p = 0.705) between patients with and without PASD histopathologically. However, there were differences in surgical history between patients with and without PAS histopathologically (p = 0.013). Most subjects with PASD underwent CS twice, while the majority of non-PASD subjects underwent CS once (Table 1).

Association between Study Subject Characteristics and PASD Incidence

Statistical analysis showed that there was a non-significant asociation between age, residence, education, and occupation with the incidence of PASD (p > 0.05). In addition, there was a non-significant relationship between comorbidities, surgical type, gravid, and gestational age with the incidence of PASD (p > 0.05) (Table 2). However, there was a significant relationship between the surgical history and the incidence of PASD. Subjects with surgical history more than once were 4.6 times more likely to have PASD than subjects with a history of surgery or without surgery (OR = 4.600 (95% CI 1.261–16.781); p = 0.037) (Table 2).

Accuracy between PAIS and Histopathological Examination Results to Diagnose PASD

By using the Receiver Operating Curve (ROC), the cut-off point of the PAIS score was 4.25 (AUC 0.900 (CI95% 0.776–1.000); p = 0.000). Based on the cut-off point, the PAIS value has a sensitivity of 98.2%; specificity of 80%; positive predictive value of 0.964; negative predictive value of 0.888; and the accuracy between PAIS and histopathology to diagnose PAS was very good (0.953).

Table 3. PAIS Score Diagnostic Test

Diagnosis		**Histopathology**		**Total**
		PASD	**Non PASD**	
PAIS	≥ 4.25	53	2	55
	< 4.25	1	8	9
Total		54	10	64

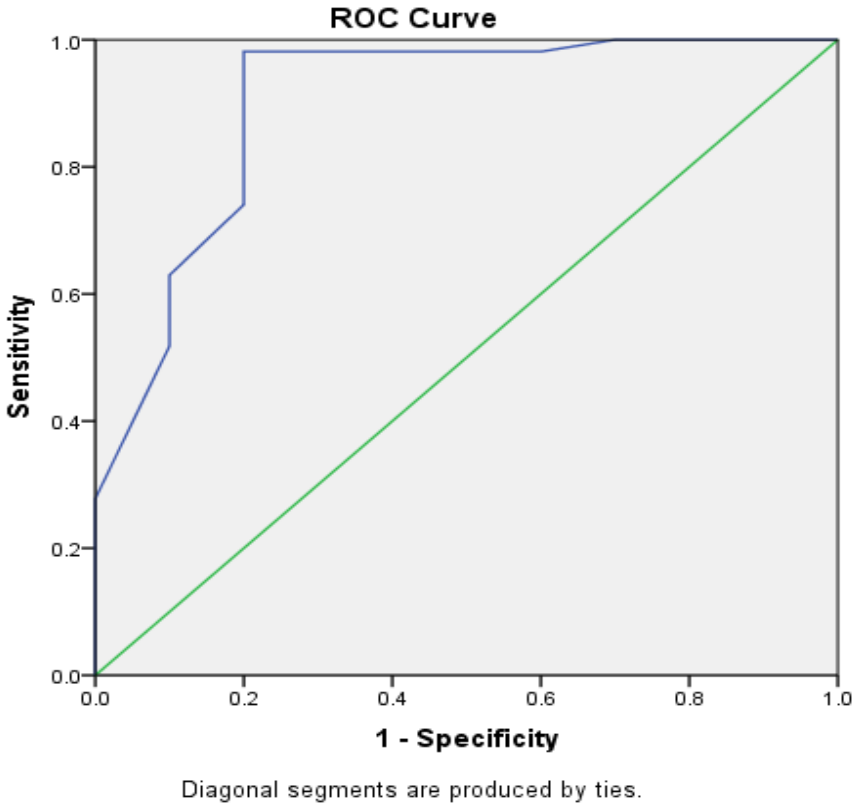

Figure 1. The ROC Curve of PAIS Score

Accuracy between PAIS and Histopathological Examination Results to Diagnose PASD
Based on the diagnostic table below, MRI examination had a sensitivity of 100%; specificity of 33.3%; positive predictive value of 0.879; negative predictive value of 1; and the accuracy between MRI and histopathology to diagnose PAS was very good (0.886).

Table 4. MRI Diagnostic Test

Diagnosis		**Histopathology**		**Total**
		PASD	**Non PASD**	
MRI	PASD	29	4	33
	Non - PASD	0	2	2
Total		29	6	35

Table 2. The Relationship between Subject Characteristics and PASD Incidence

Variables	PASD		OR (CI 95%)	p value
	Yes (n = 60)	No (n = 12)		
Age, n (%)				
• < 35 years old	36 (60.0)	5 (41.7)	2.100	0.394[a]
• ≥ 35 years old	24 (40.0)	7 (58.3)	(0.597–7.392)	
Residence, n (%)				
• Outside Palembang	26 (43.3)	3 (25.0)	2.294	0.338[b]
• Palembang	34 (56.7)	9 (75.0)	(0.564–9.330)	
Education, n (%)				
• Low education	4 (6.7)	0 (0)	-	1.000[b]
• High education	56 (93.3)	12 (100)		
Occupation, n (%)				
• Private employee	54 (90.0)	10 (83.3)	1.800	0.613[b]
• Civil Servant	6 (10.0)	2 (16.7)	(0.317–10.222)	
Surgical History, n (%)				
• > 1 CS	46 (76.7)	5 (41.7)	4.600	0.037[a]
• ≤ 1 CS	14 (23.3)	7 (58.3)	(1.261–16.781)	
Comorbid, n (%)				
• Yes	5 (8.3)	1 (8.3)	1.000	1.000[b]
• No	55 (91.7)	11 (91.7)	(0.106–9.417)	
Surgical Type, n (%)				
• Elective	48 (80.0)	9 (75.0)	1.333	0.705[b]
• Emergency	12 (20.0)	3 (25.0)	(0.312–5.694)	
Gravid, n (%)				
• Primigravid	1 (1.7)	0 (0)	-	1.000[b]
• Multigravid and Grandemultigravid	59 (98.3)	12 (100)		
Gestational Age, n (%)				
• Third trimester (> 28 weeks)	57 (95.0)	11 (91.7)	1.727 (0.164–18.173)	0.526[b]
• Second trimester (13–28 weeks)	3 (5.0)	1 (8.3)		

[a]*Chi Square Test*, $p < 0.05$; [b]*Fisher Exact Test*, $p < 0.05$

3. DISCUSSION

In this study, there was no difference in age between patients with and without PASD. The majority of PASD patients were aged 31–40 years (80%) with a mean age of 33.88 ± 4.22 years (range 23–44 years of age). The results of this study were supported by studies by Kyozuka et al.[13] and Gelany et al.[14], who reported that the mean age of PASD patients was 32.4 ± 5.3 years old and 32.4 ± 4.2 years old, respectively. In addition to age, the increasing proportion of deliveries by CS also resulted in a high incidence of PASD. A history of CS had been reported as an important predictor of the development of PASD. A person who had history of CS once (0.3%), twice (0.6%), and thrice (2.4%), respectively, will develop PASD in subsequent pregnancies. Hysterotomy scars after surgery could damage the decidua interface at the implantation site, thereby allowing for direct insertion of the placenta into the myometrium in subsequent pregnancies. [15,16]

In this study, subjects with a history of surgery more than once had a significant risk of 4.6 times experiencing PASD compared with subjects who did not have surgical history or with surgical history once. In line with this study, study which was conducted by Fitzpatrick et al. in 2012 reported that subjects with surgical history twice had a significant risk of 43.25 times experiencing PASD compared with subjects who did not have surgical history or with surgical history once (OR 43.25 (19.97–93.70); p = 0.001).[3] The most common complications in subjects with PASD and non-PASD were bleeding, bladder injury, and uterine atony. Because of that, perioperative preparation in coordination with other multidisciplinary groups was required.[1,17,18] However, in the group of subjects without PASD in this study, no bladder injury was found.

Ultrasound is one of procedures to diagnose PASD by using PAIS.[19-21] The presence of vascular lacuna, loss of the retroplacental zone, the relationship between the urinary bladder and the thin and irregular uterus, and the presence of blood vessels crossing from the placenta to the urinary bladder are the typical features of placenta accreta.[21-22] Besides that, MRI can be used as a next-level imaging modality for the diagnosis of PAS.[23-25] In the cases of posterior and lateral invasion, MRI can be performed for PAS evaluation and diagnosis.[23]

In this study, the cut-off point of the PAIS value based on histopathological results was 4.25. Based on the cut-off point, the sensitivity value was 98.2% and specificity was 80%. It meant that the ability of the PAIS to detect the presence of PASD was 98.2%. Meanwhile, the ability of the PAIS to exclude the presence of PASD was 80%. Magnetic Resonance Imaging examination had a sensitivity of 100%, but had a low specificity of 33.3%. It meant that the ability of MRI to detect the presence of PASD was 100% while the ability of MRI to exclude the presence of PASD was only 33.3%.

4. CONCLUSION

The high sensitivity, specificity, and accuracy in both examinations indicated that PAIS and MRI could be considered as diagnostic tools for PASD. However, overall PAIS had a better diagnostic value than MRI.

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