The Egyptian Journal of Hospital Medicine (January 2024) Vol. 94, Page 1254-1262

Assessment of Placental Thickness in Cases with Placenta Previa as Marker for Intra and Postpartum Bleeding

Ahmed G. Abdelnasser*, Abdel-Megeed I. Abdel-Megeed, Amira S. Ragab*, Amr A. Riad
Department of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University, Cairo, Egypt
***Corresponding author:** Ahmed G. Abdelnasser, **Mobile:** (+20) 01205533364, **E-mail:** Ahmedgamal@med.asu.edu.eg

ABSTRACT

Background: Evaluating the relationship between placental thickness and placenta accreta spectrum (PAS) disorder in placenta previa was highlighted as a primary area of interest because the prediction of abnormally invasive placentation in patients with placenta previa represents significant conflict and is frequently linked to intraoperative blood loss and blood transfusion.

Objective: This study aimed to assess the clinical value of placental thickness as a marker for intra and postpartum bleeding in cases of placenta previa. Thus, to serve as a guideline for enhancing the clinical outcomes of expectant mothers and their babies while lowering the frequency of unfavourable pregnancy-related occurrences.

Patients and methods: This prospective study was conducted at Tertiary Care Hospital, Ain Shams University Hospitals through the period from September 2022 to March 2023. The study included seventy-five pregnant women with placenta previa. 75 women were enrolled in the trial after 100 patients had their eligibility evaluated. Out of all eligible patients, 10 patients declined to take part in the trial, and 15 patients were excluded from the study due to inclusion requirements. In the end, the investigation relied on information from 75 placenta previa pregnant women.

Results: As regards the hemoglobin changes and blood loss, our study results revealed that pre-operative hemoglobin level (gm/dL) and post-operative hemoglobin level (gm/dL) were 11.4 ± 0.9 and 9.8 ± 1.1 respectively with postoperative hemoglobin drop (gm/dL) of 1.7 ± 0.41 and the blood loss (ml) was 867.3 ± 441.9. The Need to blood transfusion was in 54.7% of the studied cases. The number of transfused units of packed RBCs was one unit.

Conclusion: It is feasible to measure placental thickness in a straightforward manner. Consequently, it can be utilised as a screening test for placenta previa patients, especially those who had a Caesarean section (CS) in the past and had a very poor diagnostic performance in terms of anticipating blood loss and the need for blood transfusions.

Keywords: Placental thickness, Placenta previa, Operative bleeding.

INTRODUCTION

A serious obstetric issue known as placenta previa develops when the placenta covers all or part of the internal organs of the cervix while occupying the lower uterine segment. Placenta previa is thought to occur in 0.5% of cases. Incidence of this has gone up recently. The increased frequency of Caesarean sections, in vitro fertilisation, spontaneous and voluntary pregnancy terminations in the past, and prior uterine surgery can all be blamed for this [1, 2, 3].

One of the most serious pregnancy-related illnesses is PAS because it can cause extensive bleeding, which raises the risk of severe morbidities such as multi-organ failure, disseminated intravascular coagulopathy, intensive care unit admission, and hysterectomy, as well as maternal death [4]. One of the risk factors for PAS is placenta previa, and the imaging results for the two conditions often overlap. About 11% of patients with placenta previa have PAS issues. In clinical practice, it is critical to distinguish between placenta previa with and without PAS issues [5].

Transvaginal sonography is the gold standard for finding placenta previa. Ultrasound is the standard of treatment for diagnosing placenta previa. In connection with endocervical os on follow-up tests, it may evaluate for changes in placental migration and implantation and gives precise and comprehensive information about the placental edge. Placenta previa is a risk factor for PAS disease, particularly in those who had a previous CS. Ultrasonography is also essential in identifying instances of PAS that appear suspicious. Few studies have looked at the association between placental thickness at the lower uterine segment and PAS, despite the fact that a number of imaging signals, including loss of the clear zone, thinning of the underlying myometrium, and vascular abnormalities inside the placenta, have been researched for the diagnosis of PAS [6, 7].

Since the prediction of abnormally invasive placentation in patients with placenta previa represents substantial disagreement and frequently linked to blood transfusions and intraoperative blood loss, the connection of placental thickness with PAS dysfunction in placenta previa was 1254tilized1254d as a major area of interest [8].

This study aimed to assess the clinical value of placental thickness as a marker for intra and postpartum bleeding in cases of placenta previa. Thus, to serve as a guideline for enhancing the clinical outcomes of expectant mothers and their babies while lowering the frequency of unfavourable pregnancy-related occurrences.

PATIENTS AND METHODS

This prospective study was conducted at Tertiary Care Hospital, Ain Shams University hospitals through the period from September 2022 till March 2023 on seventy-five pregnant women with placenta previa.

Received: 26/10/2023
Accepted: 27/12/2023

Inclusion criteria: Patient with previous CS, placenta previa, singleton pregnancy, aged from 20 to 40 years with gestational age of 35-40 weeks.

Exclusion criteria: Women with known anemia (booking HB less than 10 g/dl), history of cervical surgery, comorbid cervical lesions, coagulopathy, fetal malformations, comorbid medical diseases, polyhydramnios, uterine malformation or fibroid were excluded.

Study procedure: Patients were recruited from the Prenatal Clinic for elective CS procedures at Ain Shams University Maternity Hospital.

A comprehensive history taking, a general and abdominal examination, and an obstetric ultrasound examination were performed on all individuals. Samsung H60 ultrasonic diagnostic equipment was used to assess the individuals' placental thickness (PT), and the abdomen curved probe frequency was adjusted between 3.5 and 5.0 MHz. The procedure for measuring PT involved moving the probe to the point where the decidua and chorion meet at the placenta's lower edge. Within a range of ±10 mm, the maximum vertical thickness of the placental tissue was measured. In order to reduce measurement error, the same sonographer measured each of the aforementioned indices three times in a row, averaging the results.

To identify eligible individuals, laboratory examinations include complete blood counts (before and after 6 hrs after delivery).

Estimation of blood loss was calculated by weighing towels before and after the operation and amount in suction apparatus if used.

Follow up and data recording:

Post-partum hemorrhage (PPH) was considered when:

Minor PPH: if estimated blood loss was up to 1000 ml.

Major PPH: if any estimated blood loss was over 1000 ml. Measuring hemoglobin level before & after 6 hours of delivery

Primary outcome of our study was estimated blood loss intrapartum by milliliters. Secondary outcomes were blood transfusion rate, emergency Caesarean section rate. (Occurrence of antepartum haemorrhage), postpartum haemorrhage rate that was considered as minor PPH (blood loss up to 1000 ml, major PPH: blood loss is over 1000 ml), complications as hysterectomy, bladder injury, ureteric injury, intestinal injury and rate of placenta previa accrete.

Ethical approval: Medical Ethics Committee of Ain Shams Faculty of Medicine approved this study. After obtaining the necessary information, all participants provided signed consents. The Helsinki Declaration was observed throughout the study's duration.

Statistical analysis

IBM SPSS version 22.0 was 1255tilized for the coding, tabulation, and statistical analysis of the gathered data. The mean ± SD and lowest and maximum of the range were calculated for quantitative normally distributed data when using descriptive statistics, but number and percentage were calculated for qualitative data. Shapiro-Wilk test for normality testing and independent t-test when two independent groups with normally distributed data were used for inferential analysis for quantitative variables. X^2-test was used for proportional differences and Fisher's exact test was used for variables with small anticipated numbers in inferential analyses of qualitative data for independent variables. If the P value ≤ 0.050 was considered significant, if it was greater than that it is not.

RESULTS

The mean age (years), gestational age (weeks), preoperative hemoglobin level (gm/dL) and placental thickness (cm) were 31.5 ± 5.5, 36.0 ± 1.0, 11.4 ± 0.9 and 4.1 ± 1.8 respectively. Median (1^{st}–3^{rd} IQ) of parity and previous Cesarean section was 3.0 (2.0–4.0) and 2.0 (1.0–3.0) respectively. Placental thickness ≥ 10.0 mm were in 14.7% of the studied cases (Table 1).

Table (1): Demographic data of the study

Characteristics		Mean±SD	Range
Age (years)		31.5±5.5	21.0–40.0
Gestagional age (weeks)		36.0±1.0	35.0–39.0
Preoperative Hb level (gm/dL)		11.4±0.9	10.0–13.9
Placental thickness (mm)		4.1±1.8	2.6–12.2
		Median (1^{st}–3^{rd} IQ)	**Range**
Parity		3.0 (2.0–4.0)	1.0–6.0
Previous cesarean section		2.0 (1.0–3.0)	1.0–6.0
		n	**%**
Placental thickness grade	**<10.0 mm**	64	85.3%
	≥10.0 mm	11	14.7%

Table (2) showed that intraoperative hysterectomy and bladder injury occurred in 21.3% and 8.0% respectively. Ureteric injury and intestinal injury did not occur in the studied cases.

Table (2): Intraoperative complications among the studied cases

Complications	n	%
Hystrectomy	16	21.3%
Bladder injury	6	8.0%
Ureteric injury	0	0.0%
Intestinal injury	0	0.0%

Table (3) showed that mean postoperative hemoglobin level (gm/dL), postoperative hemoglobin drop (gm/dL) and blood loss (ml) were 9.8 ± 1.1, 1.7 ± 0.41 and 867.3 ± 441.9 respectively. Need to blood transfusion was in 54.7% of the studied cases. Median (1st−3rd IQ) of number of blood transfusion units was 1.0 (0.0–2.0).

Table (3): Hemoglobin change and blood loss among the studied cases

Characteristics	Mean±SD	Range
Postoperative Hb level (gm/dL)	9.8±1.1	6.0–12.0
Postoperative Hb drop (gm/dL)	1.7±0.41	0.0–4.9
Blood loss (ml)	867.3±441.9	200.0–1950.0
	n	**%**
Need to blood transfusion	41	54.7%
	Median (1st−3rd IQ)	**Range**
Number of blood transfusion units	1.0 (0.0–2.0)	0.0–6.0

Table (4) showed that there were significant positive correlation between placental thickness and each of postoperative hemoglobin drop, blood loss and number of blood transfusion units, as well as significant negative correlation with postoperative hemoglobin level.

Table (4): Correlations of placental thickness

Variables	r	p-value
Age	0.056	^0.635
Gestagional age	-0.104	^0.375
Preoperative Hb level	-0.051	^0.684
Parity	-0.182	#0.119
Previous CS	-0.114	#0.331
Postoperative Hb level	-0.288	^**0.018***
Postoperative Hb drop	0.247	^**0.044***
Blood loss	0.275	^**0.017***
Number of blood transfusion units	0.260	**#0.024***

Table (5) showed that cases with placental thickness ≥ 10.0 mm significantly had higher postoperative hemoglobin drop and blood loss as well as more frequent bladder injury.

Table (5): Comparison according to placental thickness grade

Baseline	Placental thickness		p-value
	≥10.0 (Total=11)	**<10.0 mm (Total=64)**	
Age (years)	31.6±6.1	31.5±5.5	^0.934
Gestagional age (weeks)	35.8±0.9	36.0±1.1	^0.529
Preoperative Hb level (gm/dL)	11.6±0.9	11.4±0.9	^0.471
Parity	3.0 (2.0–3.0)	3.0 (2.0–4.0)	¤0.543
Previous CS	2.0 (1.0–3.0)	2.0 (1.0–3.0)	¤0.938
Outcomes			
Hystrectomy	4 (36.4%)	12 (18.8%)	§0.233
Bladder injury	3 (27.3%)	3 (4.7%)	**§0.028***
Postoperative Hb level (gm/dL)	9.1±1.5	9.9±1.0	^0.064
Postoperative Hb drop (gm/dL)	2.5±0.1	1.5±0.36	^**0.013***
Blood loss (ml)	1145.5±506.2	819.5±415.8	^**0.023***
Need of blood transfusion	7 (63.6%)	34 (53.1%)	§0.745
Number to blood transfusion units	1.0 (0.0–1.0)	0.0 (0.0–2.0)	¤0.799

Table (6) showed that cases that needed hysterectomy significantly had older age, more frequent history of appendectomy, bladder injury and number to blood transfusion units, as well as lower postoperative Hb level and higher postoperative Hb drop.
Placental thickness was non-significantly lower in cases needed hysterectomy.

Table (6): Comparison according to need to hysterectomy

Baseline		Need to hysterectomy		p-value
		Positive (Total=16)	Negative (Total=59)	
Age (years)		34.9±4.8	30.6±5.4	**^0.005***
Gestagional age (weeks)		35.9±1.0	36.0±1.0	^0.786
Preoperative Hb level (gm/dL)		11.2±1.0	11.5±0.8	^0.245
Placental thickness (mm)		6.4±3.6	4.9±2.7	^0.139
Placental thickness grade	**<10.0 mm**	4 (25.0%)	7 (11.9%)	§0.233
	≥10.0 mm	12 (75.0%)	52 (88.1%)	
Parity		3.0 (2.0–3.5)	3.0 (2.0–4.0)	¤0.585
Previous CS		3.0 (2.0–3.5)	2.0 (1.0–3.0)	¤0.071
Outcomes				
Bladder injury		5 (31.3%)	1 (1.7%)	**§0.001***
Postoperative Hb level (gm/dL)		9.0±1.0	10.0±1.0	**^0.002***
Postoperative Hb drop (gm/dL)		2.2±1.4	1.5±0.37	**^0.029***
Blood loss (ml)		1028.1±428.6	823.7±438.9	^0.101
Need of blood transfusion		15 (93.8%)	26 (44.1%)	**#<0.001***
Number to blood transfusion units		2.0 (1.5–3.5)	0.0 (0.0–1.0)	**¤<0.001***

Table (7) showed that placental thickness had non-significant diagnostic performance in predicting need to hysterectomy. It had high specificity and negative predictive value, but poor other diagnostic characteristics. So it could be used to exclude need to hysterectomy (< 9.1 mm), but not to confirm it (≥ 9.1 cm).

Table (7): Diagnostic performance and characteristics of placental thickness in predicting need to hysterectomy.

Characteristics	Value	95% CI
AUC	0.611	0.446–0.775
p-value	0.177	
Cut point	≥9.1 mm	
Sensitivity	43.8%	19.8%–70.1%
Specificity	88.1%	77.1%–95.1%
Diagnostic accuracy (DA)	78.7%	67.7%–87.3%
Youden's index	31.9%	6.2%–57.6%
Positive Predictive value (PPV)	50.0%	23.0%–77.0%
Negative Predictive value (NPV)	85.2%	73.8%–93.0%
Positive likelihood ratio (LR+)	3.69	1.51–8.98
Negative likelihood ratio (LR-)	0.64	0.41–0.99
Diagnostic odds ratio (DOR)	5.78	1.63–20.46

Table (8) showed that cases that had bladder injury significantly had lower preoperative and postoperative hemoglobin level, more frequent placental thickness ≥ 10.0 mm, need to hysterectomy and blood transfusion, as well as higher number of blood transfusion units. Placental thickness was non-significantly lower in cases that had bladder injury.

Table (8): Comparison according to bladder injury

Baseline		Bladder injury		p-value
		Positive (Total=6)	Negative (Total=69)	
Age (years)		31.2±5.5	31.5±5.6	^0.877
Gestational age (weeks)		35.8±1.2	36.0±1.0	^0.681
Preoperative Hb level (gm/dL)		10.6±0.5	11.5±0.9	**^0.020***
Placental thickness (mm)		7.4±4.3	5.0±2.8	^0.245
Placental thickness grade	**<10.0 mm**	3 (50.0%)	8 (11.6%)	**§0.038***
	≥10.0 mm	3 (50.0%)	61 (88.4%)	
Parity		3.0 (1.0–4.0)	3.0 (2.0–3.0)	¤0.809
Previous cesarean section		3.0 (1.0–4.0)	2.0 (1.0–3.0)	¤0.412
Outcomes				
Hysterectomy		5 (83.3%)	11 (15.9%)	**§0.001***
Postoperative Hb level (gm/dL)		8.6±1.5	9.9±1.0	**^0.014***
Postoperative Hb drop (gm/dL)		2.0±0.4	1.6±0.28	^0.518
Blood loss (ml)		883.3±547.4	865.9±436.4	^0.927
Need to blood transfusion		6 (100.0%)	35 (50.7%)	**§0.029***
Number of blood transfusion unit		2.0 (1.0–2.0)	1.0 (0.0–2.0)	**¤0.022***

Table (9) showed that placental thickness had non-significant diagnostic performance in predicting bladder injury. It had high specificity and negative predictive value, but poor other diagnostic characteristics. So it could be used to exclude bladder injury (< 11.1 mm), but not to confirm it (≥ 11.1 cm).

Table (9): Diagnostic performance and characteristics of placental thickness in predicting bladder injury

Characteristics	Value	95% CI
AUC	0.657	0.350–0.964
p-value	0.204	
Cut point	≥11.1 mm	
Sensitivity	50.0%	11.8%–88.2%
Specificity	98.6%	92.2%–100.0%
Diagnostic accuracy (DA)	94.7%	86.9%–98.5%
Youden's index	48.6%	8.4%–88.7%
Positive Predictive value (PPV)	75.0%	19.4%–99.4%
Negative Predictive value (NPV)	95.8%	88.1%–99.1%
Positive likelihood ratio (LR+)	34.50	4.21–282.81
Negative likelihood ratio (LR-)	0.51	0.23–1.13
Diagnostic odds ratio (DOR)	68.00	5.36–863.46

Table (10) showed that cases that needed blood transfusion significantly had lower preoperative and postoperative hemoglobin level and higher blood loss, as well as more frequent hysterectomy and bladder injury. Placental thickness was non-significantly lower in cases that needed blood transfusion.

Table (10): Comparison according to need to blood transfusion

Baseline		Need to blood transfusion		p-value
		Positive (Total=41)	Negative (Total=34)	
Age (years)		32.6±5.4	30.2±5.6	^0.070
Gestational age (weeks)		35.9±0.9	36.1±1.2	^0.370
Preoperative hemoglobin level (gm/dL)		11.2±0.8	11.7±0.8	**^0.014***
Placental thickness (mm)		5.8±3.2	4.5±2.5	^0.054
Placental thickness grade	**<10.0 mm**	7 (17.1%)	4 (11.8%)	§0.745
	≥10.0 mm	34 (82.9%)	30 (88.2%)	
Parity		3.0 (2.0–3.0)	3.0 (2.0–4.0)	¤0.974
Previous cesarean section		3.0 (2.0–3.0)	2.0 (1.0–3.0)	¤0.073
Baseline				
Hysterectomy		15 (36.6%)	1 (2.9%)	**§0.001***
Bladder injury		6 (14.6%)	0 (0.0%)	**§0.029***
Postoperative Hb level (gm/dL)		9.4±1.1	10.3±1.0	**^<0.001***
Postoperative Hb drop (gm/dL)		1.8±0.43	1.4±0.33	^0.078
Blood loss (ml)		1001.2±419.4	705.9±419.0	**^0.003***

Table (11) showed that placental thickness had significant low diagnostic performance in predicting bladder injury. It had high specificity and positive predictive value, but poor other diagnostic characteristics. So it could be used to confirm need to blood transfusion (≤ 7.7 mm), but not to exclude it (< 7.7 cm)**.**

Table (11): Diagnostic performance and characteristics of placental thickness in predicting need to blood transfusion

Characteristics	Value	95% CI
AUC	0.643	0.518–0.769
p-value	**0.033***	
Cut point	≥7.7 mm	
Sensitivity	36.6%	22.1%–53.1%
Specificity	88.2%	72.5%–96.7%
Diagnostic accuracy (DA)	60.0%	48.0%–71.1%
Youden's index	24.8%	6.5%–43.1%
Positive Predictive value (PPV)	78.9%	54.4%–93.9%
Negative Predictive value (NPV)	53.6%	39.7%–67.0%
Positive likelihood ratio (LR+)	3.11	1.14–8.49
Negative likelihood ratio (LR-)	0.72	0.55–0.93
Diagnostic odds ratio (DOR)	4.33	1.28–14.68

DISCUSSION

In our study found that the means of age (years), gestational age (weeks), preoperative hemoglobin level (gm/dL) and placental thickness (cm) were 31.5 ± 5.5, 36.0 ± 1.0, 11.4 ± 0.9 and 4.1 ± 1.8 respectively. Median (1st−3rd IQ) of parity and previous Cesarean section was 3.0 (2.0–4.0) and 2.0 (1.0–3.0) respectively. Placental thickness ≥10.0 mm were in 14.7% of the studied cases. In this study, intraoperative complications showed that hysterectomy and bladder injury occurred in 21.3% and 8.0% respectively. Ureteric injury and intestinal injury did not occur in the studied cases. Our results found that means of postoperative hemoglobin level (gm/dL), postoperative hemoglobin drop (gm/dL) and blood loss (ml) were 9.8 ± 1.1, 1.7 ± 0.41 and 867.3 ± 441.9 respectively. Need to blood transfusion was in 54.7% of the studied cases. Median (1st−3rd IQ) of number of blood transfusion units was 1.0 (0.0–2.0).

Elmaraghy *et al.* [9] showed that demographic data with age, parity, and number of prior CS being considerably higher in PAS patients, which is consistent with our results. **Elmaraghy *et al.*** [9] concurs with our findings regarding blood transfusion and bladder injury, noting that there was no statistically significant difference in bladder injury between the two groups, but that blood requirements were significantly higher in the PAS group (increased placental thickness) when compared to cases with complete placental separation. Our results are consistent with following study, using a transabdominal scan to assess the relationship between placental thickness and PAS in patients with placenta previa, **Elmaraghy *et al.*** [9] carried out a prospective study that enrolled 40 patients with the diagnosis of placenta previa. The results showed that the pre-operative haemoglobin level (gm/dL) was 10.90 ± 0.76. At the third trimester, placental thickness was assessed, it varied from 15 mm to 110 mm, and 50% of the patients had PAS. A hysterectomy was carried out in 42.5% (17/40) of cases, and bladder damage happened in 7.5% (3/40). There were no reports of ureteric or vascular injuries, nor of intestinal injuries [9].

Also, our finding agrees with **Bhide *et al.*** [10] who measured placental thickness in women who had low-lying anterior placentas or major placenta previa on ultrasound. They found that women with abnormally invasive placentas (AIP) had significantly higher lower segment placental thickness than women with normal placentation, and all but one of them had previously given birth by CS, compared to 33 (33%) of women with normal placentation (P < 0.001) [10]**.** In line with our findings, **Li *et al.*** [11] carried out a retrospective study involving 65 patients with placenta previa, of whom 38 had a diagnosis of PAS disorder and 27 did not. The study confirmed the histopathological findings and showed that the mean maternal age for patients with PAS disorder was 34.2 years. The maximum placental thickness was 43 mm (range 18 mm to 78 mm) for the PAS group and 30 mm (range 06 mm to 53 mm) for the non-PAS group, with a significant increase in patients with PAS (p < 0.001). All women (38/38, 100%) with PAS disorder had prior CS, compared to 16/27 (59.3%) women without PAS disorder (P < 0.001) [11].

In current study, there was a significant positive correlation between placental thickness and each of postoperative hemoglobin drop, blood loss and number of blood transfusion units, as well as significant negative correlation with postoperative hemoglobin level. Our study found that cases with placental thickness ≥ 10.0 mm significantly had higher postoperative hemoglobin drop and blood loss as well as more frequent bladder injury. Current study found that cases, which needed hysterectomy significantly had older age, more frequent history of appendectomy, bladder injury and number to blood transfusion units, as well as lower postoperative Hb level and higher postoperative Hb drop. Placental thickness was non-significantly lower in cases needed hysterectomy.

In order to investigate whether the thickness of the lower placental edge could be used to predict the clinical outcomes in patients with placenta previa, **Ghourab** [12] enrolled 104 women in a prospective observational study. The thickness of the lower placental edge ranged between 0.4 cm and 1 cm in the thin-edge group (mean, 0.73 ± 0.18 cm) and between 1.1 cm and 3.2 cm in the thick-edge group (mean, 1.9 ± 0.64 cm). Seven instances (6.7%) required Caesarean hysterectomy; all had anterior placenta previa accreta, history of CS scarring, and significant intrapartum haemorrhage. Ten individuals received an antenatal diagnosis of accreta and none of them had a placenta with a narrow margin. Thus, placental thickness served as a PAS marker [12].

Li *et al.* [11] provided evidence to support our findings by showing a correlation between increased placental thickness and the diagnosis of PAS disorder. Therefore, by combining placental thickness measurement with other subjective sonographic findings, the diagnostic accuracy for PAS disorder could be improved, and the clinical outcome of hysterectomy, bladder injury, and blood transfusion could be predicted.

Bhide *et al.* [10] found that women with AIP had a significantly higher maximum lower segment placental thickness than women without AIP (P < 0.001), and that women with invasive placentation had significantly higher median blood loss and blood product use. These findings are consistent with our findings and demonstrate the significant correlation between placental thickness and blood loss and blood transfusion. Only placental thickness and prior Caesarean delivery were found to be independent predictors of AIP and blood transfusion, according to logistic regression analysis. The risks of AIP rose by 1.051 (95% CI 1.018-1.085) for every millimeter of placental thickness over the predicted normal median. The risk of invasive placentation was raised by 40 times in those with a history of Caesarean delivery [10].

Our study found that the placental thickness had non-significant diagnostic performance in predicting need to hysterectomy. It had high specificity and negative predictive value, but poor other diagnostic characteristics. So it could be used to exclude need to hysterectomy (<9.1 mm), but not to confirm it (≥9.1 cm). Current study showed that the cases that had bladder injury significantly had lower preoperative and postoperative hemoglobin level. Also, more frequent placental thickness ≥ 10.0 mm need to hysterectomy and blood transfusion, as well as higher number of blood transfusion units. Placental thickness was non-significantly lower in cases had bladder injury. In the current study placental thickness had non-significant diagnostic performance in predicting bladder injury. It had high specificity and negative predictive value, but poor other diagnostic characteristics. So it could be used to exclude bladder injury (<11.1 mm), but not to confirm it (≥11.1 cm).

According to **Ghourab** [12]**,** there was a statistically significant increase in the likelihood of emergency delivery, peripartum haemorrhage, placenta accreta, blood loss, and blood transfusion for the thick placental edge group. In the thin-edge placenta group, the mean number of APH episodes was 1.6 ± 0.7, while in the thick edge or central placenta group, it was 3.8 ± 1.6. Consequently, the thin-edge placenta group experienced significantly worse maternal and neonatal outcomes and more serious complications, such as hysterectomy and severe haemorrhage. The rich vasculature of the lower placental edge and the sub-placental zone, as well as the interference of a thick-edge placenta with the descent of the foetal head, may account for the high rate of emergency Caesarean delivery and the increased incidence and severity of APH in patients with a thick-edge low-lying placenta [12].

Contrary to our findings, **Elmaraghy *et al.*** [9] found that in patients with placenta previa, placental thickness showed a strong link with PAS (p value= 0.000), and 17 patients, or 85% of the group with PAS, had Caesarean hysterectomy. A threshold value of 58 mm was linked to 55% sensitivity, 90% specificity, 84.6% positive predictive value, and 66.7% negative predictive value for having PAS in patients with placenta previa, according to the placental thickness ROC curve. The significant linear association between the placental thickness and the histological confirmation of PAS in either the hysterectomy specimens or the resected myometrial segments in cases who underwent conservative surgery demonstrated a direct correlation between the maximum placental thickness in the lower uterine segment and the presence of PAS disorder [10].

Conversely, **El-Maghraby** [13] carried out an observational cohort study with 200 pregnant women to examine the association between placental thickness and pregnancy outcome. The results showed that placental thickness was negatively correlated with age (r= -0.180, p=0.011) but not with placenta previa, placental abruption, bleeding, postpartum haemorrhage, or body mass index (p >0.05). **Elmaraghy *et al.*** [9] demonstrated that the divergence with our results was explained by the alternative technique. The third trimester was used to evaluate placental thickness, with findings ranging from 15 to 110 mm. These measures were compared to the gold standard diagnostic test for PAS, which is the histological analysis of excised tissues.

Our study showed that cases that needed blood transfusion significantly had lower preoperative and postoperative hemoglobin level and higher blood loss, as well as more frequent hysterectomy and bladder injury. Placental thickness was non-significantly lower in cases that needed blood transfusion. The current study found that the placental thickness had significant low diagnostic performance in predicting bladder injury. It had high specificity and positive predictive value, but poor other diagnostic characteristics. So it could be used to confirm need to blood transfusion (≤7.7 mm), but not to exclude it (<7.7 cm). Furthermore, in PAS diseases, there was a linear association between blood loss and placental thickness evaluated prior to delivery. The prevention of morbidity and death associated with PAS diseases is largely dependent on prenatal triage and detection. When prenatal instances are found as opposed to those discovered at birth, better results for both the mother and the foetus are observed. An additional benefit of scheduled delivery is that it is carried out by a multidisciplinary team [9, 11].

Women with AIP are more likely to have excessively thick placentas. This might be because the placenta is implanted or positioned in the Caesarean scar, which restricts placental migration. Rather of spreading out like a pancake across the uterine mucosa, this might cause the placenta to swell like a mushroom out of the scar defect. According to reports, trophoblast cells invade the decidual veins to cause the placenta to expand laterally. The tissue left behind during Caesarean delivery lacks decidua and is avascular. This might be the reason why in women who have a morbidly adherent placenta, the placenta is thicker in the lower uterine region [9, 10].

CONCLUSION

The present study clearly showed that individuals with placenta previa and PAS (placental thickness > 10.0 mm) had significantly higher placental thickness at the lower uterine segment than patients with placenta previa without any morbid adhesion.

It is feasible to measure placental thickness in a straightforward manner. Therefore, it could be utilised as a screening test for individuals with placenta previa, especially if they have a history of CS and have a diagnostic performance that is significantly worse than expected in terms of predicting blood loss and the requirement for blood transfusions.

REFERENCES

1. **Zhang L, Bi S, Du L *et al.* (2020):** Effect of previous placenta previa on outcome of next pregnancy: a 10-year retrospective cohort study. BMC Pregnancy and Childbirth, 20 (1): 1-8.
2. **Marshall N, Fu R, Guise J (2011):** Impact of multiple cesarean deliveries on maternal morbidity: a systematic review. Am J Obstet Gynecol., 205 (3): 1-8.
3. **Milosevic J, Lilic V, Tasic M *et al.* (2009):** Placental complications after a previous cesarean section. Med Pregl., 62 (5-6): 212-16.
4. **Silver R, Branch D (2018):** Placenta Accreta Spectrum. N Engl J Med., 378 (16): 1529–1536.
5. **Jauniaux E, Alfirevic Z, Bhide A *et al.* (2019):** Placenta praevia and placenta accreta: diagnosis and management: green-top guideline no. 27a. BJOG., 126 (1): 1–48.
6. **Jha P, Li Y, Choi H *et al.* (2020):** VP46.30: placental thickness as a screening tool for placenta accreta spectrum disorder in women with placenta previa. Ultrasound Obstet Gynecol., 56: 275. doi: 10.1002/uog.23095
7. **Einerson B, Rodriguez C, Kennedy A *et al.* (2018):** Magnetic resonance imaging is often misleading when used as an adjunct to ultrasound in the management of placenta accreta spectrum disorders. Am J Obstet Gynecol., 218: 1 – 7.
8. **Jauniaux E, Hussein A, Fox K *et al.* (2019):** New evidence-based diagnostic and management strategies for placenta accreta spectrum disorders. Best Pract Res Clin Obstet Gynaecol., 61: 75–88.
9. **Elmaraghy A, Fayed S, Ali M *et al.* (2023):** Diagnostic Accuracy of Placental Thickness in Lower Uterine Segment Measured by Ultrasound in Prediction of Placenta Accreta Spectrum in Patients with Placenta Previa. A Diagnostic Test Accuracy Study. International Journal of Women's Health, 15: 311-320.
10. **Bhide A, Laoreti A, Kaelin Agten A *et al.* (2019):** Lower uterine segment placental thickness in women with abnormally invasive placenta. Acta Obstet Gynecol Scand., 98 (1): 95-100.
11. **Li Y, Choi H, Goldstein R *et al.* (2021):** Placental thickness correlates with placenta accreta spectrum (PAS) disorder in women with placenta previa. Abdominal Radiology, 46: 2722-2728.
12. **Ghourab S (2001):** Third-trimester transvaginal ultrasonography in placenta previa: does the shape of the lower placental edge predict clinical outcome? Ultrasound Obstet Gynecol., 18: 103–108.
13. **El-Maghraby I (2021):** Ultrasonographic Evaluation of Placental Sites and Thickness at Second Trimester and Its Correlation with Pregnancy Outcome. The Egyptian Journal of Hospital Medicine, 82 (2): 316-322.