

A COMBINED ULTRASOUND AND CLINICAL SCORING MODEL FOR THE PREDICTION OF PERIPARTUM COMPLICATIONS IN PREGNANCIES COMPLICATED BY PLACENTA PREVIA

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Received: 13 September 2021, Revised and Accepted: 20 October 2021

ABSTRACT

Objective: Patients with placenta previa are at an increased risk of uncontrolled hemorrhage. Various clinical and ultrasound parameters can predict the risk of bleeding in these patients. Hence, the objective of our study is to develop a combined ultrasound and clinical scoring model for the prediction of peripartum complications in pregnancies complicated by placenta previa.

Methods: Fifty singleton pregnant women with placenta previa who underwent cesarean delivery in our hospital were included in the study. We collected clinical and ultrasound data prospectively, and the score was given to each parameter, and total score correlated with the occurrence of peripartum complications. Clinical parameters included age, parity, history of dilatation and evacuation, previous cesarean delivery, history of placenta previa, antepartum hemorrhage, and ultrasound parameters included type of previa, no. of lacunae in placenta, uteroplacental hypervascularity. The peripartum complications noted were the need for blood transfusion, uterine artery ligation, and cesarean hysterectomy.

Results: According to the composite scoring done, uterine artery ligation was needed in more than 50% of patients at a score of 9–10. It increased to 100% as the score increased to ≥ 11 . At a score of ≥ 12 , hysterectomy was needed in around 75% of patients, and 100% of patients needed a blood transfusion. Univariate analysis using the Pearson Chi-square test was also done to know whether individual parameters and peripartum complications were significantly related that is $p < 0.05$ with one another.

Conclusion: The scoring system may serve to predict peripartum complications in pregnancies complicated by placenta previa.

Keywords: Placenta praevia, Complications, Ultrasonography

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INTRODUCTION

Placenta previa is a major risk factor for antepartum and postpartum hemorrhage and can lead to severe morbidity and mortality of the mother and neonate [1]. The various known risk factors include advanced maternal age, multiparity, prior suction and curettage, multifetal gestation, history of cesarean section or any other uterine surgery, and placenta previa in the previous pregnancy. However, it may also occur whenever there is an altered hormonal or implantation environment [2].

Most of the patients are now diagnosed as having placenta previa in the antenatal period in the second and third trimester by routine ultrasonography. Nearly, 90% of placentas identified as “low lying” in the second trimester will be located in the upper segment by the third trimester [3,4]. Hence, a follow-up sonogram is important and recommended at a gestational age of 28–32 weeks to look for persistent placenta previa [5]. In the antenatal period, due to increased chances of preterm delivery and gestational diabetes mellitus, high-risk placenta previa deliveries are further complicated [6].

Patients with placenta previa are at increased risk of uncontrolled hemorrhage and increasing needs for blood transfusion, devascularization procedures, and even peripartum hysterectomy [7]. Various ultrasound findings can predict increased chances of profuse uterine bleeding. These include loss of interface between the bladder and uterine surface, extreme thinning of the underlying myometrium, and presence of vascular changes in the placenta (lacunae) and placental bed hypervascularity [8].

A few studies have been done to relate both clinical and ultrasound parameters to the risk of bleeding in placenta previa and peripartum

complications. In our study, we have combined various clinical and ultrasound factors in pregnancies complicated by placenta previa and developed a scoring model based on their correlation with the occurrence of peripartum complications. We have also tried to determine whether each clinical and ultrasound factor is significantly associated with the occurrence of various peripartum complications. This score was developed with the intent to facilitate a multidisciplinary treating team of anesthetists and obstetricians to be more prepared to manage peripartum complications and thus prevent maternal morbidity and mortality.

METHODS

This study was a prospective study done on 50 patients with diagnosed placenta previa. We included vitally stable patients with singleton pregnancy and gestational age ≥ 30 weeks. The patients having any medical disorder or any other obstetric complication were excluded from the study. Clinical history was taken from patients who fulfill inclusion criteria. Ultrasound was done for scoring parameters in known cases of the placenta previa. Ethical clearance was taken from the Institutional Ethics Committee. Informed consent was obtained from all patients according to the World Medical Association Declaration of Helsinki, revised in 2000, Edinburgh. All placenta previa pregnant women were delivered by cesarean section at our hospital. Perioperative complications including the need for perioperative blood transfusion, uterine artery ligation, and cesarean hysterectomy were noted. The clinical parameters included are shown in Table 1.

Placenta previa was diagnosed by transabdominal ultrasound from 28 weeks onwards. Grade of placenta previa was noted. Grading of location was done as Grade I, IIA, IIB, III, or IV. No. of lacunar spaces in the placenta and uteroplacental hypervascularity were also noted for

scoring. Lacunar spaces in the placenta were classified into four grades (from grade 0 to 3) according to Finberg's criteria [9]. Uteroplacental hypervascularity was noted whether increased or not and scoring was done as shown in Table 2.

All patients underwent cesarean section at our institution. Peripartum complications in the form of need for perioperative blood transfusion, uterine artery ligation, cervicoisthmic sutures, and cesarean hysterectomy were noted. In case of bleeding uterine artery ligation or cervicoisthmic sutures were applied and if still bleeding was not controlled or the patient's vitals became unstable then peripartum hysterectomy was done. Cesarean hysterectomy was also done for placenta accreta spectrum. Based on clinical factors and ultrasound parameters, we have tried to determine a combined scoring model for the prediction of need for blood transfusion, uterine artery ligation, cervicoisthmic sutures, and cesarean hysterectomy. Statistical methods that is Pearson Chi-square test, Fisher's Exact Test, and linear by linear association were used for analyzing our data in the univariate analysis as appropriate. Those clinical and ultrasound parameters whose $p < 0.05$ were considered statistically significant.

RESULTS

A total of 50 singleton pregnancy patients with diagnosed placenta previa were included in the study. As our hospital is a tertiary care centre, many of the patients were referred with antenatal diagnosis of placenta previa for institutional delivery. The mean gestational age of cesarean delivery was 35 weeks and 5 days. The mean age of the patients was 28.7 years with a standard deviation of 2.9. The number of blood transfusions required was on average 2.6 units with a standard deviation of 1.99. On univariate analysis using the Pearson Chi-square test, each parameter was individually correlated with the occurrence of peripartum complication and need for blood transfusion. The association is shown in Tables 3-5.

The above table represents the no. of patients who had particular clinical or ultrasound risk factors in the study to the need for blood transfusion (Yes/No). On univariate analysis individual clinical and ultrasound

Table 1: Clinical parameter and score given to each parameter

Parameter	Score		
	0	1	2
Age	<35 years	≥35 years	
Parity	Primigravida	2 nd Gravida	3 rd Gravida or more
History of Dilatation and evacuation (D and E)	Absent	Present	
History of previous Cesarean Delivery (LSCS)	Absent	1 LSCS	≥2 LSCS
History of placenta previa in previous pregnancies	Absent	Present	
History of Antepartum hemorrhage in 2 nd or 3 rd trimester	Absent	Present	

LSCS: Lower segment Cesarean section

Table 2: Ultrasound parameters and scoring given to each parameter

Parameter	Score			
	0	1	2	3
Grade of previa	None	I and II a	II b and III	IV
No. of lacunae	None	1-3	4-6	Whole (>6)
Uteroplacental hypervascularity	Normal	Increased		

parameter was correlated with the need for blood transfusion and p-value was calculated. Those risk factors whose $p < 0.05$ were considered statistically significant for the blood transfusion.

The above table represents the no. of patients who had particular clinical or ultrasound risk factors in the study to the need for uterine artery ligation (Yes/No). On univariate analysis individual clinical and ultrasound parameter was correlated with the need for uterine artery ligation and p-value was calculated. Those risk factors whose $p < 0.05$ were considered statistically significant for the uterine artery ligation.

The above table represents the no. of patients who had particular clinical or ultrasound risk factors in the study to the need for cesarean

Table 3: Association of clinical and ultrasound factors with the need for blood transfusion (Done in total 39/50 patients)

Clinical factors	Blood transfusion		p-value
	Yes	No	
Age (≥35 years) (12%, 6/50)	5	1	0.737
Multiparity (66%, 33/50)	29	4	0.014*
Prior LSCS (42%, 21/50)	18	3	0.209
Prior placenta previa (20%, 10/50)	7	3	0.495
Prior D and E (20%, 10/50)	10	0	0.06
Antepartum bleeding (72%, 36/50)	32	4	0.003*
Ultrasound findings type			
Grade I (18%, 9/50)	6	3	0.081
Grade II a (16%, 8/50)	4	4	
Grade II b (4%, 2/50)	1	1	
Grade III (10%, 5/50)	5	0	
Grade IV (52%, 26/50)	23	3	
Lacunae No (4%, 2/50)	2	0	0.377
1-3 (52%, 26/50)	19	7	
4-6 (30%, 15/50)	11	4	
Whole (14%, 7/50)	7	0	
Hypervascularity Normal (58%, 29/50)	25	4	0.100
Increased (42%, 21/50)	14	7	

Data are expressed as number of patients. * $p < 0.05$ statistically significant, LSCS: Lower segment Cesarean section

Table 4: Association of clinical and ultrasound factors with the need for uterine artery ligation (Done in n=10 patients)

Clinical factors	Uterine artery ligation		p-value
	Yes	No	
Age (≥ 35 years) (12%, 6/50)	1	5	0.737
Multiparity (66%, 33/50)	8	25	0.258
Prior LSCS (42%, 21/50)	6	15	0.126
Prior placenta previa (20%, 10/50)	4	6	0.077
Prior D and E (20%, 10/50)	1	9	0.377
Antepartum bleeding (72%, 36/50)	7	29	0.290
Ultrasound findings type			
Grade I (18%, 9/50)	1	8	0.290
Grade II a (16%, 8/50)	0	8	
Grade II b (4%, 2/50)	0	2	
Grade III (10%, 5/50)	2	3	
Grade IV (52%, 26/50)	7	19	
Lacunae No (4%, 2/50)	1	1	0.025*
1-3 (52%, 26/50)	1	25	
4-6 (30%, 15/50)	5	10	
Whole (14%, 7/50)	3	4	
Hypervascularity Normal (58%, 29/50)	2	27	0.06*
Increased (42%, 21/50)	8	13	

Data are expressed as number of patients. * $p < 0.05$ statistically significant, LSCS: Lower segment Cesarean section

Table 5: Association of clinical and ultrasound factors with the need for cesarean hysterectomy (Done in n=5 patients)

Clinical factors	Caesarean hysterectomy		p-value
	Yes	No	
Age (≥ 35 years) (12%, 6/50)	1	5	0.56
Multiparity (66%, 33/50)	5	28	0.109
Prior LSCS (42%, 21/50)	5	16	0.00*
Prior placenta previa (20%, 10/50)	2	8	0.239
Prior D and E (20%, 10/50)	1	9	1.00
Antepartum bleeding (72%, 36/50)	4	32	0.675
Ultrasound findings type			
Grade I (18%, 9/50)	0	9	0.274
Grade II a (16%, 8/50)	0	8	
Grade II b (4%, 2/50)	0	2	
Grade III (10%, 5/50)	0	5	
Grade IV (52%, 26/50)	5	21	
Lacunae No (4%, 2/50)	0	2	0.00*
1-3 (52%, 26/50)	0	26	
4-6 (30%, 15/50)	1	14	
Whole (14%, 7/50)	4	3	
Hypervascularity Normal (58%, 29/50)	0	29	0.006*
Increased (42%, 21/50)	5	16	

Data are expressed as number of patients. *p<0.05 statistically significant, LSCS: Lower segment Caesarian section

hysterectomy (Yes/No). On univariate analysis individual clinical and ultrasound parameter was correlated with the need for cesarean hysterectomy and p-value was calculated. Those risk factors whose p<0.05 were considered statistically significant for the cesarean hysterectomy.

Blood transfusion was significantly associated with the parity and those who had a history of antepartum hemorrhage in the II or III trimesters. Ultrasound factors were not predictive of the need for blood transfusion in our study. No. of lacunae and increased uteroplacental hypervascularity were significantly associated with uterine artery ligation and peripartum hysterectomy whereas grade of previa was not significantly associated with the occurrence of these complications. None of the clinical factors were significantly associated with uterine artery ligation. The patients who had prior cesarean delivery due to any indication were at significant risk of peripartum hysterectomy in placenta previa patients. All the patients who needed hysterectomy were placenta accreta intraoperatively. Different peripartum complications were associated with different clinical and ultrasound parameters. A composite score was made as all the parameters taken are dependent on each other for predicting peripartum complications.

At a scoring value from 6 to 8, there were 40% chances that bleeding was controlled by uterine artery ligation. As the score increased to 9/15 and 10/15 more than half of the patients had to undergo uterine artery ligation, which increased to 100% at a score of 11/15. Hysterectomy was needed at a score of 12/15 or more in around 75% of patients and 25% had uterine artery ligation. Hence, as the score increases, there is a need to shift to higher surgical intervention. The peripartum complications increases requiring the need for uterine artery ligation and hysterectomy. The need for blood transfusion also increases when the score is more than 5/15 and at a score of 12 or more all the patients needed a blood transfusion.

DISCUSSION

Patients with placenta previa fall into the high-risk group because of increased chances of morbidity and mortality. The continuously increasing rates of placenta previa cases are a consequence of increasing rates of cesarean delivery, maternal age, and assisted reproductive

technology [6]. Placenta previa can cause a torrential bleed in the antepartum and intrapartum period leading to increased maternal and fetal morbidity.

This study was carried out to determine whether high-risk clinical factors and ultrasound parameters can be combined to form a score to predict peripartum complications. Due to routine ultrasonography, now it is easy to diagnose placenta previa even without a patient presenting with antepartum hemorrhage. Regular antenatal patients who are diagnosed early offer a chance for better planning of cesarean delivery and have a better maternal and fetal outcome. Various parameters studied are dependent on each other, and thus a combined score can give a better idea of the complications which may arise in a particular patient. We had prospectively designed the study to identify individual risk factors as well as to make a combined score for predicting peripartum complications.

A study was done by Yoon *et al.* to calculate a pre-delivery risk score depending on the clinical history and ultrasonographic characteristics for patients with placenta previa. They have taken clinical parameters, i.e., parity, the number of previous cesareans, and prior history of placenta previa, and three ultrasound findings, i.e., type of placenta previa, lacunar grade, and hypervascularity of placenta to develop the combined score. They related this score to the occurrence of peripartum complications and found that when the total score was ≥ 7 , 100% of patients required a cesarean hysterectomy, and when the total score was ≥ 6 , in about three-fourths of patients' blood transfusion was needed [10].

In our study, we have taken an age, parity, history of antepartum hemorrhage, history of dilatation and evacuation, previous cesarean delivery, and history of placenta previa and ultrasound parameters, i.e., grade of previa, no. of lacunae in the placenta, and uteroplacental hypervascularity and developed a score. Our results show that at a score of more than 9 about 50% of patients required uterine artery ligation and at a score of more than 12, about 75% of patients needed a cesarean hysterectomy. The need for blood transfusion significantly increases at a score of ≥ 5 . At a score ≥ 12 , all the patients needed blood transfusion.

According to a study done by Lyu *et al.*, they have seen that history of 1 or more cesarean sections, anterior placenta, complete placenta previa, placenta accreta, preterm labour, and anemia were independent risk factors of need for peripartum hysterectomy. In our study, the patients having a history of a previous cesarean section along with ultrasound factors, i.e., increased no. of lacunae and significant uteroplacental hypervascularity were more predictive of the need for cesarean hysterectomy whereas grading of the placenta was not significantly associated with peripartum hysterectomy [11].

In a study done by Sanad *et al.*, on the effect of uterine artery ligation in patients with central placenta previa, the investigators found that the intra-operative blood loss was much less in patients who had uterine artery ligation before giving incision on the uterus and delivering the baby than the control group. Furthermore, the need for blood transfusion was significantly lower in patients with prophylactic uterine artery ligation. Surgical interventions were needed in the control group and not in study cases. In our study, we have seen that a score of 9 or above the chances of uterine artery ligation was 50% and at a score of 11 and above all the patients had to undergo uterine artery ligation. Hence, if we combine the results of both studies, the patients who have a score of 9 or above, uterine artery ligation can be done before delivering the baby. This may help to avoid blood loss and the need for blood transfusion. Prophylactic uterine artery ligation in every patient as stated by investigators carries a risk of urinary bladder injury due to adhesions from prior pelvic surgery and severe bleeding from varicose veins. Hence, the scoring will help choose patients in whom uterine artery ligation should be done [12].

A study was done by Boyle *et al.* to determine whether blood transfusion in placenta previa can be predicted. They had found that gestational age at delivery (32–35 weeks) and cesarean hysterectomy were the independent risk factors associated with blood transfusion in patients with placenta previa. Factors such as maternal age, race, parity, smoking status, grade of the placenta, accreta, and previous uterine surgery were not associated with the need for blood transfusion. In our study, we found that the blood transfusion was significantly associated with parity, history of antepartum hemorrhage in the second or third trimester, and cesarean hysterectomy. Similar to their study our study also concluded that risk factors like age, history of previous cesarean section, history of placenta previa in a previous pregnancy, history of dilatation and evacuation, grade of Previa, number of lacunar spaces in the placenta, and hypervascularity at the uteroplacental interface were not significantly associated with the need for blood transfusion [13].

CONCLUSION

By analyzing the data, we have made a scoring system to predict peripartum complications in patients with placenta previa. Furthermore, individual parameters were correlated with the occurrence of peripartum complications. Scoring will help the treating team of anesthetists and gynecologists to better plan the management and foresee the need for blood transfusion and surgical interventions. However, more studies need to be carried out in different study populations for better external validity.

ACKNOWLEDGMENT

None.

AUTHORS CONTRIBUTIONS

All the authors contributed to the preparation of the final manuscript.

CONFLICT OF INTEREST

No conflict of interest.

AUTHORS FUNDING

The authors did not receive any funding for this research work.

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