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Validation of a Scoring Model for the Prediction of Peripartum Complications in Patients with Placenta Previa

K Bhatia[1], Y M Mala[1], R Tripathi[1], A Manchanda[2], M M Singh[3]
[1]Department of Obstetrics and Gynaecology, Lok Nayak Hospital
[2] Department of Radiology, Lok Nayak Hospital
[3]Department of Preventive and Social Medicine, Lok Nayak Hospital
Corresponding author: Karishma Bhatia

Email: karishmabhatia21@gmail.com

Abstract

A Prospective cohort study conducted at Lok Nayak Hospital India. A clinical history was obtained and a transabdominal ultrasound was done for patients with placenta previa. The degree of previa, the location and the number of intraplacental lacunae were recorded. Echolucent area between placenta and uterine wall and the interface between bladder and uterine wall were also analyzed. Color Doppler was used to assess vascularity within the placenta. Subsequently, a score was assigned between 0 to 11.The main outcome measures were occurrence of peripartum complications like blood transfusion, uterine artery embolization and peripartum hysterectomy. The score was correlated with these outcomes and with the incidence of adherent placenta. The incidence of adherent placenta was 3.2%, 13.3%, 57.1 % in patients with no previous caesarean, previous one, previous two caesareans respectively (p value <0.001). Patients with score over 7 had more peripartum complications requiring blood transfusions, operative procedures like uterine artery embolisation and hysterectomy (p<0.001). This scoring model was valid in our population and can also be used to predict occurrence of adherent placenta, 85.7% of patients with scores more than 7 had adherent placenta.

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Keywords

Placenta previa, adherent placenta, placenta accrete, placenta previa complications, placenta previa scoring

I. Introduction

The incidence of placenta previa is 1 in 200 (0.5%) pregnancies [1]. Placenta accreta or morbidly adherent placenta is a leading cause of peripartum hysterectomy associated with haemorrhage, increased morbidity and mortality accounting for more than 30% of maternal deaths in Asia [2]. It is an obstetric complication occurring in about 1 in 2500 pregnancies [3]. Uterine scarring has been postulated to be responsible for abnormal placentation as well as for defects in the nitabuch' s layer leading to adherent placenta [4]. Hence, the incidence of both placenta previa and accreta is rising in parallel to the increasing caesarean section rates.

Ultrasound features like loss of normal hypoechoic retroplacental zone, thinning or interruption of the hyperechoic uterine serosa-bladder wall interface and presence of intraplacental lacunae has been associated with adherent placenta. Finberg and Williams classified these lacunae into four grades on the basis of size, shape and number and achieved a positive predictive value of 77.8% and negative predictive value of 93.3% for adherent placenta [5]. Twickler et al found that colour Doppler can improve the accuracy of diagnosis of adherent placenta [6]. It is known that caesarean section in placenta previa can be associated with profuse uterine bleeding regard-less of the presence of adherent placenta. The present study is a prospective cohort study con-ducted on 54 patients diagnosed to have placenta previa. A pre-delivery risk score based on clinical history and ultrasonographic characteristics was deduced in Korea for patients with placenta previa. It is composed of clinical factors (parity, number of previous caesareans and prior history of placenta previa) and three ultrasound findings (type of placenta previa, lacunar grade and hypervascularity of placenta). Based on this formula they found 100% positive predictive value for caesarean hysterectomy in patients with score 7 or more [7]. We have applied this score to our population and tried to determine its significance and assess its validity in our population. We have also studied various clinical and ultrasonographic factors and studied their correlation with occurrence of peripartum complications. This quantification can help patients with a higher score understand the risks associated and the treating gynaecologists and anaesthesiologists be more prepared to manage the complications.

Hence, the objective of this study is to assess the validity of a scoring model for the occurrence of peripartum complications in patients with placenta previa as well as correlation of various clinical and ultrasound factors with these complications.

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II. Material and Methods

This is a prospective cohort study in which 54 patients with placenta previa, i.e. placenta lying within 2 cm of cervical os were included. The study population comprised of patients admitted in Obstetrics and Gynaecology department of Lok Nayak hospital in New Delhi, India within the study period from January 2015 to February 2016. A detailed clinical history and a trans-abdominal ultrasound was done for all patients with placenta previa, patients where the placenta later migrated were excluded from the study. During caesarean section peripartum complications like need for blood transfusion, devascularization procedures, embolization and need for hysterectomy were noted.

The diagnosis of placenta previa was based on transabdominal ultrasonography done in the late second or early third trimester of pregnancy using 2 to 5MHz convex sector probe on Philips IU-22 or Siemens S-2000 machine. The degree of previa i.e. minor (not covering os) or major (covering os), the location (anterior or posterior) and the number of intraplacental lacunae were also recorded. Echolucent area between placenta and uterine wall and the interface between bladder and uterine wall were also analyzed. Cervical length was measured. Co and color Doppler was used to assess vascularity within the placenta. All ultrasounds were done by the same person. Based on these findings a score was assigned between 0 to 11(Table 1).

The calculated score was documented. The treating obstetrician was blinded to this result. The patients were managed as per hospital protocol and the peripartum complications, occurrence of bleeding, blood transfusion given, need for compression suture application, devascularisation procedures and hysterectomy were recorded. The need for blood transfusion was decided by the treating anaesthesiologist and clinician. Intraoperative measures to control bleeding were decided by the operating surgeon. Hysterectomy was done in cases with massive blood loss despite such measures or in cases with adherent placenta with profuse bleeding. Some cases with adherent placenta were managed with a conservative approach. Later, the clinical and ultrasound factors as well as the calculated score were correlated with the occurrence of complications. Neonatal out-comes were also recorded as birth weight, maturity and Apgar scores obtained. Statistical analysis was done by univariate and multiple logistic regression analysis using chi square test and fischer s exact test.

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III. Results

A total of 54 patients were included in this study during a time period of one year (January 2015 to February 2016). The mean age of the population was 26.6 years. Most of the patients (66.7%) were enrolled in the study at more than 34 weeks period of gestation and the rest between 24 to 34 weeks. The mean haemoglobin value of the patients was 10.3 gram%. In terms of obstetric history, 90.74 % 84% patients were multiparous, 50% of the patients had a history of previous abortion and one patient (1.8%) had placenta previa in a previous pregnancy. These factors were not found to hold any statistically significant relation with the peripartum complications. History of previous caesarean section was present in 42.6 3% patients of which 13% had previous two caesarean sections. This factor was statistically significant and had a major impact on the degree of complications during caesarean section. (Table 2).

Amongst the ultrasound factors, a higher lacunar grade, absence of echolucent area between placenta and uterine wall, interruption of bladder wall- uterine wall interface as well as placental vascularity were found to be associated with higher complication rates (Figure 1 and 2). The type of previa, location of placenta and cervical length did not influence the outcome. (Table 3).

Over all, patients with score less than 7 had lower complication rates and those with a score over 7 had more incidence of adherent placenta (6,85.7%), blood transfusion (7, 100%) , embolization (3,42.8%), caesarean hysterectomy (3,42.8%) and placenta left in situ (5, 71.4%) (Table 4).

In the multiple logistic regression analysis, there was no independent predictive factor in either ultrasound or clinical factors for any of the peripartum complications. However, on univariate analysis with total score <7 and >7 showed statistically significant relationship with the peripar-tum complications. Patients with higher score (>7) had higher rates of blood transfusion and need of operative procedures like uterine artery embolisation and caesarean hysterectomy ($p < 0.001$). (Figure S1). Fetal outcome was independent of the calculated score and was dependent on the birth weight of the baby. (Figure S1)

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IV. Discussion

Placenta previa can cause major obstetric haemorrhage leading to maternal mortality with poor fetal outcome. Such cases require special attention, preparation, planning, individualization and a multidisciplinary approach. In some cases the delivery might be uncomplicated and just like a routine caesarean section, in others it can prove to be a near death event for the mother. Hence being adequately prepared in terms of a well equipped center, experienced surgeons, availability of blood bank and ICU facility is of utmost importance. We calculated risk score based on a pro-posed formula and found it to hold validity for our population.

In our study population, the occurrence of adherent placenta was 3.2%, 13.3%, 57.1 % in patients with no previous caesarean section, previous one, previous two caesarean sections respectively (p value <0.001) . Our findings were in agreement with other studies and confirm that in-crease in the number of previous caesarean sections is associated with an increase in the occurrence of morbidly adherent placenta [8-9].

In the present study we also found an association between the requirement for blood transfusion and a history of previous caesarean section (p <0.02). Hasegawa et al had a similar conclusion in their study on factors associated with increased haemorrhage during caesarean section in patients with placenta previa [10]. No significant correlation was found between the type and location of placenta with both maternal and fetal outcome.

We used Finberg's criteria and graded the lacunae into grade 0, 1, 2 and 3. We observed that the need for blood transfusion and procedures like uterine artery embolisation and caesarean hysterectomy was significantly more in patients with a higher lacunar grade (p <0.01). Several authors have demonstrated a significant correlation of lacunar grade with maternal outcome in patients with placenta previa. Finberg and Williams achieved a 77.8% positive predictive value and 93.3% negative predictive value for adherent placenta [5]. In another study by Yang et al cases with a higher grade of intraplacental lacunae had a higher rate of complications, need for massive trans-fusion, admission to ICU and caesarean hysterectomy [11]. Hence, intraplacental lacunar grade is an important factor to predict peripartum complications in patients with placenta previa. We also found in this study that the peripartum complications were more in patients where the echolucent area between placenta and uterine wall was absent (p <0.01). In five patients (9.25%) the inter-face between bladder and uterine wall was interrupted and all of them had adherent placenta and higher morbidity compared to the rest of the cases (p <0.01). It was found that in patients with increased placental vascularity the incidence of postpartum haemorrhage was more. The placenta was adherent or required devascularisation procedures (< 0.01) and blood transfusion (p = 0.02).

Majority of the patients, i.e. 87% had a score of less than 7 and 13% had a score more than 7. The score obtained was not disclosed to the

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operating surgeon and the patients were managed as per the hospital protocol (figure S2). The maternal outcome was different when we compared patients in different score groups. In the group with a score < 7, lesser number of patients developed postpartum haemorrhage and fewer procedures were needed to control this haemorrhage. About 15 % of the patients in this group needed blood transfusion as opposed to 100% of the patients (n=7) with a score more than 7 ($p < 0.001$). Among patients with score less than 7 (87%) few patients had postpartum haemorrhage intraoperatively which required operative interventions. Uterine artery ligation was done in 12.8% of the patients and compression sutures were applied in 8.5% of the patients with low score. These procedures were sufficient to control the haemorrhage and none of the patients with low score required uterine artery embolisation or a caesarean hysterectomy in this group.

In our study, among those patients who had score greater than 7 (13%), the incidence of peripartum complications of post-partum haemorrhage and morbidly adherent placenta were higher in this group ($p < 0.001$). Uterine artery ligation was performed in 28.5% of the patients and uterine artery embolisation was done in 42.8% (n=3) of the patients. Embolisation rates were also more when the score was higher ($p < 0.01$). Hysterectomy was performed in 42.8% (n=3) of the patients with scores over seven. One caesarean hysterectomy, one interval hysterectomy and one emergency interval hysterectomy were performed in view of morbidly adherent placenta. Most of the complications occurring in patients with placenta previa in our study can be attributed to the occurrence of morbidly adherent placenta (Figure S2). In our study, 13% of the patients (7/54) had morbidly adherent placenta intra operatively. When this was correlated with the score placenta was found to be morbidly adherent in 85.7% of the patients with score above seven ($p < 0.001$)

Certain ultrasound factors which are not included in the above mentioned score like absence of echolucent area between placenta and uterine wall and interruption of interface between bladder and uterine wall were also found to have a significant association with occurrence of morbidly adherent placenta and increased incidence of peripartum complications ($p < 0.01$). In the present study, we have also observed that patients in whom the calculated risk score was over 7 had more peripartum complications requiring blood transfusions and operative procedures like uterine artery embolisation and hysterectomy ($p<0.001$). Hence, we find that this scoring model is valid in our study subjects.

Strengths

This was a prospective study and results were blinded to the treating surgeon. All ultrasounds were performed by the same person to eliminate any interobserver variation.

Limitations

Color Doppler was done to assess vascularity of placenta which is a subjective finding. Studies with bigger sample size and involving various populations are further required to confirm this scoring model.

Interpretation

This scoring model was found to be valid in our population and can also be used to predict occurrence of adherent placenta as 85.7% of

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patients with scores more than 7 had adherent placenta.

V. Conclusion

The use of this scoring model can help in providinggive an objective means for better counselling of the patients with Placenta Previa and relatives. Also, sit may assist surgeons, anesthetists and blood bank facilities to tailor the management of such patients with more vigilant approach and preparedness. Studies with different populations and larger sample size are needed to further assess its validity.

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Disclosure of interest

There is no conflict of interest

Contribution to authorship

This study was conceptualized by Dr. Karishma Bhatia and Dr. Y M Mala. The patients were recruited and relevant information was collected, consents taken well as ultrasounds were per-formed. Dr. Reva Tripathi has constantly extended her expertise and guidance in making this study possible. The ultrasounds were supervised by Dr. Alpana Manchanda and contributed to this work. Dr. M M Singh has assured proper statistical analysis of the data obtained and reach-ing the outcome of the study. All the authors have contributed towards the study as well as writ-ing the research article.

Ethics approval

The study protocol had been approved by the ethics committee at Maulana Azad Medical College, New Delhi in October 2014 prior to the study period.

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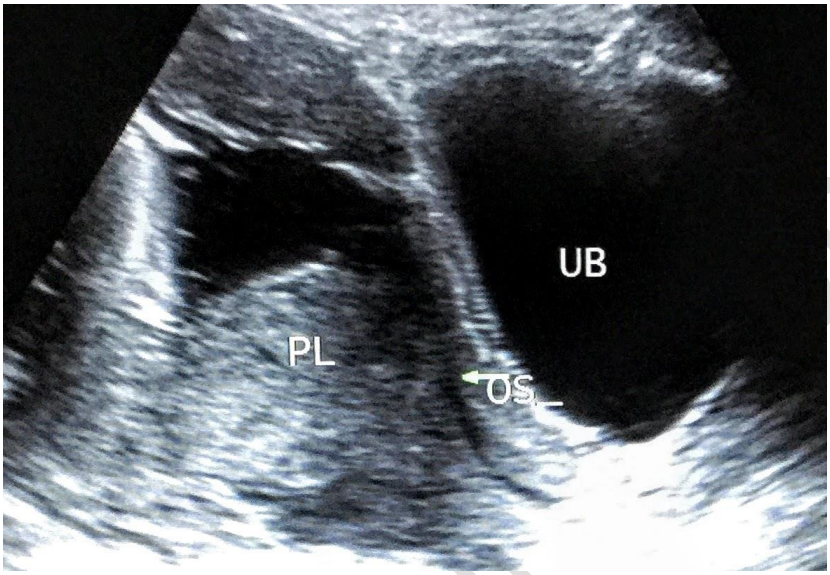

Figure 1 : Longitudinal ultrasound image shows placenta covering the internal os. Bladder wall uterine interface is intact. Lacunae grade is zero. This patient had a low score and intraoperatively placenta was not adherent.

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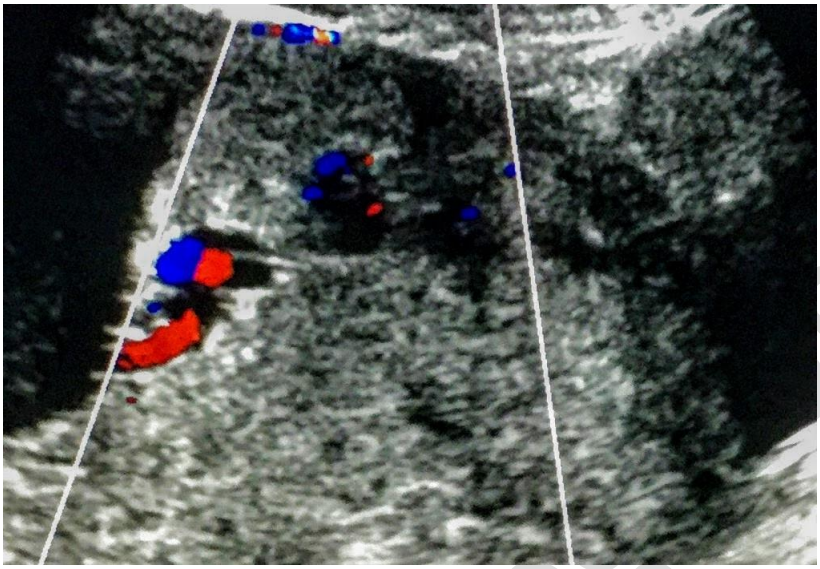

Figure 2: Longitudinal ultrasound image shows placenta covering the internal os. Bladder wall uterine interface is interrupted in this case. Grade 3 intraplacental lacunae seen in the placenta. Score was high and placenta was found to be adherent intraoperatively

Table 1 : Scoring model Based on clinical and ultrasound factors in patients with placenta previa. Score assigned is between 0 to 11.

Factor assessed	**Score assigned**			
	0	1	2	3
Multiparity	No	Yes		
Prior previa	No	Yes		
Prior caesarean section	No	Once	Twice or more	
Type	Partial		Total	
Lacunae	None	1-3	4-6	Whole
Hypervascularity	Normal	Moderate	Severe	

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Table 2: Association of clinical factors with the occurrence of peripartum complications

Clinical factor (n=54)	Blood Transfusion			Uterine artery embolisation			Caesarean Hysterectomy		
	Yes (n=14)	No (n=40)	P	Yes (n=3)	No (n=51)	P	Yes (n=3)	No (n=51)	P
Age >35 years n=1 (1.8%)	0	1	0.74	0	1	0.94	0	1	0.94
Multiparity n=49 (84%)	14	35	0.20	3	46	0.74	3	46	0.74
Prior abortion n=27 (50%)	7	20	0.62	2	25	0.50	0	27	0.11
Prior previa n=1 (1.8%)	1	0	0.25	1	0	0.06	0	1	0.94
Prior C.S. n=23 (42.6%)	12	11	**0.02**	3	20	0.07	3	20	0.07

Fisher's exact test was applied

Data expressed as number of patients

Table 3: Association of ultrasonographic factors with the occurrence of peripartum complications

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Ultrasound factors	Blood Transfusion			Uterine artery embolisation			Caesarean Hysterectomy		
	Yes (n=14)	No (n=40)	P	Yes (n=3)	No (n=51)	P	Yes (n=3)	No (n=51)	P
Type **Minor (14, 25.9%)**	4	10	0.50	0	14	0.40	0	14	0.40
Major (40, 74.1%)	10	30		3	37		3	37	
Location **Anterior (36, 66.7%)**	11	25	0.22	3	33	0.28	3	33	0.28
Posterior (18, 33.3%)	3	15		0	18		0	18	
Lacunae **Grade 0 (15, 27.8%)**	0	15	**0.01**	0	15	**0.01**	0	15	**0.01**
Grade1 (25, 46.8%)	6	19		0	25		0	25	
Grade2 (8, 14.8%)	2	6		0	8		1	7	
Grade3 (6, 11.1%)	6	0		3	3		2	4	
Echolucent area **Present (49, 90.7%)**	9	40	**0.01**	0	49	**0.01**	0	49	**0.01**

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Absent (5, 9.3%)	5	0		3	2		3	0	
Placental vascularity **Normal (39, 72.2%)**	3	36	**0.02**	0	39	**0.01**	0	39	**0.01**
Moderate (12, 22.2%)	8	4		2	10		1	11	
Severe (3, 5.5%)	3	0		1	2		2	1	
Bladder-uterine interface **Intact (49, 90.7%)**	9	40		0	49		0	49	
Interrupted (5, 9.3%)	5	0	**0.01**	3	2	**0.01**	3	2	**0.01**

Fisher's exact test was applied

Data are expressed as number of patients

Table 4: Association of risk score with maternal peripartum complications

Peripartum complication	**Score <7 (n= 47)**	**Score >7 (n=7)**	**'p' value**

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Blood transfusion (n=14)	7 (14.9%)	7 (100%)	**<0.001**
Uterine artery ligation (n=8)	6 (12.8%)	2 (28.5%)	0.27
Compression sutures (n=4)	4 (8.5%)	0 (0%)	0.56
Morbidly Adherent Placenta (n= 7)	1 (2.1%)	6 (85.7%)	**<0.001**
Placenta left in situ (n=6)	1 (2.1%)	5 (71.4%)	**<0.001**
Uterine artery embolisation (n=3)	0 (0%)	3 (42.8%)	**<0.001**
Caesarean/Interval Hysterectomy (n=3)	0 (0%)	3 (42.8%)	**<0.001**

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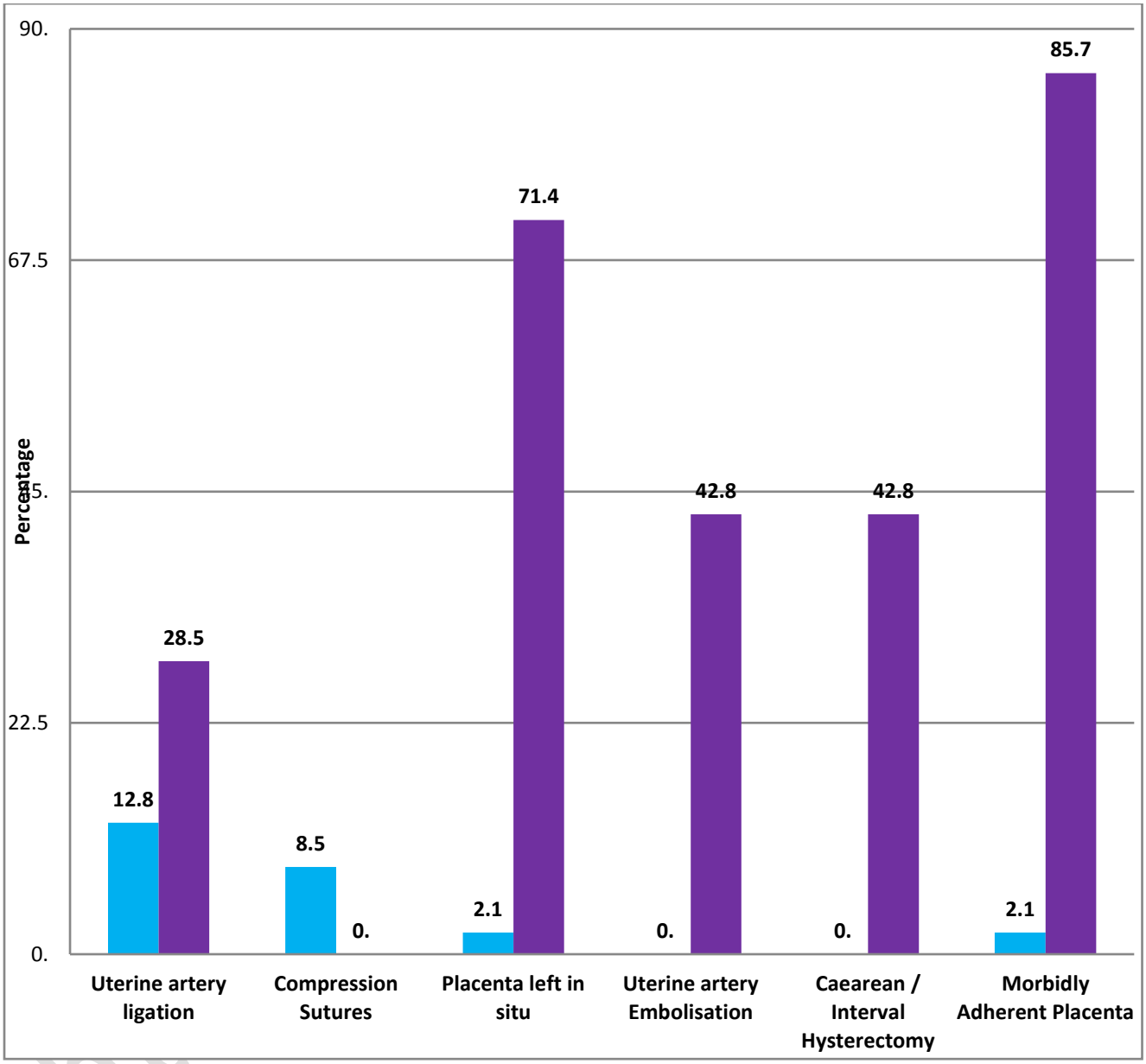

Figure S1: Association of risk score with outcome obtained. Blue bar denotes patients who scored less than 7, violet bar denotes patients with score 7 or more. The need for

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devascularization procedures, uterine artery embolization and hysterectomy is more in patients with higher score. Occurrence of adherent placenta was also more in patients with higher score

Figure S2: MANAGEMENT OF PATIENTS IN THE STUDY

Flowchart depicting outcomes of patients in the study(n=54). Note that seven patients in this study had adherent placenta, four of whom were managed conservatively.

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