

A prospective evaluation and management of different types of placenta praevia using parallel vertical compression suture to preserve uterus

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Abstract

The rising tendency of cesarean sections will lead invariably to more complications such as placenta praevia. The aim of our study was to evaluate the utility of parallel vertical compression suture to preserve uterus in cases of placenta praevia, and to propose a rational approach of these problematic cases, according to their grade of myometrial invasion.

We prospectively included 95 consecutive cases diagnosed with placenta praevia (group 1 [Gr1]) where we used parallel compression suture and compared to retrospectively analyzed 100 consecutive cases managed without using this technique (group 2 [Gr2]). We differentiated the types of placenta praevia according to their invasion in myometrium because this parameter appreciates best their degree of severity, so we had 4 Grs: simple praevia (no adherent), accreta, increta, and percreta. All patients underwent ultrasound evaluation before surgery. Cesarean section was planned at 35 to 36 weeks. The main goal was to preserve the uterus whenever was possible. After opening the peritoneal cavity, we first inspected the lower segment and bladder. If no signs of engorged and tortuous vessels we dissected first the bladder and then performed a transverse hysterotomy, removed the placenta and placed 2 parallel vertical sutures on the lower segment below the hysterotomy incision through the entire thickness of both uterine walls. In cases of massively engorged vessels we dissected the bladder after infant delivery and made a transverse uterine incision slightly higher. We measured the amount of blood loss and performed three postoperative ultrasound exams, on day 2, 4 and at 6 to 8 weeks.

Using this technique, we were able to preserve the uterus in 98.33% of Gr1 versus 78.47% from Gr2 of simple placenta praevia, in 88.23% in Gr1 compared to 42.86% in Gr2 of placenta accreta, only in 14.28% of increta type and in none (0%) of the 2 cases with placenta percreta.

The simplified compression technique for hemostasis and preserving uterus in cases of simple placenta praevia and accreta is easy to perform without special surgical skills and is rapid. There are no short and long-time complications related to the technique. In cases of placenta increta the problem is not that this technique is unsuccessful but getting to that point to place the sutures is difficult. In severe cases of placenta percreta, unfortunately, the hysterectomy remains the treatment of choice.

Abbreviations: Gr = group, mL = milliliter.

Keywords: compression suture, parallel vertical compression suture, placenta praevia

1. Introduction

Placenta praevia is diagnosed when the placenta is inserted wholly or in part into the lower segment of the uterus. A morbidly adherent placenta includes placenta accreta, increta, and percreta as it penetrates through the decidua basalis into and then through the myometrium. The lack of a plane of cleavage between the placenta and the uterine wall leads to major hemorrhage if an attempt is made to remove villous tissue embedded within the myome-

trium.^[1] The severity of the complications is proportional with the depth of villous invasion. In percreta type, besides the villous invasion of surrounding pelvic organs, excessive neovascularity is often present making any surgical procedure technically difficult.^[2]

In the pathophysiology of abnormally adherent placenta during the years several concepts have been proposed, but the current explanation is that a secondary defect of the endometrium-myometrial interface determine abnormal decidualisation in the area of a uterine scar, allowing abnormally deep placental anchoring villi and trophoblast invasion.^[3]

The rising incidence of cesarean sections combined with increasing maternal age, the number of cases of placenta praevia and its complications, including placenta accreta, will continue to increase.^[4-6]

In cases with placenta praevia, during cesarian section, usually severe bleeding occurs after placental removal. Bleeding is caused by poor contraction of the lower uterine segment and subsequent inability to compress the vessels, therefore uterotonic agents are ineffective to control bleeding from the placental site.

The traditional surgical techniques for hemostasis include artery ligation^[7] or cesarean hysterectomy. The rapid accumulation of blood in the surgical field obscures the bleeding site, making control difficult. Internal iliac artery ligation is the most effective way to control hemorrhage and preserve uterus, but

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this surgical procedure is difficult and requires a high degree of surgical skill and training.

Hwu et al^[8] simplified the square suturing technique described by Cho et al,^[9] replacing it with simple vertical sutures, which requires only 1 stitch instead of 4. But one of the sutures was passed through the lower segment cavity and inserted into the middle layer of the posterior wall of the lower segment and the needle did not penetrate the entire thickness of posterior wall. However, this type of suture might be difficult to perform because of the small cavity, the large needle, and the massive bleeding. Moreover, when the surgeon tightens the suture it might induce lacerations of the posterior wall increasing the bleeding.

We used modified parallel vertical compression sutures placing them through the entire thickness of both uterine walls.

Mohamed and Mohamed^[10] recently published a study where they evaluated the effectiveness of full-thickness vertical compression suture and intrauterine catheter in cases with placenta previa/accreta.

Guang-Tai Li et al^[11] modified the parallel vertical compression sutures placing them through the entire thickness of both uterine walls. Because the suturing range of their procedure includes the full length rather than a partial length of the lower uterine segment, it is better able to stop bleeding in most patients. The other advantages of this procedure are that it is simple, easy, safe, effective, and practical, as it requires less experience than other conservative devascularisation methods, including internal iliac artery ligation.

The main problem of these reports is that they do not differentiate clearly the surgical technique used in cases of simple placenta praevia and placenta accreta, increta, and percreta, those being included in a group (Gr) of morbidly adherent placenta. The importance of treating them separately in our opinion is major because the bladder dissection before opening the uterus and extracting the baby may be very difficult and extremely haemorrhagic in cases of “morbidly adherent placenta”, and sometimes when trying to remove such a placenta we practically do not have an anterior wall of the lower segment to place a suture.

The aim of our study is to provide a rational approach of cases diagnosed with placenta praevia according to their severity simple praevia, accreta, increta, and percreta in order to avoid unnecessary postoperative morbidity and preserving whenever is possible the uterus.

2. Material and methods

We prospectively included in study 95 consecutive cases diagnosed with placenta praevia admitted in the Department of Obstetrics and Gynecology from Emergency County Hospital, Timisoara, Romania. We excluded those with placenta praevia who had no bleeding from placental site and did not require compressive suture. For comparison, we retrospectively reviewed the last consecutive 100 cases with placenta praevia, using the same classification as for the prospective Gr, these cases being managed without using the parallel vertical compression suture. These Grs were divided in Gr1 with prospective evaluation and Gr2 with retrospective evaluation

The classification used was the 4 types:

- Type I—placenta is near but not touching mouth of cervix (low-lying placenta)
- Type II—placenta reaches mouth of the cervix but doesn't cover it (marginal praevia)

- Type III—placenta partially covers the mouth of the cervix (partial praevia)
- Type IV—placenta completely overlays the mouth of the cervix (complete or total praevia)

We differentiated the types of placenta praevia according to their invasion in myometrium because this parameter appreciates best their degree of severity. Therefore, we have 4 Grs: simple placenta praevia (no abnormal adherence, easily removable), accreta myometrial invasion but possible to manually remove, the main part of myometrium remains intact), increta (myometrial invasion on its entire thickness, placenta removal affects severe the uterine wall or needs excision) and percreta (placenta invades the adjacent structure).

All patients underwent transabdominal and transvaginal ultrasound evaluation before surgery. The ultrasound diagnostic criteria used were as described by Shih et al.^[12] Using gray scale we looked for complete loss of the retroplacental sonolucent zone or its irregularity, thinning or disruption of the hyperechoic uterine serosa-bladder interface, exophytic masses invading the urinary bladder and the presence of abnormal placental lacunae. The color Doppler diagnostic features were: diffuse or focal lacunar flow pattern, vascular lakes with turbulent flow, increased vascular pattern of the uterine-bladder interface with abnormal vessels linking the placenta to the bladder and markedly dilated vessels over the peripheral subplacental region. In cases with suspicion of placenta increta and percreta MRI was performed to clarify diagnosis.

The cesarean section was planned at 35 to 36 weeks except for those who came with vaginal bleeding and required immediate intervention. All patients with elective cesarean section received corticoid therapy for lung maturation at 32 weeks and were admitted to hospital at 34 weeks.

Our main goal was to preserve the uterus whenever was possible. Abdominal wall incision was transverse Pfannenstiel type, in 4 cases median incision because of a previous midline incision. After opening the peritoneal cavity, we first inspected the lower segment and bladder. If there were no signs of engorged and tortuous vessels we dissected first the bladder and then performed a transverse hysterotomy. After infant delivery, the placenta was removed manually, in cases of accreta or increta we left some small fragments attached to uterine wall or a small part of the uterine wall containing placenta was excised. The uterus was exteriorized in every case, bladder kept away with a Doyen retractor and we placed 2 vertical parallel sutures on the lower segment below the hysterotomy incision as described by Hwu et al^[8] but through the entire thickness of both uterine walls using absorbable nr. 2 sutures. After placing the suture and the bleeding stopped, the uterine closure was performed in the usual manner with continuous suture. In cases of massively engorged vessels on the lower segment we did not dissect the bladder and made a transverse uterine incision slightly higher in order to avoid the incision of these vessels. After infant delivery, the bladder was dissected and pushed downwards, the vascular engorgement diminished slightly, after that we tried to remove the placenta. If we succeed even with small fragments left in place, the parallel vertical suture was placed. The uterine closure was made with continuous suture and when sometimes bleeding persisted from puncture sites on the lower segment, we performed bilateral uterine artery ligation. If the removal of placenta was impossible or massive bleeding occurred, the uterus was exteriorized and hysterectomy performed.

The method was used as first attempt to stop the bleeding followed by immediate closure of uterus and every patient had 2 postoperative ultrasound examinations because of the theoretical risk of lochiometra on day 2 and 4 and 1 at postpartum control between 6 to 8 weeks.

Every patient with compression sutures received uterotonic agents such as oxytocin and prostaglandins. The assessed parameters were: uterus preservation, the amount of blood loss, intraoperative complications such as bladder or ureter injury, postoperative immediate and late complications linked to compressive sutures.

After approval was obtained from local ethical committee, patient had signed a written informed consent in which was clearly stated that in case of failure to achieve haemostasis a hysterectomy will be performed.

In Gr2, we retrospectively evaluated the 100 consecutive cases with placenta praevia treated in our hospital prior to introducing the method described before in order to compare the results and mainly uterus preservation. The same classification was used for types of placenta praevia as described for the prospective Gr, data were extracted from sonographic and MRI reports and in cases with hysterectomy, we revised the pathology reports. The following parameter was extracted from the records: uterus preservation, the amount of blood loss, intraoperative complications such as bladder or ureter injury, postoperative immediate and late complications.

The interventions performed in the retrospective Gr were: in cases of simple placenta praevia or accreta, cesarean section in the usual manner through a Pfannenstiel incision. After placental extraction, bilateral uterine artery ligation was performed. In cases of persistent hemorrhage, bilateral internal iliac ligation and/or hysterectomy were made. In cases with placenta praevia increta or percreta, uterine incision was made above the margin of the placenta followed by hysterectomy without attempting to remove the placenta in percreta types and with placental removal in 5 cases of placenta increta.

We compared the 2 Grs for uterus preservation and the amount of blood loss using student *t* test for values and chi square for proportions using MedCalc v18.10 (MedCalc Software, Belgium).

3. Results

From the total patients diagnosed with placenta praevia the majority occurred on an existing previous cesarean scar 93.68% in Gr1 and 94% in Gr2. We had 22 cases in Gr1 with type IV,

among them 2 had placenta praevia percreta and 30 cases in Gr2 with 3 percreta. The majority in both Grs had simple placenta praevia and the rest of 27.37% in Gr1 and 35% in Gr2 had abnormal adherent placenta. The main characteristics of the 2 study Grs are listed in Table 1.

We were able to perform parallel vertical suture on the lower segment in Gr1 in all cases (100%) of simple placenta praevia with bladder dissection before hysterotomy, in 2 cases there was persistent bleeding from the suture site and bilateral uterine artery ligation was performed. One case, a type III anterior, had postoperative vaginal and intraperitoneal persistent haemorrhage, and after 3 hours needed intervention and hysterectomy. From 17 cases with placenta accreta we have been able to perform 15 compression sutures (88.23%), 2 needed hysterectomy because of massive bleeding (11.77%). Regarding the increta type, we did only 1 compression suture (14.28%) where multiple small fragments of placenta were left in place, and additional bilateral uterine artery ligation was performed. In the other 6 cases (85.72%) after trying to manually remove the placenta we had to perform hysterectomy because of the heavy bleeding, and in 2 cases we had no lower anterior uterine segment to suture. We had only 2 cases of placenta praevia percreta, 1 anterior, invading the bladder, in this case we opened the uterus at a higher point, away of the margin of placenta, we did not attempt to extract the placenta and performed hysterectomy with bladder resection and bilateral ureter reimplantation. The other case placenta invaded the parametrial tissue, after infant delivery through a uterine incision made above the upper margin of placenta; the haemorrhage was extremely massive leading to cardiac arrest. After successful resuscitation, hysterectomy was performed and bilateral internal iliac artery ligation because bleeding persisted. In Gr2 the uterus was preserved only in 78.47% of simple praevia type, statistically significant ($P < .001$) less than in Gr1 98.55% and in accreta type we observed as well a statistically significant difference between Grs in uterus preservation, Gr1 88.23% vs Gr2 42.86% ($P < .001$). Regarding increta and percreta type we did not find any difference between Grs. (Table 2).

We measured the total blood loss in every case, by adding the volume of quantified blood in the suction canister with the volume of blood calculated by weighting all blood-soaked materials (Table 3). The average blood loss in simple placenta praevia was similar between Grs, in accreta Gr was significantly less in Gr1 with compression suture than in Gr2, in increta Gr we found no statistically difference and in the percreta type the blood loss was significantly less in Gr2 (>4000 [milliliter]mL) comparing to Gr1 (2600 mL).

Table 1
Characteristics of study groups.

Type of praevia	Number of cases		Previous cesarian (number of cases)		Simple Praevia (number of cases)		Accreta (number of cases)		Increta (number of cases)		Percreta (number of cases)	
	Gr1	Gr2	Gr1	Gr2	Gr1	Gr2	Gr1	Gr2	Gr1	Gr2	Gr1	Gr2
Type I anterior	14	12	13	12	13	12	1	0	0	0	0	0
Type I posterior	11	9	11	8	11	9	0	0	0	0	0	0
Type II anterior	12	9	12	9	11	8	1	1	0	0	0	0
Type II posterior	9	11	9	9	8	9	1	2	0	0	0	0
Type III anterior	19	23	18	23	10	10	5	7	4	6	0	0
Type III posterior	8	6	6	5	6	5	2	1	0	0	0	0
Type IV	22	30	20	28	10	12	7	10	3	5	2	3
Total	95	100	89	94	69	65	17	21	7	11	2	3

Gr = group.

Table 2**Success rates using compressive suture according to severity degree.**

Degree of severity	Total number of cases		Compression suture number of cases (%)		Hysterectomy number of cases (%)		Uterus preserved number of cases (%)		P value
	Gr1	Gr2	Gr1	Gr2	Gr1	Gr2	Gr1	Gr2	
Simple placenta praevia	69	65	69 (100%)	0 (0%)	1 (1.44%)	14 (21.53%)	68 (98.55%)	51 (78.47%)	<i>P</i> <.001
Accreta	17	21	15 (88.23%)	0 (0%)	2 (11.77%)	12 (57.14%)	15 (88.23%)	9 (42.86%)	<i>P</i> =.006
Increta	7	11	1 (14.28%)	0 (0%)	6 (85.72%)	11 (100%)	1 (14.28%)	0 (0%)	<i>P</i> >.05
Percreta	2	3	0 (0%)	0 (0%)	2 (100%)	3 (100%)	0 (0%)	0 (0%)	<i>P</i> >.05

Gr = group.

Table 3**Estimated blood loss according severity degree.**

Degree of severity	Blood loss (mL) average (range)		P value
	Gr1	Gr2	
Simple placenta praevia	1350 (850–1700)	1450 (750–1800)	<i>P</i> >.05
Accreta	1550 (1100–1950)	1750 (1150–2100)	<i>P</i> <.001
Increta	2600 (2100–3150)	2750 (1900–3300)	<i>P</i> >.05
Percreta	>4000	2600 (1500–3900)	<i>P</i> <.001

Gr = group, mL = millilitre.

The ultrasound examination performed in Gr1 on day 2, day 4 and at 6 to 8-week postpartum did not find lochiometra or any pathological feature. (Fig. 1) We had no postoperative complications attributable to the compression suture.

Using this technique, in Gr1, we were able to preserve the uterus in 98.55% of simple placenta praevia, in 88.23% of placenta accreta, only in 14.28% of increta type and in none of the 2 cases with placenta percreta.

4. Discussions

During time a lot of techniques were imagined in order to control bleeding from placenta praevia and to preserve uterus because this is 1 of the major causes of postpartum hysterectomy and

**Figure 1.** Sagittal section of uterus showing one of the sutures (white arrows).

therefore compromising the reproductive future of a woman. The results of our study demonstrate that this technique of compressive suture is very good in achieving hemostasis in cases of placenta praevia and prevent hysterectomy. But this works only in less severe cases with non-adherent placenta praevia and accreta, in those like placenta increta is not so effective and in cases of percreta is safer not to try to preserve the uterus. Although we have a small number of cases, this study may provide a rational approach to these extremely severe situations because until now there are no published studies using this surgical technique and making distinction between the types and degree of myometrial invasion of placenta praevia.

Cho et al^[9] reported a square suturing technique to compress the anterior and posterior uterine walls to control postpartum hemorrhage. This is a way of achieving hemostasis while preserving the uterus without performing internal iliac artery ligation. However, the technique requires 4 stitches to form a square, but it might be difficult for an on-duty surgeon to remember the sequence of suture placement in an emergency.

Hwu et al^[8] described the vertical parallel compression suture in 2005 simplifying the technique described by Cho, but 1 of the sutures was passed through the lower segment cavity and inserted into the middle layer of the posterior wall of the lower segment and the needle did not penetrate the entire thickness of posterior wall. This type of suture might be difficult to perform because of the small space, the large needle and the massive bleeding, therefore, is more time consuming meanwhile the patient is bleeding. Moreover, when the surgeon tightens the suture it might induce lacerations of the posterior wall increasing the bleeding.

We used the parallel vertical compression sutures placing them through the entire thickness of both uterine walls below the uterine incision achieving the same results in less time and without complications.

The B-Lynch technique^[13] is also a compression suture to appose the anterior and posterior uterine walls to control hemorrhage but is addressing especially to uterine atony and is less effective in cases of placenta praevia.

Hayman et al^[14] suggested placing 2 transverse compression sutures but these obliterate the lochia drainage and to ensure that the cervical lumen remain patent inserted a pair of closed artery clamps before tightening the sutures. We used these forceps between the vertical parallel sutures but only in the first 3 cases, the rest of the cases had a normal lochia drainage therefore it is not necessary.

Guang-Tai Li et al^[11] published a paper where they used a vertical parallel suture placed after the placenta was removed, the bladder separated from the lower uterine segment but the puncture sites were below and above the hysterotomy line with an overall success rate of 86%. In our opinion is better to make the transverse uterine incision a little higher, especially in anterior located placenta, above its margin to prevent more blood loss by transplacental extraction of the baby. In cases of previous cesarian scar this type of incision offers also a thicker lower margin of hysterotomy and expose the entire lower segment for the compression suture.

Mohamed and Mohamed^[10] published in 2017 a study and they evaluate the effectiveness of full-thickness vertical compression suture and intrauterine catheter in cases with placenta praevia/accreta with a success rate of 98.2%. In their study, there are no differentiation by the degree of severity and they report in 49 cases of morbidly adherent placenta the dissection of bladder flap before the uterine incision. In our case series, we find a

massive vascular engorgement in adherent types of placenta and trying to dissect the bladder will invariable lead to a heavy bleeding. After infant extraction, the congestion diminishes and is more prudent to postpone the bladder dissection.

This technique controlled the hemorrhage immediately after tightening the knots, therefore the amount of blood loss was quite low. It is easy to perform without special surgical skills and is rapid. It must be used as first attempt of achieving hemostasis before other methods.

The normal postoperative and long-term ultrasound examinations showing normal relations and the normal amount of menstrual bleeding makes us to affirm that this simplified technique is safe despite the small number of cases.

In case of placenta increta 1 may attempt to remove the placenta if it works the compression suture may be successful. Our results show that is safer to perform hysterectomy in case of placenta increta from the beginning because the preservation of the uterus might be achieved in only 14.28% of the cases.

Regarding placenta percreta, we had severe intraoperative complications and cardiac arrest, without even attempting to preserve the uterus, and if hysterectomy is performed without touching the placenta, the blood loss is significantly less. Therefore, we think that hysterectomy remains the first choice of treatment in such cases. Based on our results and other published study we developed an algorithm which can help for decision making in such problematic cases (Fig. 2).

For such cases of placenta percreta, Belfort et al^[15] described recently a technique of hysterectomy which minimize the blood loss using diathermy to open the uterus away from the placenta in an avascular box created by placing full thickness anterior wall sutures in a box pattern and then continuing the incision without rupturing the membranes with a linear cutting stapler. After infant delivery, the uterus is closed with the placenta on site and hysterectomy is performed. Sak et al^[16] suggests for postpartum hysterectomy for placenta percreta also an incision far from the placenta and hysterectomy with placenta left "in situ", after bladder flap dissection and bilateral internal iliac arteries ligation if uncontrollable bleeding occurs due to the bladder dissection.

5. Conclusions

The simplified technique of 2 vertical parallel compression suture of the lower uterine segment for hemostasis and preserving uterus in cases of simple placenta praevia and accreta is easy to perform without special surgical skills, is rapid, takes less than 3 minutes and controls bleeding immediately without short or long-time complications. It is advisable to be used as first attempt of achieving hemostasis before other complex measure are undertaken.

In cases of placenta increta the problem is not that this technique is unsuccessful but getting to that point to place the sutures is difficult.

In severe cases of placenta percreta unfortunately the hysterectomy remains the treatment of choice.

Author contributions

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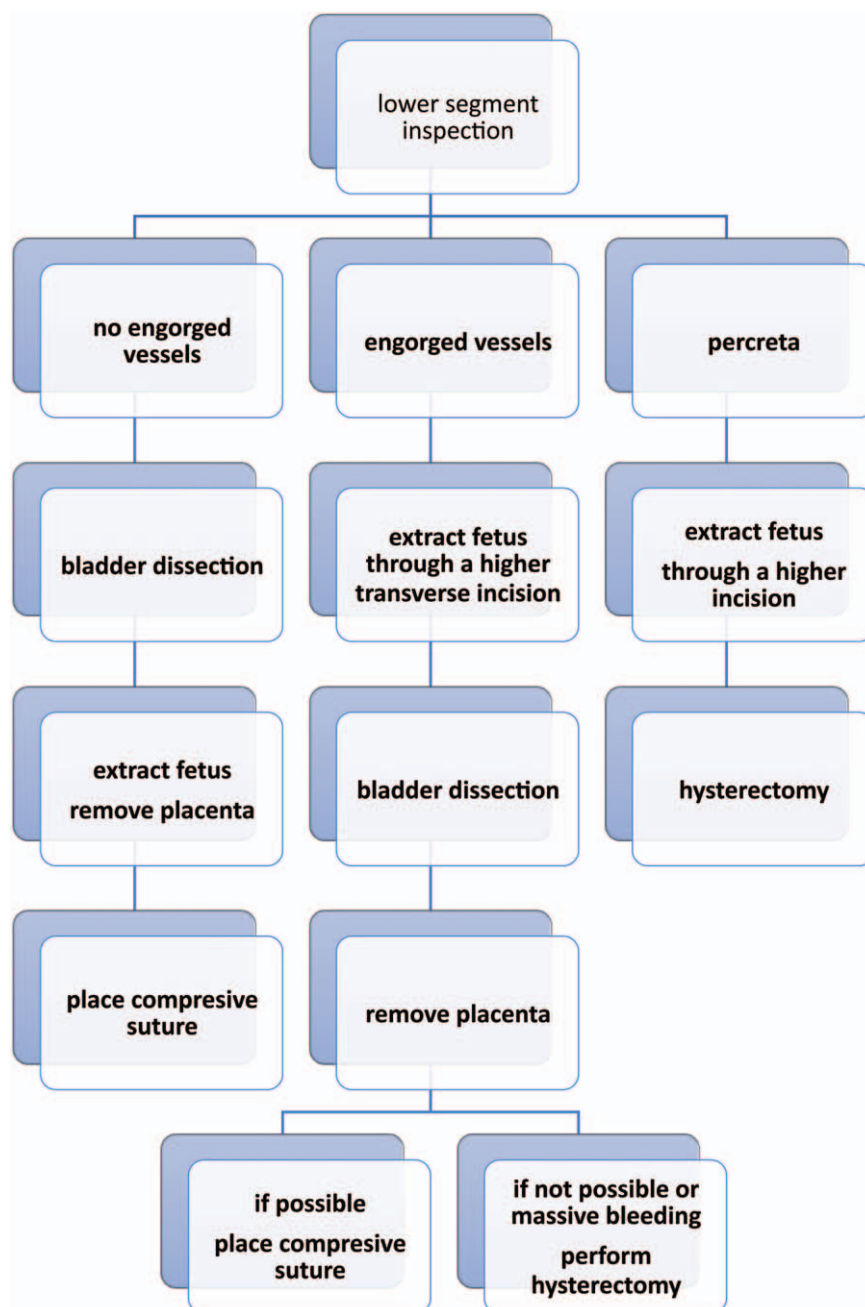


Figure 2. Algorithm for intraoperative steps in placenta praevia.

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