WHAT WOULD YOU DO?

Uterine Artery Embolization Prior to Gravid Hysterectomy

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CASE PRESENTATION

A 32-year-old woman who is 20 weeks and 6 days pregnant presents to our service with abnormal placentation and suspected placenta accreta. The condition was diagnosed on a routine anatomic survey ultrasound at another facility. She is gravida 4 with one prior term delivery, one preterm delivery, one abortion, and three living children (TPAL: 1-1-1-3). Before being seen at the outside facility, she complained only of achy pelvic pain for 8 weeks and on-and-off painless vaginal spotting.

The transvaginal sonogram showed that the placenta had a moth-eaten appearance and increased vascularity. There were no clear borders between the uterus and the bladder. The imaging displayed vascular extensions into the serosa of the bladder. Our physician team discussed the images as well as management options. We ordered an MRI for better delineation of the anatomy, which confirmed the diagnosis of placenta percreta (Figure 1).

After extensive counseling, the patient and her husband decide to have an in situ hysterectomy. A multidisciplinary team is assembled consisting of urology, interventional radiology, anesthesia, obstetrics and gynecology, and the ethics department.

The night before surgery, to help with the anticipated severe blood loss, interventional radiology performs bilateral uterine artery embolization after fetacidal digoxin (Figure 2), and both uterine arteries are successfully embolized.

The next day, the patient undergoes a gravid hysterectomy, cystoscopy, bilateral ureteral stent placement, and bladder dome repair. The postoperative gravid hysterectomy specimen shows complete placental erosion of the serosal surface of the uterus (Figure 3).

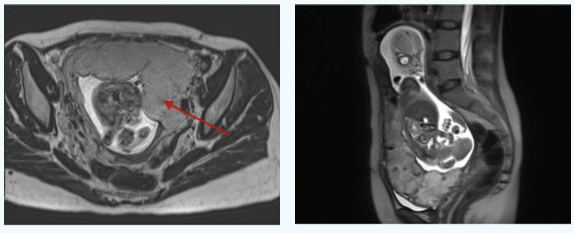

Figure 1. MRI showing that the placenta is anterior in location with increased vascularity. Full-thickness invasion of the myometrium and disruption of the uterine wall with placental tissue are seen (red arrow). Bladder involvement could not be clearly excluded.

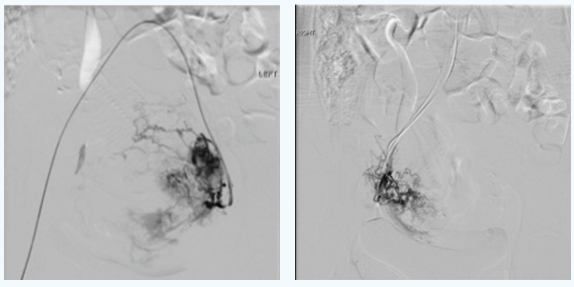

Figure 2. Digital subtraction angiograms showing enlarged left and right uterine artery vascular blush compatible with hypervascular placentation.

Despite embolization, the patient has a large volume blood loss of 5.7 L during the operation. The patient is admitted to the intensive care unit for 24 hours and is

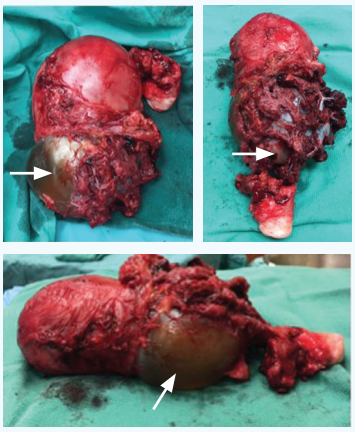

Figure 3. Postoperative gravid hysterectomy specimen showing complete placental erosion of the serosal surface of the uterus. Amniotic sac protrusion is noted through the uterine wall (arrows).

subsequently discharged home on postprocedure day 5.

The pathologic findings were consistent with placenta percreta with the products of conception (placenta and umbilical cord). In addition, the uterus and cervix showed a uterus with decidualized endometrium, a portion of urinary bladder wall, and a laminated hematoma.

How often do you see this type of patient in your practice—either preoperative embolization or prepartum versus postpartum embolization? In cases where hysterectomy is the final outcome, would your management of the patient change in any way?

Dr. Levy: In our practice, most patients referred to the multidisciplinary team desire to preserve the fetus. So, we are much more commonly asked to perform preoperative balloon occlusion with possible postoperative embolization rather than preoperative embolization. The most common management plan in this setting is a cesarean hysterectomy. Our hospital is in the top two nationwide in number of deliveries, so unplanned postpartum embolization is a very common weekly occurrence.

Dr. Miller: I have not been asked to embolize the uterus prepartum. Cases are planned for scheduled delivery using a multidisciplinary team. If the patient presents with bleeding or preterm labor, the team would activate to manage fetal maturity and surgical planning. The multidisciplinary team would assess intraoperatively if cesarean hysterectomy or delayed hysterectomy would be performed. In either case, embolization would be performed in the hybrid operating room (OR) using polyvinyl alcohol (PVA) particle embolization. In cases of extensive placental invasion of surrounding structures, any recruited supply to placental tissue, including the cystic artery, would be embolized to reduce bleeding risk, and then delayed hysterectomy would be performed. Embolization has been shown to reduce the need to transfuse in immediate hysterectomy and reduce bleeding risk in the delayed group.

Dr. Powell: In our practice, we have yet to see a patient with this exact presentation. However, we have treated multiple patients with abnormal placentation. Our experience has been with term or near-term deliveries. In these cases, the consensus is that our involvement has made a difference in the amount of blood loss at the time of hysterectomy. I think one of the interesting issues in this case is why there was so much blood loss despite preprocedural uterine artery embolization (UAE). I suspect that in this case of placenta percreta and bladder invasion, there may have been recruitment/involvement of additional internal iliac artery vessels, and perhaps a more generalized internal iliac or at least artery division of the internal iliac treatment may have decreased the blood loss.

What embolic agents do you use?

Dr. Miller: I use > 710-µm PVA to have more proximal embolization; this is sufficient to reduce bleeding without small vessel embolization, which could compromise healing of spared structures within the pelvis. In my experience, we never inflate the balloons to stop bleeding acutely. This made us reconsider our approach, so we migrated to single femoral artery access, which would allow rapid exchange and placement of an aortic occlusion balloon. Otherwise, we use the 8-F sheath to do standard pelvic angiography and UAE.

Dr. Powell: We use occlusion balloons.

Dr. Levy: In planned situations, we use balloons and inflate in the OR when necessary. Embolization can then be performed coaxially in cases of continued bleeding with Gelfoam (Pfizer, Inc.) or 500- to 700-µm and 700- to 900-µm Embosphere microspheres (Merit Medical Systems, Inc.). Occasionally, the obstetrician plans on preserving the uterus. In this scenario, we typically embolize immediately after the cesarean delivery with Gelfoam. In unplanned postpartum embolization, we use Gelfoam or 500- to 700-µm and 700- to 900-µm Embosphere microspheres.

How often do you request MRI?

Dr. Powell: By the time most patients present to us, an MRI has already been ordered. If not, then we would order it.

Dr. Levy: We obtain MRI for all patients with placenta accreta.

Dr. Miller: We routinely request MRI for these patients. We use sagittal dynamic imaging to assess bladder involvement.

How do you deal with the ethical concerns in cases of late-trimester procedures? What if the fetus is still alive? Do you use fetacidal digoxin? Is there a need for an ethics consult?

Dr. Levy: In our experience with placenta accreta cases, intentional termination of the pregnancy is rare. If termination is the plan, the high-risk obstetrics/gynecology team usually takes care of the ethics consult. We don't use fetacidal digoxin in placenta percreta cases. We have used combination therapy for cervical and interstitial ectopic pregnancies. Some examples include intra-arterial methotrexate and/or direct potassium injection before particulate embolization.

Dr. Miller: Although embolization of an intact fetus would be difficult personally, the best interest and survival of the mother is the priority in the management of this situation. Institutional consent would probably need to be obtained by the multidisciplinary team before performing the procedure.

Dr. Powell: I am not sure of the need for an ethics consult, but clearly extensive counseling of the patient and family is necessary so that they understand the implications and options. Individual hospital policies on pregnancy termination in the case of a living fetus may vary.

In other cases, we have used a radial approach, especially if the patient will need to be placed in a lithotomy position. What is your experience with the radial artery approach?

Dr. Levy: We rarely use the radial approach. An unpublished retrospective review of our interventional radiology section's femoral artery access cases over a consecutive 10-year period demonstrated a complication rate of < 0.1%. In a single-institution retrospective review of transradial access, Posham et al demonstrated a complication rate of 3.78%.[1] This complication rate becomes even more important in a population with the potential for future dialysis where radial artery injury eliminates the possibility of placing a fistula. Specifically, in balloon occlusion cases, we usually leave the bilateral femoral sheaths in for 24 hours, so the requirement for a lithotomy position after removal is unlikely. Finally, because we are using bilateral access, radial access would require both right and left radial sheaths, which would require crossing all three great vessels.

Dr. Powell: Although we are using the radial approach for routine UAE, we have not used this approach in these types of cases. I remain concerned that a radial artery approach in this type of case will unnecessarily increase the risk of stroke. We certainly know that peripartum patients are hypercoaguable. More importantly, a catheter/occlusion balloon in cases such as this will almost certainly be left in place for over an hour. Again, this seems to introduce too high a risk of stroke in my mind. That said, the worry of catheter dislodgement remains great. My greatest horror was walking into the OR after placing occlusion balloons via a bilateral common femoral approach in the interventional radiology suite. The anesthesiologist had the patient sitting upright in order to place the epidural anesthetic. Thankfully, there were no related issues, but it stresses the need for detailed communication with all involved in the case. At our main hospital, we perform the hysterectomy in the OR-compatible angiography suite to minimize patient movement and the chance for catheter dislodgement.

Dr. Miller: I have not used a radial approach in this scenario. In my opinion, radial access limits the options for rapid handling of massive bleeding that could be encountered during management of these cases. If there is no immediacy, then a radial approach is possible. A radial approach with preparation of an emergent femoral access site would probably be a consideration. Luck favors the prepared. Optimal access to manage acute massive uterine bleeding has been my main priority despite my decision with the multidisciplinary team to stop placing bilateral internal iliac occlusion balloons.

In cases of preventive management before a cesarean section, what is your current treatment protocol (particles vs balloons, radial vs femoral, day before or day of surgery, in OR vs in interventional radiology suite)?

Dr. Miller: First, the multidisciplinary team would try to assess the degree of invasion of the placenta with the surrounding structures with preprocedure MRI of the pelvis. All cases would start with an 8-F sheath placed into the right common femoral artery before delivery. The patient would be placed in the lithotomy position

after access was obtained. If there was extensive invasion of the lower uterine segment to the bladder, then the plan would be to perform a delayed hysterectomy and fundal cesarean section, and primary abdominal closure would be performed, followed by embolization of pelvic vessels supplying placental tissue. If there was less extensive invasion or controllable area of involvement and it was felt immediate hysterectomy was possible, a fundal cesarean section would be performed. The uterus would be closed and the abdomen left open. The blood supply to the placenta would be embolized to stasis. Once sufficient stasis was obtained, hysterectomy would be performed. Access would be maintained in the right common femoral artery until the surgery was completed to allow for potential immediate placement of an aortic occlusion balloon if needed. But, we have never had the need to implement this during management of these patients. In both scenarios, we used > 710-µm PVA particles through 0.035-inch catheters.

Dr. Powell: Our current protocol is bilateral 6-F sheath placement in the common femoral arteries. Using a C2 catheter, the aortic bifurcation is traversed and contralateral internal iliac artery catheterization is performed. A Fogarty occlusion balloon (Edwards Lifesciences) is then placed in the proximal internal iliac artery. The guidewire is then temporarily removed and the balloon is inflated. Contrast is then injected to determine if adequate occlusion has been achieved. The inflation volume is then recorded, and the balloon is then deflated. The wire is again advanced more distally. It is felt that replacement of the guidewire helps to prevent catheter dislodgement. We record the balloon volume in case there is significant hemorrhage. These situations can become rather chaotic, and there is a potential to overinflate the balloon, which could lead to either balloon or vessel rupture, either of which could be catastrophic. If there is significant hemorrhage despite balloon inflation, then the guidewire is removed and a Gelfoam slurry is infused. However, it is extremely rare to use any Gelfoam with this technique. An additional benefit of this technique is that it can be done quickly with minimal fetal radiation exposure. A further advantage over more selective embolization or occlusion balloon placement is that all branches of the internal iliac artery can be temporarily occluded.

Although it can shut down a room for a significant amount of time, once the balloons are placed, the obstetrics team performs the delivery in the hybrid OR suite. This limits the movement of the patient and the potential for catheter dislodgement. In addition, the interventional radiology team is available to inflate the balloons (and perform potential Gelfoam embolization) if necessary.

Dr. Levy: The multidisciplinary team includes obstetrics/gynecology, a high-risk obstetrics/gynecology consult, gynecological oncology, urology, and a representative from the intensive care unit. A meeting of all management teams occurs several days before the intended delivery. The patient is brought to interventional radiology on the day of the delivery. In the interventional radiology suite, a large-bore central venous access catheter is placed, followed by bilateral internal/external nephroureteral stents. The patient is placed supine and bilateral internal iliac balloons are placed. A test inflation is done to demonstrate that each balloon is occlusive at the junction of the internal iliac artery and the anterior division branch. The amount of milliliters needed to obtain occlusion is noted. A nurse practitioner from the interventional radiology team that is trained in balloon inflation follows the patient to the OR to give direct instructions of how many milliliters to inflate the balloon based on the test injections. The balloons are inflated after the delivery of the baby only if requested by the operative team. If bleeding continues to be a problem despite inflation, the interventional radiologist is called to perform an embolization. If there is time, the patient is transferred to interventional radiology for an embolization that can be better directed, but if there is no time, embolization is performed in the OR with the C-arm, typically with Gelfoam. The patient is transferred to the intensive care unit for observation with the arterial sheaths, and the sheaths are removed the next morning.

DISCUSSION

Abnormal adherence of the placenta to the myometrium (placenta accreta) is a serious and sometimes life-threatening problem. Placenta accreta results from a defect in the decidua basalis and Nitabuch's layer, leading to an abnormal attachment of trophoblastic tissue to the uterine wall. There are three subtypes in the placenta accreta spectrum (ie, placenta accreta vera, placenta increta, and placenta percreta), which are classified by the depth of penetration into the myometrium.[2] The most common, placenta accreta vera, occurs when the chorionic villi attaches strongly to the superficial myometrium without penetration (Figure 4A). Placenta increta occurs when there is an invasion of the chorionic villi into the myometrium but not through its entirety (Figure 4B). Placenta percreta is the most rare and highest-risk condition

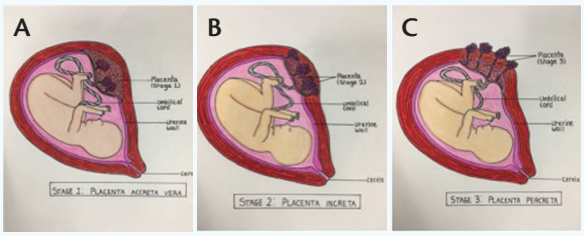

Figure 4. Illustrations courtesy of Sarah Dunn, MD, Emory Healthcare.

and occurs when the placenta penetrates through the entirety of the myometrium with potential to invade adjacent organs such as the rectum or the bladder (Figure 4C).[2]

Placenta accreta can lead to life-threatening postpartum hemorrhage. Currently, the standard of care is to perform an abdominal hysterectomy.[3] The two greatest risk factors for placenta accreta are prior cesarean section and prior placenta previa, a condition where the placenta covers the cervical opening.[4] During UAE, a catheter is used to deliver small particles that block the blood supply to the uterine body.[5] UAE has proven to be an effective treatment for fibroids[6] and is also used to treat postpartum hemorrhage, which, in turn, decreases maternal morbidity and mortality.[2,4] Although UAE is successful for treating postpartum hemorrhage, the reported success rate in cases of placenta accreta is lower due to persistent bleeding after embolization.[3] Bilateral femoral artery access is the standard access, followed by selective internal iliac artery catheterization and subselective uterine artery catheterization. Embolization can be performed with gelatin sponge, PVA, or calibrated microspheres. Gelatin sponge particles are temporary and provide transient occlusion for 1 to 3 weeks.[7] Coils are rarely used.

In patients where abnormal placental implantation is discovered during prenatal screening and confirmed on MRI, a planned cesarean section and consultation with an interventional radiologist is the standard course. In those instances, the interventional radiology attending and staff and the interventional radiology suite must be available with the ability for rapid transfer of the patient, should embolization become necessary.

There is less understanding and consensus when abnormal placental implantation is discovered and a term pregnancy is not feasible. In these cases, interventional radiologists continue to play a central, critical, and life-saving role in the management and successful outcomes for these patients. ■

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