ROUNDTABLE DISCUSSION

Postpartum Hemorrhage Response, Outcomes, and Outreach

Global perspectives on PPH and uterine artery embolization, awareness concerns, barriers to care, protocols for PPH and establishing a response team, and outreach to low-to-middle-income countries.

With Janice M. Newsome, MD, FSIR; Ethel Rivas Zuleta, MD; and Greg Makris, MD, PhD, DIC, FRCR

Janice M. Newsome, MD, FSIR
Associate Professor, Department of Radiology and Imaging Services
Emory University School of Medicine
Division Director and Chief
Interventional Radiology and Image-Guided Medicine
Emory University Hospital Midtown
Atlanta, Georgia
janice.newsome@emoryhealthcare.org
Disclosures: Strategic Board, Boston Scientific; consultant, Cook Medical and Hyperfine; Emory Research Agreement, Philips, Terumo, Avail, Immertec, Verizon.

Ethel Rivas Zuleta, MD
Interventional Radiologist
Salvadorean Institute of Social Security (Instituto Salvadoreño Del Seguro Social)
San Salvador, El Salvador
erivas.zuleta@gmail.com
Disclosures: None.

Greg Makris, MD, PhD, DIC, FRCR
Consultant in Endovascular and Interventional Radiology
Guy's and St Thomas' Hospital
NHS Foundation Trust
London, United Kingdom
Past Chair, CIRSE European Trainee Forum
g.makris09@doctors.org.uk
Disclosures: None.

The last decade has seen an increase in research and attention on uterine artery embolization (UAE) for postpartum hemorrhage (PPH), a leading cause of maternal mortality and a contributor to other serious morbidities: shock, adult respiratory distress syndrome, and fertility loss due to hysterectomy.[1] What has been your personal experience with using UAE for PPH?

Dr. Makris: There is no doubt that UAE is a safe and effective way of managing certain cases of PPH that are resistant to conservative management. In the United Kingdom (UK), every hospital with a maternity unit has access to an interventional radiologist 24/7. In our hospital, we have very capable obstetrician/gynecologists (OB/GYNs) and intensivists who can conservatively manage most cases of PPH, but interventional radiology (IR) is occasionally involved, and it makes a huge difference when you consider that you are not only saving the life of a young woman but also protecting her childbearing potential by preventing hysterectomy. From my experience, it is essential for IR to establish good communication

with OB/GYNs so they know you can offer this service 24/7 and to be easily accessible, with clear protocols and communication pathways in place. In these situations, you don't want to waste any time looking for the right person or the right pager. This should be readily available, and PPH protocols should be agreed on in advance to make communication as easy and as quick as possible. Of course, prevention is always better, and that is why we have slightly different pathways for high-risk pregnancies, such as in cases of placenta accreta. It is important to discuss these cases and make plans in collaboration with the IR department to ensure that someone will be available to help for the duration of the process. You must also keep in mind that, depending on the hospital and local arrangements, these cases can take a long time and can occupy an IR consultant/attending for an entire day. Thus, good planning is essential.

Dr. Newsome: My involvement came out of curiosity and outrage many years ago, before I knew that there was something I could do as an endovascular specialist. When I became an interventional radiologist and started doing procedures to stop bleeding for other parts of the body, before I had heard of UAE for PPH, I wondered how it was that a specialty that can save someone's life in trauma care doesn't have a role in stopping bleeding in the uterus, where the outcome is loss of that organ. We have a huge role in the spleen, for instance. We have algorithms that say when we should observe or embolize based on the different categories of bleeding and papers discussing proximal or distal embolization or whether you should embolize with coils versus plugs in the spleen—and you can lose that organ without as much consequence. It was curious to me that the thought process when bleeding happens in the uterus was that you should just remove the organ.

Dr. Zuleta: The incidence of PPH in El Salvador is increasing, and for the last 5 years, there has been an effort to increase the use of IR for treating PPH, as these deaths are usually considered preventable. My initial approach was balloon occlusion of the iliac arteries in placenta accreta, but I now offer obstetric hemorrhage embolization as first-line management.

A 2020 study by the Commonwealth Fund recently reported that the United States has the highest maternal mortality rate among the 11 high-income countries studied.[2] Dr. Newsome, why is this problem so prevalent in the United States, and what needs to be done to address it?

Dr. Newsome: For someone like myself and others who are involved with global health, it's sad to know that you live and reside in a country that can provide such great care elsewhere but continue to be plagued with that statistic. And this is just concerning maternal mortality; what do the morbidity rates look like? We don't talk much about the people who are financially ruined by this or who end up with other injuries from the associated morbidities.

I don't know all the answers to why this keeps happening in the United States, but I do know that it's partially tied to funding and health equity. Additional theories stem from the fact that in the United States, as in many other industrialized countries, we like to plan our pregnancies and births. We've seen an increase in uterine instrumentation from cesarean sections or other things that may be predisposed to placental implantation abnormalities, which increase the risk of PPH. I also wonder if we've gone through an age now where giving birth can happen without much involvement from health care providers.

There's something about how we approach birthing and intervention in certain situations that could be affecting subsequent births, but much is unknown.

What we do with these facts needs to be a main focus of research; we need health care dollars to be poured into it. The Momnibus Act is a major legislative focus this year for the Society of Interventional Radiology (SIR), and it's going through Congress now. Although it has the word "mom," it really could be called "Familybus" because this affects the entire family, who will be left to bear the brunt of the burden when mothers die in childbirth.

What do we do about this? We need to start being deliberate about how we approach funding. We need women to include in their birth plans what they want to happen if we encounter PPH. We need more intelligent technology that helps measure blood loss at the time of childbirth. We need an algorithm to ask when embolization happens, when hysterectomy occurs, when you stop doing uterine massage or stop trying to stop bleeding by oxytocin or other drugs. This can't be just something that I'm figuring out here at Emory in Atlanta. How do we leverage our collective powers everywhere and use artificial intelligence to help make intelligent algorithms? Rather than being reactionary, how can we predict who is really at risk? Who do we need to save before we are just using this threshold of 1-L blood loss to say when you qualify for PPH? Let's call IR. Because for that person, it may be already too little, too late.

Drs. Zuleta and Makris, what are the challenges with PPH care in El Salvador and the UK, and your own institutions?

Dr. Zuleta: In El Salvador, one of the main challenges is the need for prompt recognition and diagnosis, which is essential for the successful management of primary PPH, as the major factor in adverse outcomes is a delay in initiat-

ing appropriate management. Additionally, a hospital in El Salvador that is dedicated to OB/GYN pathology will not have IR because I'm the only interventional radiologist in the country, and I work at the referral (trauma) center.

Dr. Makris: Working for the National Health Service, and more specifically for one of the best tertiary centers in the country, means that there are no major challenges when it comes to PPH care, but we are always auditing our clinical practices and pathways to ensure we deliver the best possible care every time. In the UK, we are very fortunate that the Royal College of Obstetricians and Gynaecologists and the British Society of Interventional Radiology (BSIR) put together robust recommendations regarding PPH management that includes UAE. This took place very early, and it has been almost a decade since the publication of those guidelines.[3] There are still smaller district hospitals that might still struggle to follow the guidelines due to an insufficient number of interventional radiologists to cover their out-of-hours emergency needs. In those cases, networks of bigger and smaller hospitals with local arrangements in place to cross-cover their needs without sacrificing providing quality patient care are important. This model of hospital networks can work not only for covering the PPH rota but also other emergency procedures in IR.

Although its pivotal role in controlling bleeding has been established in the literature, UAE continues to be used less frequently than hysterectomy for PPH. What are the potential areas of improvement when it comes to UAE being more fully embraced for PPH (eg, institutional barriers, research needs, technical improvements, referrals)?

Dr. Newsome: Our workforce and workplaces need to be better structured to deal with these urgent scenarios. Although we know how to respond to someone who is having a heart attack or to trauma codes, interventional programs need to be prepared for PPH response because you can't wait for the IR team to come while a mother is dying. UAE is currently mostly for fibroids or adenomyosis, and those patients are seen in our clinics at a time that is good for them and us. That's the way OB/GYNs interact with IRs for UAE—not for emergencies. If they encounter a vascular problem, they are used to handling it surgically and will call vascular surgery, other OB/GYNs, or a surgical specialty. If we can provide an algorithm, it will allow us to say, "This is how we can help you." I don't believe that any OB/GYN feels great about doing a hysterectomy. That is usually the final option.

This is more than just IR. We need teams that will be on call 24/7. We need to engage the hospital intensive care units. We need to consider how we proceed when it's time for someone to move from the obstetric space or the birthing room to the IR table. Does this happen in the operating room? Do we have access to the hybrid suites? Those are the barriers that having what I call a PPH response team formalized within your hospital system will help us overcome.

Dr. Makris: There should be no doubt that UAE is safe and effective for managing certain PPH cases before hysterectomy is needed. In my opinion, the main reasons we still see a slow adoption in certain places are low availability of interventional radiologists, poor communication between hospital departments, and inundated hospital practices.

It is true that as a new specialty, IR is still building up its capacity in terms of a qualified workforce. Unfortunately, even within the developed world, we see a very slow increase in the number of qualified interventional radiologists in some places. We know that training any medical specialist can take from 10 to 20 years, and that is part of the problem. However, we cannot forget that there is still quite a lot of training heterogeneity for IR, even within European Union or the United States. This does not help with building up the specialty.

Poor communication and lack of appropriate local and national protocols that incorporate UAE as part of the PPH management pathway are still missing from many hospitals, and I believe it's the role of the national IR and gynecology societies to work together to produce clear guidelines that allow both teams to work together to achieve the best possible outcome and avoid hysterectomies, even in a high-pressure environment like that of PPH.

Finally, although the volume of published data is sufficient to convince even the most skeptical critics within an inundated hospital practice, as an IR community, we should continue producing high-quality data on this issue to further improve the outcomes and management pathways.

Dr. Zuleta: I am the only interventional radiologist in my country, and therefore, the procedure cannot be offered in all health centers as the procedure of choice. However, I work in a tertiary care center where work has been done on the early recognition and referral of the pathology, and we have successfully performed many procedures.

As for areas of improvement, many current residents are interested in the field of IR, and they can now participate not only in the diagnosis but also in the treatment of emergency pathologies. Next year, two of my residents will be from IR programs.

Establishing and disseminating a management algorithm that allows for smooth communication between

the medical staff involved in the treatment is also essential for prompt IR care.

Dr. Newsome, as you mentioned, in an announcement of your study on the use and effectiveness of hysterectomy versus UAE for clinically significant PPH presented at SIR 2021, you envisioned the creation of PPH response teams, similar to existing trauma teams, to identify risk factors and ensure the right staff are present to respond quickly.[4] Can you briefly walk us through what this would look like and what needs to happen to make this vision a reality?

Dr. Newsome: Similar to a pulmonary embolism response team (PERT), wherein a multidisciplinary team responds to PE, with a PPH response team concept, we too are looking at ways we can prevent a rapid deterioration that could lead to death. It will not look the same at every institution, but this is what I envision for the community of folks who know how to stop bleeding and support people in hemorrhagic shock: that we begin by getting together and asking how we can address this embarrassing problem at our institution, in our region, in our country, and around the world.

But we can all pool our data together similar to when we created PERTs to say that yes, it begins at my hospital with my intensivist, my anesthesiologist, my OB/GYN team, my interventional radiologist, labor and delivery nursing—anyone who is part of the birthing process. Our transportation teams also play a huge role in terms of how to move patients. They know if the hybrid suite is in use, if we should put two C-arms in labor and delivery, or if all patients will be treated in the IR suite.

At Emory, the conversation has been started, and although we don't yet have a formalized plan, we have high-functioning teams coming together to discuss simulation training and to develop a standard lexicon. What we're finding is that when someone calls me, the only reason that I know that a mom is in distress is because of the pressured voice of the person on the other end of the phone. Someone calls me with that and it's like a trauma code. I don't ask questions; I just start heading to the trauma room. Whereas if someone calls and says, "I have someone with a submassive PE, a code stroke, a non–ST-segment elevation myocardial infarction," an entire team can mobilize. Everyone understands that one language, and we need the same for PPH. Although some hospitals already have massive transfusion protocols or bleeding teams, interventional radiologists—the very specialty that could minimally invasively stop the bleeding—are not often included.

Drs. Zuleta and Makris, what are your institutions' protocols for PPH? What would your ideal care plan for new mothers at risk of PPH look like?

Dr. Makris: All maternal units should have 24/7 access to IR, whether that's within your hospital or through collaboration with another hospital within your network. However, high-risk pregnancies should only take place in tertiary centers where IR support is available without delays. I think it should be unacceptable to not have these arrangements in place when you are dealing with placenta accreta patients; this patient group should be carefully discussed in the appropriate multidisciplinary team setting to ensure the appropriate steps are taken so that all clinical teams are well informed and engaged, including IR. In my hospital, we have a very close collaboration with our OB/GYNs, and all high-risk pregnancy cases are carefully discussed in advance to ensure we have the available resources and time. For PPH that occurs in a non–high-risk pregnancy, the local protocol is first to try to manage the condition with conservative measures after the patient has stabilized (uterine massage, tranexamic acid, transfusion). If this fails, IR will be involved, and a hysterectomy is only considered as a last resort if everything else has failed.

Dr. Zuleta: For now, my institution's protocol is the following: first line, pharmacologic therapy; second line, insertion of a uterine balloon; third line, hysterectomy or IR. An ideal plan would include prompt recognition and diagnosis and the aforementioned management algorithm, in which IR plays a major focus as a potential treatment for primary PPH because of its prompt hemostasis, minimal invasiveness, and potential fertility preservation. The timing of the decision to shift to a more intensive, invasive, and aggressive treatment should be appropriate and not subject to delay. The multidisciplinary OB/GYN team should summon IR as soon as abnormal bleeding is observed, because IR is useful and important.

Dr. Makris, in a recent TEDx talk as well as in published papers, you've detailed your work in reducing maternal mortality and morbidity rates related to PPH in Uganda and other East Africa countries by establishing an IR training curriculum. What have been the biggest highlights and challenges from your work in these programs? How can societies and other physicians help with this outreach program?

Dr. Makris: A recent paper by *The Lancet* showed that a woman delivering a baby in sub-Saharan Africa by cesarean section is 100 times more likely to die from

bleeding compared to the same woman delivering the same baby in London or Paris.[5] I was shocked by this statistic, especially given that we are talking about the preventable death of young mothers, who often have more children and families to support. I was even more shocked when I realized that IR is virtually nonexistent in the entire continent. For the last 3 years, we have worked on an unofficial campaign with many other interventional radiologists and IR societies to raise awareness about the extent of the problem. I have personally been involved with an assessment visit to Kampala, Uganda, to understand their local needs with the kind support of Health Education England and the Uganda-UK Health Alliance.

The COVID-19 pandemic unfortunately prevented us from organizing more trips like that one, but we hope to soon send volunteers to Uganda to help with their imaging and IR services, for example via the Gulu Diagnostic Imaging Programme, sponsored by Health Education England UK.[6]

Many people think that developing such training programs in low-to-middle-income countries (LMICs) is not possible, but the Road2IR organization experience in Tanzania shows the opposite. A team of Yale University and Emory University radiologists and interventional radiologists built an amazing IR training program that we hope to replicate in many other sub-Saharan countries, including Uganda (see www.road2ir.org). The road to this will be long, and we need all the available help from international societies like the Cardiovascular and Interventional Radiological Society of Europe and SIR, which have already started supporting this movement via presentations in their annual conferences, reduced and/or no registration fees for radiologists from LMICs who want to attend, and their support when it comes to reaching out to other organizations, as they did when we sent an open letter to the World Health Organization urging them to take this issue more seriously and suggesting ways to do so.[7] Industry also needs to step up efforts to help bring IR to LMICs. There is virtually no medical device supply chain for sub-Saharan Africa, but we hope that in the future, companies will realize the huge potential of these areas and enjoy great business opportunities while helping save lives.

Dr. Newsome, as Program Director of the Road2IR IR training program in Tanzania, can you share the main goals of the program and any that relate to PPH?

Dr. Newsome: As Dr. Makris mentioned, although the program is housed in Tanzania, the main goal of Road2IR Tanzania is to provide IR training for all of sub-Saharan Africa. We all know how to go into different places where IR is nonexistent and perform some procedures with what we have. However, we also know that to make this sustainable, someone needs to do it when you leave. The only way to accomplish that is to train the people who are there, not just by teaching them how to do the procedure but also put together a curriculum through the university program, similar to fellowship programs in the United States. This can foster a "brain gain" rather than a "brain drain" scenario, something I am familiar with as an immigrant myself.

I also believe that the wealth of any country is dependent on the health of its people. If you want to change poverty in any way, you need people to be healthy. IR is one of those specialties that can really change people's lives and has the goal of health improvement. I am at Emory University and am the Division Chief for one of the largest IR training programs in the United States. I've trained people and have been fortunate to see them go on to do better work elsewhere. If you believe you're doing great work, you don't want to see it just done at your home institution. That's why we started this outreach program 3 years ago, and just this year, we're graduating our first fellowship-trained interventional radiologists out of Tanzania. We have two native Tanzanians and one doctor from Rwanda—who has returned to Rwanda—which is great because under no circumstances did we want this program to start and end in Tanzania. We wanted to develop training programs through a real, vetted curriculum that was specific for that place but can be spread to other LMICs. We hope that this curriculum will be picked up in South American countries and elsewhere too. If there is a university and a radiology base, you can set up a training program to grow minimally invasive procedures in that part of the country. That's what the program is about.

For PPH specifically, we've started the same way that interventional radiologists start with their relationship with OB/GYNs in the United States: by introducing a comprehensive women's health program and engaging in a more controlled setting with fibroid embolization. Emergency IR care is not being delivered there just yet because we need to catch up with infrastructure and supply chain. Currently, there are no distribution pathways for interventional equipment. For now, we're just establishing that we exist. However, a small procedure like a nephrostomy tube is a life-saving procedure there because the cervical cancer rate is high, and women die from hydronephrosis because they can't get their blocked urine drained. The first time we started putting in nephrostomy tubes there, it was considered a miracle. For PPH, that miracle will come. We have to first be sure to cause no harm, which means proper imaging equipment and better relationships with our industry partners so we can have more distribution lines. We've just

started, but I'm confident that in a few more years we'll be doing UAE for PPH in sub-Saharan Africa.

How can awareness of PPH and UAE as a solution be increased for mothers and those on their care teams?

Dr. Zuleta: Focus on helping OB/GYNs understand the utility of IR for PPH, and standardize the indications and techniques by introducing and refreshing the guidelines in the different residency programs. All decisions must be focused on the minimally invasive procedures offered by IR as potential treatment for primary PPH.

Dr. Makris: This is a very important question, and I believe it is as equally important as the effort to produce robust clinical evidence. We need to be more active as a community when it comes to educating patients and our colleagues from other specialties. We need to have more presence in the relevant multidisciplinary meetings and insist on having more face-to-face clinics where we see our patients before and after the procedure. It is also very important to engage with relevant patient groups and participate in their activities. There are many patient groups that, in my opinion, are overlooked by the medical community. They can help us reach out to our patients without having to spend a lot of money on expensive promotional campaigns. Having said that, sometimes it is also important to invest in promotional public engagement campaigns. That is why we are trying to initiate a collaboration between the BSIR and the All-Party Parliamentary Group on Women's Health to map the use of UAE for the management of fibroids and raise awareness among women across the UK.

Dr. Newsome: Get the word out. This is something that affects everyone. It is a women's health issue, but really, this affects families everywhere. In the United States, one of the things that everyone could do is look into the Momnibus Act and support that by telling your legislators that the lives of moms matter to you. We need to know what the problem is to do something about it. How we get the word out is through interviews like this: put it into the sphere where people are and encourage them to partner with their OB/GYNs because that is who every pregnant woman will see for prenatal care. It's important to emphasize that we are not a threat to OB/GYNs here—we're all on the same team and want the same thing.

There is also significant disparity around PPH. As a Black woman in this space, I want to address that regardless of socioeconomic status, wealth, and education, women who are Black and Latina have a much higher risk of maternal mortality related to PPH. This is a complex issue, but we know it is partly because these women are not heard. The Centers for Disease Control and Prevention has launched a campaign called Hear Her (www.cdc.gov/hearher), which aims to address this disparity. We need to hear every woman, regardless of the color of their skin or their religious preferences. Another group that is struggling in this particular area is Jehovah's Witnesses, for whom the algorithm of giving blood for blood loss does not apply. In the same way that we address myomectomy with UAE in women who refuse to take blood, we need to also think about that religious group. This is a space where IR can make a huge difference.

If you know someone who is pregnant, encourage them to have this conversation with their OB/GYN. Yes, I want the PPH team to be developed at Emory, Mount Sinai, and other hospital centers where there are already efforts being made. But I also care about your wife, your cousin, your aunt, your daughters, and your friend's daughters. Change happens by one person at a time asking, "Can I talk to you about what could happen if I bleed?" and then by physicians engaging together and with their respective societies. We can't do this alone. We need to work together to figure out a comprehensive way of addressing this for mothers. ■

1. Newsome J, Martin JG, Bercu Z, et al. Postpartum hemorrhage. Tech Vasc Interv Radiol. 2017;20:266-273. doi: 10.1053/j.tvir.2017.10.007
2. The Commonwealth Fund. Maternal mortality and maternity care in the United States compared to 10 other developed countries. Accessed November 8, 2021. https://www.commonwealthfund.org/publications/issue-briefs/2020/nov/maternal-mortality-maternity-care-us-compared-10-countries
3. Royal College of Obstetricians and Gynaecologists. The role of emergency and elective interventional radiology in postpartum haemorrhage. Accessed December 13, 2021. https://www.rcog.org.uk/globalassets/documents/guidelines/goodpractice6roleemergency2007.pdf
4. Endovascular Today. Large study shows UAE is used significantly less than hysterectomy to manage postpartum bleeding. Published March 16, 2021. Accessed December 1, 2021. https://evtoday.com/news/large-study-shows-uae-is-used-significantly-less-than-hysterectomy-to-manage-postpartum-bleeding
5. Sobhy S, Arroyo-Manzano D, Murugesu N, et al. Maternal and perinatal mortality and complications associated with caesarean section in low-income and middle-income countries: a systematic review and meta-analysis. Lancet. 2019;393:1973-1982. doi: 10.1016/S0140-6736(18)32386-9
6. NHS Health Education England. Gulu Diagnostic Imaging Programme (GDIP). Accessed December 1, 2021. https://global-learning-opportunities.hee.nhs.uk/get-involved/regions/africa/gulu-diagnostic-imaging-programme-gdip/
7. Yang Y, Moore A, Gaupp FL, et al. A call to action; an open letter to WHO from the international interventional radiology community. CVIR Endovasc. 2021;4:3. doi: 10.1186/s42155-020-00195-2