

# TraumaSystemNews

Trauma leadership and management

## How to build an endovascular trauma program at your hospital

Welcome to the 2018  
EVTM Symposium



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Trauma leaders worldwide show a growing interest in using endovascular tools in trauma resuscitation, hemorrhage control and definitive injury management.

This interest is driven in part by the development of new endovascular devices designed specifically for injured patients. In addition, the emergence of resuscitative endovascular balloon occlusion of the aorta (REBOA) has increased overall awareness of catheter-based approaches to trauma and critical care.

However, establishing an endovascular trauma program — or taking an existing program to the next level — is a major undertaking. The barriers include securing resources, assembling the right team and ensuring adequate training. Even leading trauma centers have struggled with these challenges.

Recently, three experts in endovascular trauma management shared their solutions for establishing, growing and optimizing an endovascular trauma program.

#### **Endovascular trauma: creating the team**

The first step to establishing a new endovascular trauma program is to identify the clinicians who will lead the program.

“The people issue is probably the one thing that hospitals don’t spend enough time focusing on,” said Melanie Hoehn, MD, a University of Maryland School of Medicine vascular surgeon. “The success of an endovascular trauma program is highly dependent on your team.”

#### **Physician leadership and participation.**

Question number one is which specialists will be involved in the endovascular trauma program and who will lead it?

According to Dr. Hoehn, the answer will depend largely on your hospital’s resources and culture.

“Trauma surgeons will usually be leading the charge since they are the ones involved with patient care and will also be doing some of the basic procedures such as REBOA,” said Dr. Hoehn, who is currently in a trauma and critical care fellowship at Grady Hospital in Atlanta. “But once you get past those basics, you will need specialists who are able to perform diagnostic angiography and more advanced endovascular procedures such as embolizations and stent placements.”

Specialist support will vary from institution to institution. “Traditionally, many of these embolization procedures have been done by interventional radiologists, but in more recent years vascular surgeons have started taking on some more of these cases,” she said. “Everyone has a slightly different skill set, and you also have to work with the politics in your system to figure out who will be doing these procedures.”

**Nursing and tech support.** Most successful endovascular trauma teams include IR technologists. “It’s my opinion that you need an IR tech in your program,” Dr. Hoehn said. “Not only can they run the equipment for you and load the images, but many IR techs are also quite capable of scrubbing into the operating room and assisting.”

There are different ways to structure IR tech support. “At the Shock Trauma...

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# Q&A with Dr. Tal Hörer, founder of the EVTM Symposium, on the future of endovascular trauma management



## Q. Why did you and your colleagues start the EVTM Symposium?

**Hörer:** Many trauma congresses have a small amount of information about using endovascular tools to treat bleeding patients. But most of the time this information is quite old and not up to date with new technologies.

The EVTM Symposium is the only conference dedicated to endovascular resuscitation and new technologies and data in this area.

We held our first EVTM Symposium in 2017 in Sweden. This first event was such a great success that we immediately began planning the second European EVTM Symposium, which will take place in June 2018.

But meanwhile I suggested to some contacts in the United States that they consider hosting a similar event sometime in the future. As it turned out, there was a strong demand from our American colleagues to do a U.S. event right away.

So we launched the Pan-American EVTM Symposium in 2018. And that conference took place February 8 and 9 in Houston.

As I said, this symposium is the only congress dedicated to endovascular resuscitation. It's also the only event where you can find people speaking about solving bleeding problems in a multidisciplinary way.

## Q. What are the most important new trends in endovascular trauma management?

**Hörer:** We are moving away from seeing REBOA as only a bleeding stopper and toward viewing it as a tool for stabilizing the patient. REBOA doesn't just stop the bleeding; you can also use it to gain time to think about other options and to try other interventions.

Along these lines, the most exciting development in endovascular trauma management is "partial REBOA" — which means you don't occlude the



Tal Hörer, MD, PhD

aorta totally; you try to occlude it partially to maintain perfusion to the organs.

This has many potential uses. We know of trauma cases where the right specialists were not available in the hospital, so REBOA was used to hold pressure and keep the patient alive until the specialists arrived to provide definitive care.

We also know of three cases of "transfer REBOA," where a patient is stabilized with REBOA or partial REBOA and then transferred to another center with higher treatment capabilities. Two of these cases took place in the U.S.

And I should note that endovascular resuscitation tools are moving beyond trauma to problems like cardiogenic shock, iatrogenic bleeding, spontaneous bleeding and postpartum hemorrhage. In fact, we are starting a new registry for postpartum bleeding and REBOA.

The registry will be managed by a U.S. center, so this is an exciting cooperation on a totally new subject.

People are even starting to think about using REBOA as a bridge to...

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# Case Report: ER-REBOA™ catheter deployed to support a hemodynamically unstable patient prior to IR embolization

Rebecca Vogel, MD, Department of Surgery  
St. Anthony Hospital, Lakewood, CO

## Presentation

The patient was a 21-year-old female who presented to the Emergency Department after skiing into a tree. She was transported via helicopter after a two-hour extrication off the mountain. The patient became hemodynamically unstable prior to arrival to the ED, was not intubated and presented without a pelvic binder.

## Diagnosis

Initial evaluation revealed a right femur and pelvic fractures. Final diagnosis included bilateral pulmonary contusions, left abdominal wall muscular disruption, open book pelvic fracture with pelvic ring instability, sacral fractures, right midshaft femur fracture, right acetabular fracture and left comminuted elbow fracture with posterior dislocation.

## Course of Care

The patient entered the Emergency Department as a highest-level trauma activation. Heart rate was in the 160s with an arterial blood pressure of 48/22. Base deficit and lactate were 12 and 2.1 on admission. Patient was alert and talking despite her profound hypotension. Patient was intubated and central line placed while pelvic binder was applied and FAST was performed. Massive transfusion protocol was initiated. Chest (Figure 1) and pelvic (Figure 2) x-rays were obtained. FAST was negative for any evidence of blood in the peritoneal cavity. CXR revealed no obvious injury, and the pelvic x-ray was positive for an open book fracture.

Due to the patient's continued hemodynamic instability despite resuscitative efforts, an ER-REBOA™ Catheter was utilized. The initial approach for access via ultrasound to the common femoral artery was on the patient's left side, as it was opposite the right femur fracture. The initial approach was unsuccessful as the wire was unable to thread into the vessel properly. As a result, the ER-REBOA™ Catheter was placed into the patient's right side, using ultrasound as guidance for percutaneous access, where the wire was easily passed. The ER-REBOA™ Catheter was placed into Zone III. The balloon was inflated with 8 cc of a 1:3 ratio of contrast to saline, and placement of catheter was confirmed with x-ray (Figure 3). After balloon inflation, patient's heart rate came down to the 110s and systolic blood pressure went up to the 90s. A total of 2 units pRBCs and 2 units FFP were transfused.

The patient was taken to CT to rule out head or other solid organ injury while IR was preparing the hybrid OR suite for an angioembolization (Figures 4 and 5). Preceding the pelvis portion of the CT scan, the balloon was deflated temporarily, less than two minutes, at the request of IR as a means to identify the area of extravasation. The SBP decreased from the 110s

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down to 85-90. The balloon was re-inflated after the pelvic CT scan was completed. The balloon was ultimately deflated and the ER-REBOA™ Catheter pulled once IR was prepped and draped. The balloon was inflated for approximately 28 minutes. IR used the previously placed 7Fr sheath from the Prytime convenience kit for access. The patient's bilateral hypogastrics were embolized (Figure 6). The sheath was left in for 24 hours to ensure access in the event additional angio was necessary. Patient received 16 units PRBCs, 13 units FFP...

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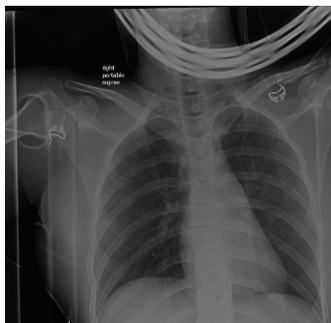


Figure 1. Chest x-ray



Figure 2. Pelvic x-ray



Figure 3. Zone III REBOA

# ER-REBOA™ Case Report *(continued)*

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...4 (5-packs) cryoprecipitate, and 2 units platelets during treatment.

## Patient Outcome

The patient did well and was discharged to rehab on hospital day 23. Patient required multiple orthopedic interventions for her fractures.

## Considerations

This was Dr. Vogel's first deployment and use of the ER-REBOA™ Catheter. Dr. Vogel had taken a REBOA course entitled "Advance Endovascular Skills for Trauma Surgeons" with Dr. Charles Fox from Denver General. As a result of her attendance at this course, Dr. Vogel was asked to present a talk about the ER-REBOA™ Catheter at a trauma nurse symposium the day prior to this patient's crash. The lecture was a nice refresher and it helped Dr. Vogel and her team become more familiar with REBOA.

## Takeaway points:

- Stay calm.
- If access is not easily obtained on one side, go to the other side.
- Prepare REBOA kits and become familiar with their location within the hospital.
- Consider adding extra sheaths and wires in REBOA kits; after this case it was realized that these extra supplies may be needed.

"I was frankly astonished by the effectiveness and will definitely plan to use the REBOA again," Dr. Vogel said. "It is very intuitive to place. A patient like this would generally have had an exploratory laparotomy and pelvic packing. A 21-year-old female was spared a large incision that ultimately would have accomplished the same end as a femoral puncture and REBOA placement."

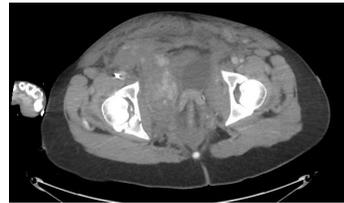


Figure 4. CT scan

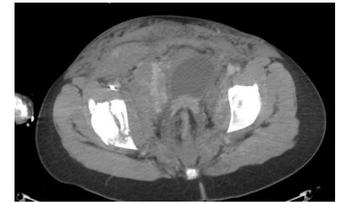


Figure 5. CT scan



Figure 6. IR angioembolization

## References

1. Prytime website / package insert.
2. Moore LJ, Martin CD, Harvin JA, Wade CE, Holcomb JB. Resuscitative endovascular balloon occlusion of the aorta for control of noncompressible truncal hemorrhage in the abdomen and pelvis. *Am J Surg.* 2016 Dec;212(6):1222-1230.
3. Costantini TW, Coimbra R, Holcomb JB, Podbielski JM, Catalano R, Blackburn A, Scalea TM, Stein DM, Williams L, Conflitti J, Keeney S, Suleiman G, Zhou T, Sperry J, Skiada D, Inaba K, Williams BH, Minei JP, Privette A, Mackersie RC, Robinson BR, Moore FO; AAST Pelvic Fracture Study Group. Current management of hemorrhage from severe pelvic fractures: Results of an American Association for the Surgery of Trauma multi-institutional trial. *J Trauma Acute Care Surg.* 2016 May;80(5):717-23; discussion 723-5.
4. DuBose JJ, Scalea TM, Brenner M, Skiada D, Inaba K, Cannon J, Moore L, Holcomb J, Turay D, Arbabi CN, Kirkpatrick A, Xiao J, Skarupa D, Poulin N; AAST AORTA Study Group. The AAST prospective Aortic Occlusion for Resuscitation in Trauma and Acute Care Surgery (AORTA) registry: Data on contemporary utilization and outcomes of aortic occlusion and resuscitative balloon occlusion of the aorta (REBOA). *J Trauma Acute Care Surg.* 2016 Sep;81(3):409-19.

# How to build an endovascular trauma program *(continued)*

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...Center, the IR techs are specifically assigned to the OR,” she said. “However, other hospitals bring their techs in from the IR suite, so that’s an option too.”

The main challenge is securing coverage. “I think it’s important that you have someone in the room who has expertise in endovascular procedures and is available 24 hours a day, seven days a week,” Dr. Hoehn said. “However, it’s not necessarily feasible to have an IR tech in the hospital around the clock.”

At Shock Trauma, an IR tech is in the hospital 12 to 14 hours a day and on call during the remaining 10 to 12 hours.

“When the team was originally set up, the IR techs had a very short response time,” Dr. Hoehn said. “Most of them could be in the hospital in 15 or 20 minutes, which was very helpful.”

Trauma nurses were trained to set up and start endovascular cases while the team waited for the interventional radiology tech to arrive. (See below for more information on nurse training.)

“Ideally, the IR tech was able to pick up the already-started case from the trauma nurses,” Dr. Hoehn said. “Sometimes when we had a staffing shortage, the surgeons would double-scrub the case and help out, especially for the sickest patients, just to make sure things went smoothly.”

**Creating a new mindset.** At the same time you are assembling the endovascular trauma team, it is important to create a new team vision.

“I think one of the keys to setting up a successful program is creating a new mindset,” Dr. Hoehn said. “Trauma surgeons, myself included, are trained to treat things via a particular algorithm. What you need is a group of people who are open minded and interested in trying to do things differently. That includes everyone, from the trauma surgeons to the nurses to the vascular surgeons, interventionalists and anesthesiologists.”

## **Endovascular trauma: equipment/supplies**

Once you’ve determined who will lead and take part in the endovascular trauma program, the next step is to plan and secure the program’s physical resources and equipment.

One big question is whether or not to create a dedicated trauma hybrid room. Dr. Hoehn believes that hybrid rooms are useful but not essential to a successful endovascular trauma program.

“A hybrid room is nice if you have it, but in my opinion it’s not mandatory for setting up an endovascular trauma program,” she said. “It’s a very expensive undertaking, so if your institution does not have the resources to take that on, you can still implement a program with a portable C-arm as long as you get a machine of high enough quality and also put up all the other support systems.”

**Imaging systems.** What C-arm capabilities are essential? “It’s my opinion that any procedures you do in trauma tend to be in patients that are critically ill, and so the procedures tend to be relatively straightforward,” Dr. Hoehn said. In terms of imaging, that means the C-arm should enable basic to moderately complex procedures.

“The system you choose will vary a little based on the level of complexity of the procedures that you will be doing,” she said. “You definitely need one that runs vascular programs, and you’ll want something that is going to give you a wide enough field-of-view that you can work on these cases.”

Key parameters include institutional resources and the unique makeup of your endovascular team. “Again, it’s going to depend a great deal on what your budget is, who is going to be using the system and what they will be using it for.”

**Endovascular supplies.** Core endovascular trauma supplies include all the basic wires, catheters and other items stocked in an endovascular room. You will also need a wide variety of stent grafts.

“So besides aortic stent grafts, you will want to have at least some thoracic devices available in-house,” Dr. Hoehn said. “In addition, it is very important to have some peripheral artery stent grafts

on hand, in particular subclavian artery grafts. This would include some smaller covered stents.”

The room should also be stocked with basic embolization coils and endovascular plugs. “In terms of coils, you need to have some .035-inch and ‘micro-catheter’ coils available,” she said.

One way to ensure supply availability and control costs is to centralize endovascular services where possible. “At Shock, our trauma hybrid room was separate from our vascular room, so it was a challenge to centralize our equipment so it was readily available to the trauma team without someone having to go to the other side of the hospital,” Dr. Hoehn said. “We eventually had to duplicate some of the stock so that it was immediately available.”

**Hybrid rooms: 3 keys to success.** Juan Duchesne, MD, section chief of trauma and critical care at Tulane University School of Medicine, described his experience with the trauma hybrid suite at the Norman McSwain Trauma Center in New Orleans.

He identified three keys to building and running a successful hybrid room:

**1. Sufficient volume.** “The main challenge is convincing administration that a hybrid room will benefit patients,” Dr. Duchesne said. “If you’re in an environment where you don’t see that much complex blunt trauma, it will be hard to convince administration to allocate all the resources for your trauma group.” The key is to demonstrate a sufficient volume of hypotensive poly-trauma patients who would benefit from a hybrid room. “If you are a busy facility, you should be using the hybrid room an average of 2 to 5 times a month.”

**2. Trauma surgery ownership.** “It is extremely important that trauma surgeons are in control of these hybrid rooms,” he said. If another specialty is in charge of the room, it will often not be available when needed by an injured patient. “If trauma does not own the hybrid room, it will be used for many other procedures — procedures that will be...

*(continued on page 7)*

# Q&A on the future of endovascular trauma *(continued)*

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...ECMO. So the concept of endovascular resuscitation is expanding.

## **Q. What are the biggest misconceptions about endovascular trauma management?**

**Hörer:** There are two misconceptions. One is that endovascular resuscitation always goes very fast. It doesn't. It can take some time to perform these procedures. People say, "Just embolize it" — but that may take half an hour. So endovascular trauma management is not a magic solution.

The other misconception is the exact opposite — that only good old open surgery can solve any given problem. This is a misconception because at times minimally invasive techniques can help you solve problems better than surgery can — for example, traumatic pelvic bleeding.

As part of this, it's important to realize that hybrid procedures are also a possibility. For example, you can use REBOA to stabilize a patient before you move to a laparotomy. In this case, the endovascular technique is used to win time and prevent problems. Or you might do an endovascular procedure with embolization, but you also pack the pelvis. Or say you have a patient bleeding in the lung who has no blood pressure. You can use a balloon to get some pressure and then do a thoracotomy as a parallel procedure to close the bleeding. This approach is contro-

versial, but it has been done.

So there are no magic tools. But in the right patient at the right place with the right team, you can use endovascular techniques to do amazing things.

## **Q. What specialties should come together to provide multidisciplinary bleeding control?**

**Hörer:** Endovascular trauma management naturally leads to a multidisciplinary way of thinking. In my institution, it includes trauma surgeons, vascular surgeons, general surgeons, anesthesiologists, and interventional radiologists. And of course the problems don't stop after surgery, so the multidisciplinary team also includes ICU and rehabilitation staff. It also includes prehospital providers, helicopter EMS and military medics who bring the patients in.

But it also depends where you work. In Europe, for example, the trauma surgeon operates but maybe does not take care of the patient on day two and day three (it's the ICU people). In other countries, there are some very advanced team approaches. I know of a team in Israel where a trauma surgeon leads the process but there is a dedicated radiologist on call to put the REBOA in. So far they have done 12 cases working in this model.

The great thing about multidisciplinary care is that it lets us discover a lot of tools. One very hot issue now is the use of ECMO to address sepsis in trauma patients, maybe not in the first hours but later on. Here we can learn a lot from colleagues like cardiologists and thoracic

surgeons. *What catheter do you use? What balloon do you use? What ECMO machine are you using?*

## **Q. Speaking of equipment, what are the latest tools of endovascular resuscitation?**

**Hörer:** There are a lot of amazing new tools for diagnosing and treating bleeding, and they are becoming more widespread. There are two major companies in the market now with 7 French REBOA balloons; and one or two more are coming soon, so there is great interest in this. And then of course there are a lot of different catheters, sheaths, embolization agents, stent grafts, endografts and other devices.

But we have also seen huge development in imaging — from ultrasound to C-arms to CT to hybrid suites. Many of these pieces of equipment are very expensive but very useful. For example, you have "CT on rails" which lets you move the CT to the patient instead of moving the patient to the CT. I know of three hospitals in Europe where this is installed and eight in Japan.

## **Q. Who do you believe should attend the EVT M Symposium?**

**Hörer:** Anybody who is interested in the treatment of hemostatically unstable patients. Trauma/general surgeons, vascular surgeons and nurses should be there, of course, but also anesthesiologists, interventional radiologists, prehospital providers, military providers, etc. We also hope to see gynecologists who deal with postpartum bleeding.

We are very interested in a multidisciplinary approach to these issues. This conference is a great opportunity for people to collaborate, and I hope everybody who has an interest in these exciting techniques can come and be a part of what we are doing.

**Tal Hörer, MD, PhD**, associate professor of surgery at Örebro University Hospital & University. Dr. Hörer is the founder of the EVT M Symposium.



## How to build an endovascular trauma program *(continued)*

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...indicated, but which will often not leave room for those patients with multiple comorbidities and vascular injuries. So it is extremely important that administration back up the trauma system on this point.”

### 3. Adequate specialty coverage.

“You need to make sure that the interventional radiologists and vascular surgeons understand that there is a time-frame for responding to a trauma activation,” Dr. Duchesne said.

Once the trauma activation call is placed, endovascular specialists need to be on site working with the patient within 30 minutes.

“It is extremely important that the trauma group work together on this,” Dr. Duchesne said.

### Endovascular trauma: training physician and nursing staff

Since many trauma surgeons and trauma nurses have little or no training in endovascular techniques, new endovascular trauma programs must make education a priority.

**Training for trauma surgeons.** For many trauma surgeons today, the focus of endovascular training is learning to perform REBOA.

“The most challenging part of REBOA training is common femoral artery (CFA) access,” said Megan Brenner, MD. “This finding mirrors our published experience demonstrating that CFA access is the rate-limiting step to REBOA.”

Dr. Brenner is a trauma and vascular surgeon, and the creator and chair of the Basic Endovascular Skills for Trauma (BEST) Course, which is the third surgi-

cal skills course to be offered by the ACS Committee on Trauma.

“Students enter the course with varying degrees of endovascular skills, and choosing the right training module depends on comfort with percutaneous and open surgical CFA access,” she said. “That’s why our perfused cadaver model is a critical part of the BEST Course.”

However, Dr. Brenner said there are other options for REBOA training. “Physicians who are already proficient with percutaneous and open surgical CFA access skills, or who are interested in an introductory REBOA course, can benefit from the BEST Workshop which uses didactics and synthetic simulators for instruction.” In addition, there are many other REBOA courses offered throughout the U.S.

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# How to build an endovascular trauma program *(continued)*

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**Sustaining endovascular skills.** Once a trauma surgeon has received initial endovascular training, how does he or she sustain those skills long-term?

“Skills sustainment for REBOA is an area of ongoing investigation,” Dr. Brenner said. “Placing CFA arterial lines in patients who need continuous monitoring and may be potential REBOA candidates is a good start. Surgeons can also review course slides routinely and make time to ‘practice’ the steps of the procedure either alone or on a simulator. Some centers have required a minimum number of access procedures performed by joining IR or vascular in the initial part of their endovascular cases.”

In addition, she recommends the “Introduction to REBOA Module” that will be part of the next edition of the Advanced Surgical Skills for Exposure in Trauma (ASSET) course. “We hope this brief module will serve as an introduction and a refresher.”

**Training trauma nurses and scrub techs for endovascular cases.** Endovascular trauma teams need experienced interventional radiology technologists to support a variety of basic to complex endovascular procedures. But as discussed above, many hospitals are unable to keep IR techs in the hospital around the clock. As a result, it is important to train regular trauma staff to support endovascular cases.

“There has to be a lot of flexibility from your staff because even experienced trauma nurses and scrub techs will have to learn some things that may be a bit outside their comfort zone,” Dr. Hoehn said. “There has to be a lot of education to make sure they understand the procedures enough to be appropriately helpful.”

One goal is to become familiar with endovascular equipment and supplies. “Trauma nurses need to have a basic understanding of the different wires and catheters, the variety of sizes, and where the equipment is stored so they can bring you the right thing when

you ask for it,” Dr. Hoehn said. “When the surgeon asks for a particular wire, the nurse might not necessarily know all the fine details, but they have to be able to at least get what is being asking for on a very basic level. It’s not quite as simple as one might think because the equipment can get a little complicated.”

Trauma nurses should also become familiar with setting up the table, positioning the patient and other unique steps in preparing an endovascular case.

“Scrub techs have even more to learn,” Dr. Hoehn said. “Not only do they need to understand the equipment, but they also have to learn the flow of the procedures.” Assisting in an endovascular trauma procedure can be very different from what scrub techs are used to. “They have to learn how to manage and hold wires and put different pieces of equipment together.”

Dr. Hoehn recommends scheduling ample in-service training. “In addition, consider doing hands-on training where you double-scrub for endovascular procedures on more stable patients,” she said. “All these approaches are useful for getting the staff up to speed.”

## **Endovascular trauma: ensuring quality and patient safety**

Some endovascular trauma procedures are relatively uncommon. Therefore, a robust quality assurance strategy is an essential part of any endovascular trauma program.

**Risk mitigation for endovascular trauma.** “The best way to mitigate the risks is to prepare and plan for them,” Dr. Brenner said. For REBOA and other endovascular procedures, it is important to identify the potential pitfalls.

“Understanding the pitfalls at each step, the resultant complications, and knowing who can help when these occur are important to a successful REBOA program.”

Program leaders should create protocols for mitigating the risk of the most common complications. “Patients who receive REBOA (or any endovascular procedure) require monitoring and surveillance both during and after the procedure, particularly at the *access site* and

*distal extremity*,” Dr. Brenner said.

In general, education and training are invaluable for reducing risks associated with endovascular trauma cases. “And this should be a multi-disciplinary effort — with trauma, anesthesia, interventional and vascular surgery colleagues — as they will all likely be taking an active role in the care of these patients,” Dr. Brenner said.

**Endovascular trauma and PIPS.** The goal of trauma performance improvement and patient safety (PIPS) is to continuously improve the care delivered to injured patients. A strong PIPS effort is especially important for an endovascular trauma program.

“Some of the things we do in endovascular trauma management are on the leading edge and at this point not necessarily supported by large data sets,” Dr. Hoehn said. “So it’s very important that you review your cases to make sure you’re using these endovascular resources and tools responsibly.”

Since endovascular trauma management is multidisciplinary in nature, it is important to involve interventional radiology and vascular surgery in the PIPS process.

According to Dr. Duchesne, endovascular PIPS teams should look at several metrics. “Number one is *time to response* for endovascular surgeons or IR,” he said. “The other item that needs to be monitored is *time to puncture*, which is definitely an indicator that the patient was promptly intervened.” His team also monitors patient endpoints. “We need to make sure patients are leaving the endovascular room with *good hemodynamics*.”

(In addition, see the recent ACS/ACEP joint statement for more guidance on REBOA quality assurance.)

Dr. Brenner emphasizes the importance of consistent case review for REBOA and other endovascular procedures. “Quality assurance measures should be in place at each institution and REBOA cases reviewed routinely, regardless of outcome,” she said. “So much can be learned and taught from each and every one.”