

How to build an endovascular trauma program at your hospital

A trauma leadership e-book from *Trauma System News*



Endovascular trauma: Introduction

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.

This trauma leadership e-book from *Trauma System News* features input from three experts in endovascular trauma management. They share their solutions for establishing, growing and optimizing an endovascular trauma program.

The insights and solutions are grouped in four sections:

- I. Creating the team**
- II. Essential equipment and supplies**
- III. Training physician and nursing staff**
- IV. Ensuring quality and patient safety**

Endovascular trauma:

I. Creating the team

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

“The people issue is probably the one thing 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. “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.”

This 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 interventional radiology technologists. “It’s my opinion that you need an IR tech in your program,” Dr. Hoehn said. “Not only can they run the equipment and load the images, but many IR techs are also quite capable of scrubbing into the OR and assisting.”

There are different ways to structure IR tech

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support. “At the Shock Trauma 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 IR 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 trying to do things differently. And that includes everyone, from the trauma surgeons to the nurses to the vascular surgeons, interventionalists and anesthesiologists.”

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II. Essential equipment and 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 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 proce-

dures 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.



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“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.”

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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 polytrauma 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 an-

other 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 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 timeframe 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.”

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

Endovascular 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 surgical 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.

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

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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

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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.”

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IV. Ensuring quality and patient safety

Some endovascular trauma procedures are relatively uncommon. Given that fact, 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 management 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.”

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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 interventional radiologists,” 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*.”

According to the recent [joint statement](#) from the ACS Committee on Trauma and the American College of Emergency Physicians, a REBOA quality management program should specifically evaluate “(1) each placement for appropriateness and complications to maximize patient safety and (2) availability and timeliness of definitive surgical or angioem-

bolic control of bleeding following REBOA.”

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.”



Thank you

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