PANEL DISCUSSION

Core Elements and Key Adjustments Made for Modern PE Teams

A panel discussion on the essential components of a pulmonary embolism response team, who should be involved, and how to handle communication among team members.

With Jay Giri, MD, MPH; Brent Keeling, MD; and Robert Lookstein, MD, MHCDL, FSIR, FAHA, FSVM

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What are three core elements every pulmonary embolism response team (PERT) must have or emphasize?

Dr. Giri: First, a multidisciplinary framework, with emphasis on the concept that noninvasive clinicians should be heavily involved and at least equal partners in the overall clinical infrastructure of the team. To truly improve the system of care for pulmonary embolism (PE), PERT should not just be a thinly veiled structure to "juice" procedural volumes.

Second, a framework for rapid mobilization of resources and escalation of care for the sickest patients. The ability for the most advanced therapies may not exist in many limited-resource settings, but PERTs serve as a platform to create expeditious referral to tertiary or quaternary care settings.

Third, the ability to follow-up patients with clinicians who are invested in long-term PE and venous thromboembolism care.

Dr. Keeling: Every PERT must be multidisciplinary and have a variety of medical backgrounds represented. Each PERT must also have a way to communicate about patients, prefer-

ably in real time. Last, each PERT needs to have some infrastructure to support quality improvement initiatives and possibly research.

Dr. Lookstein: There are actually four core elements: (1) a specialist in the medical management of acute PE, (2) an expert in the endovascular management, and (3) an expert in the surgical management. The final element is a seamless mechanism for these three individuals to communicate and share decision-making responsibilities in a rapid, democratic manner.

What is the biggest change your PERT has made since its inception, with the most meaningful return?

Dr. Keeling: Our local PERT has initiated a follow-up clinic whereby patients are seen after their hospitalizations. This is multispecialty, and the providers chart a course for lifelong PE care, including potential filter removal, duration of anticoagulation, and diagnosis of hypercoagulable disorders.

Dr. Giri: The process will not work unless you have both a fairly broad "coalition of the willing," as well as individual champions in noninvasive inpatient hospital care, intensive care unit care, endovascular procedures, cardiac surgery, and mechanical support. It took us some time to find individuals in each of these domains who were passionate about pushing the PERT concept forward.

Dr. Lookstein: I would plan on having regular group meetings to review data and outcomes, as well as the latest peer-reviewed literature. This kind of quality assurance or performance improvement mechanism is incredibly valuable to long-term success. This is the founding principle of the national PERT Consortium database, which allows an individual clinical site to receive regular feedback over time and compare their outcomes to the rest of the country.

From a specialty or background standpoint, who should comprise the ideal PERT?

Dr. Lookstein: An ideal PERT should include practitioners in the areas of pulmonary/critical care, cardiology, and cardiac surgery, as well as interventional vascular specialists. Other members may include hematologists, emergency physicians, and diagnostic radiologists.

Dr. Keeling: The ideal PERT should include both proceduralists and nonproceduralists. I don't believe that any one specialty should always be represented.

Dr. Giri: Broadly speaking, noninvasive clinicians, emergency physicians, clinical pharmacists, endovascular proceduralists, and cardiac or thoracic surgeons should be included in a PERT. The latter two specialists may not be available at every hospital, so relationships with more advanced referral centers are advised in these circumstances.

How does your PERT communicate regarding each case, and how has this changed over time?

Dr. Keeling: We have always preferred real-time text messages. These are quick and ubiquitous and don't require any special software. Moreover, recipient lists can often adjust after hours to reflect who is on call.

Dr. Giri: Our PERT works as a straightforward consult service. A group of ten pulmonologists and cardiologists volunteer about 5 weeks per year each to serve as the PERT consult attending. We take and triage consults similarly to how any other service works. We are fortunate to have fellows involved with initial calls for some of these rotations. Each PERT attending has a phone list of all other attendings (as well as those of three adjunctive CT surgical attendings) and can easily reach out for additional opinions if they feel this is valuable in an individual circumstance.

Dr. Lookstein: We typically communicate over a secure chat program that allows the team members to share medical images, lab values, vital signs and symptoms, and medical opinions. We are collaborating with several vendors to develop app-based software combined with artificial intelligence algorithms to enhance our ability to rapidly communicate and triage patients.

Disagreements are bound to happen. How is the final say on a patient's therapeutic course determined when differing opinions are strongly held?

Dr. Giri: Ultimately, the PERT service is a consult service at our hospital, so we are making recommendations to a primary team. For the most part, these teams defer to us regarding PE management. The PERT consult attending is ultimately responsible for the final recommendations made to the primary team.

Dr. Lookstein: We try to be democratic as much as possible. The most important operating principle is that all team members are trying to keep the patient safe and prevent adverse events. In many instances, strong disagreements are focused on subjective perceptions of risk versus benefit. When we all recognize that is the

cause of disagreement, it allows everyone to reach consensus rapidly.

Dr. Keeling: Disagreements happen less often than one would imagine, and the group is usually able to come to consensus. Significant disagreements usually come down to two to three people, and those are usually handled in person. Importantly, most members write notes in the chart, so responsibility is shared.

What is one adaptation your PERT has made as a result of COVID-19?

Dr. Lookstein: We are very sensitive to limited resources with respect to staff and protected or low-risk areas for procedures and recovery. This has become part of our decision-making process regarding management of acutely ill patients, especially with respect to escalation therapies.

Dr. Giri: We have been more reticent to take symptomatic COVID patients for endovascular procedures due to all the complexities involved logistically with this.

Dr. Keeling: We have become much more conservative in how we manage patients. We employ much more medical management at this point during the pandemic.

What's the one item at the top of your wish list, whether technologic, data, or other?

Dr. Giri: We need more research in the imaging arena to more carefully guide our potential success with both catheter-based embolectomy and lytic approaches for patients at the higher end of risk. PE can have highly variable individual gross pathologic characteristics, and this is associated with success of our endovascular procedures. It would be great to have a better feel for these characteristics before attempting procedures.

Dr. Keeling: We anxiously await data confirming a more aggressive interventional approach to PE.

Dr. Lookstein: We need an accurate risk-stratified algorithm to assist with deciding who should receive medical management, endovascular management, or surgical management. Until that is available, we must all participate in prospective research to assist in the development of such an algorithm. ■