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DISCUSSION

Dr Charles B. Ross (*Atlanta, Ga*). Pulmonary embolism (PE) is the third leading cause of cardiovascular mortality. During the past decade, therapeutic options for management of patients with large-burden PE have expanded dramatically. As Dr Xenos rightly points out, matching the best therapeutic option to achieve optimal outcome for a given patient is not always straightforward. This is precisely why modern care for PE has evolved toward the PE response team (PERT). This approach is characterized by the rapid response of a multidisciplinary team to develop and implement a management plan for an individual patient based on risk stratification and patient characteristics, such as comorbidity and age.

Through analysis of the outcomes of a recent cohort of patients who received PERT care at University of Kentucky Medical Center compared with a matched group of patients from the Vizient database, identified through diagnostic codes and matching demographics, severity of illness, and risk of mortality, Dr Xenos has shown no mortality benefit attributable to PERT care. However, lower intensive care unit length of stay, lower overall length of stay, and, even though invasive intervention was used more frequently in the PERT group, no cost difference compared with controls were observed.

I have a few observations and questions. The essence of PERT activation is to identify and to select best management for an individual patient to prevent clinical deterioration. Considering that most PERT activations occur for patients with intermediate-risk PE who have a low predicted mortality regardless of treatment selected and considering that 5% to 10% of PERT activations occur for massive PE patients, many of whom may die regardless of the approach used, was this study powered adequately to prove or to refute a mortality benefit attributable to the PERT approach? I sincerely hope that no one interprets this negative finding to mean that the PERT approach does not make a difference.

Although there are signals of improvement in recent reports, mortality from massive PE is generally reported in the range of 50%. In the experience that you have reported in this manuscript, mortality is 80%. What interventions has your PERT considered to reduce this mortality? Have you considered adding transfer algorithms, such as systemic lysis before initiating transport or even during transport in the case of in-transit deterioration?

Has your PERT ever experienced a major complication of PE intervention in a patient who might have done better if treated with a different option? Does your PERT have an active quality assurance program, and if so, how is this program refining PERT practices at your institution?

As your secondary data points showed, I believe that the PERT approach is advancing care for PE, and I think this is only the beginning. I think the PERT approach, from care of individual patients to sharing of best practices and research, offers the best hope for making a substantial, positive impact in reducing mortality and morbidity from PE. I enjoyed your paper, appreciated

early receipt of the manuscript, and I greatly appreciate the honor from the Society to open this discussion.

Dr Eleftherios S. Xenos. Dr Ross, thank you for your comments. They are very insightful. I do not believe our study was underpowered. Initially, when we did the review, we had about 435 patients in the control group, and we expanded that to about 992. We found a difference in the intensive care unit length of stay and the overall length of stay, so I think if there was a mortality difference, we would have detected it. The data I presented showed that the mortality of the PERT group and the mortality of the control group were similar between 14% and 15%, so I'm not sure this was a power problem. For your second question, indeed 80% mortality for the massive PE is a very high number, I agree. I think it kind of reflects our pattern of practice. Most of these people conceivably reached us without a chance of our having an impact on the outcome, and what you said about transfer algorithms is probably one solution to the problem. At this point, our PERT does not have reach outside of our institution, we do not even know sometimes that the patient has a PE until they get to us, so we don't intervene before they get to the University of Kentucky. To do so is a consideration, but it does have some medical-legal and logistic ramifications that we have not explored yet. Regarding your third question, the comparison I show you was with our own patients; these 992 patients were University of Kentucky patients. We just used the Vizient database. That is our database. We don't have a different database to extract data from for these patients, we don't have a separate database for that. So these were our own patients before the PERT implementation. Regarding the fourth question about the complications, if we had treated these patients otherwise—I would say that I would have to speculate about that. Once a complication happens, everything is in hindsight, and you can change your approach; but so far, we haven't made any changes, and we do have a quality program. We do review all of these cases, and we do have our data, and we hope that with our participation in the PERT Consortium we will be entering our data to the registry and will have a clearer understanding of our performance compared with others. Thank you.