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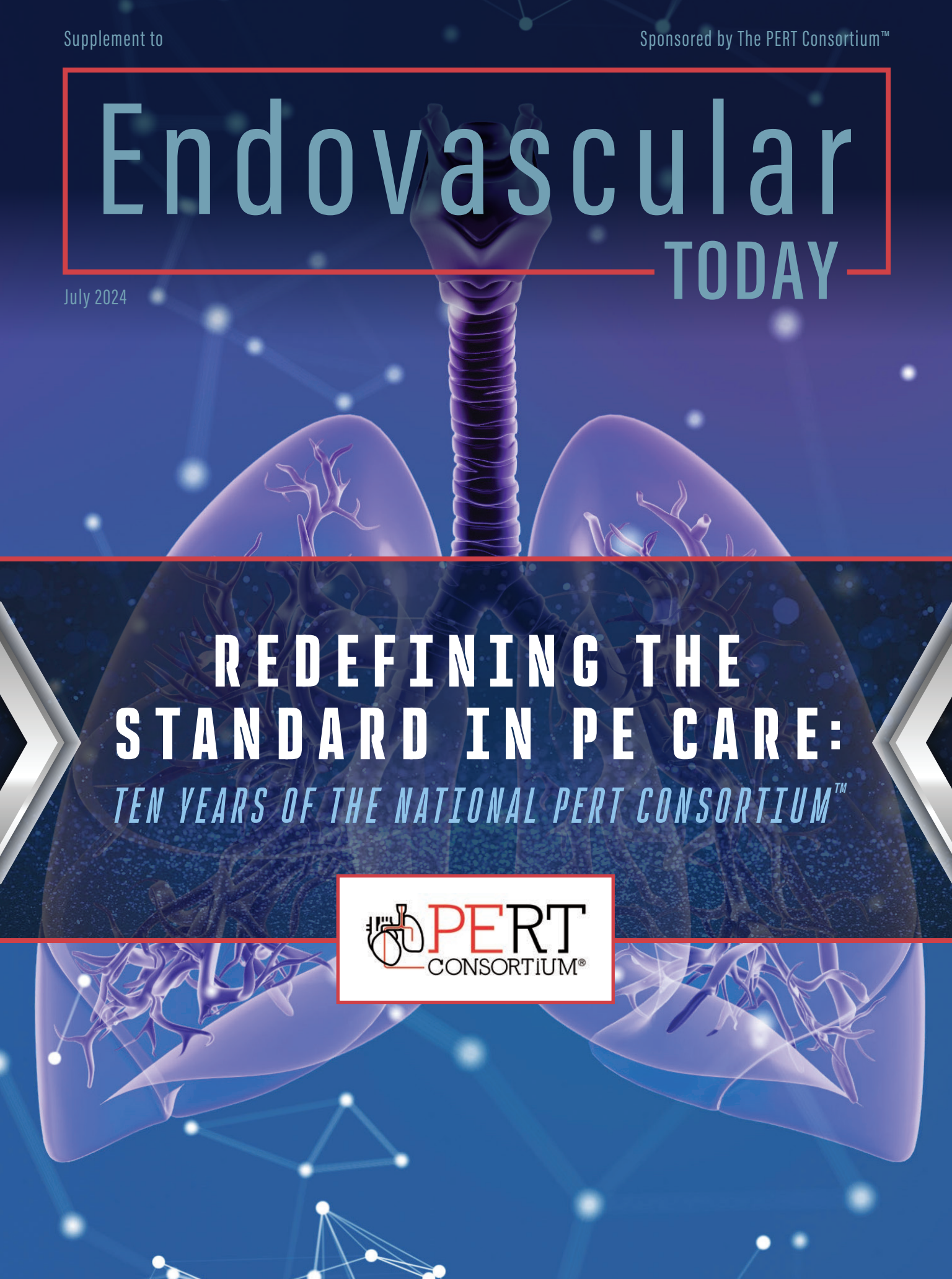

REDEFINING THE STANDARD IN PE CARE:

TEN YEARS OF THE NATIONAL PERT CONSORTIUM™

PERT CONSORTIUM®

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Redefining the Standard in PE Care

Ten years of The National PERT Consortium™.

The National Pulmonary Embolism Response Team (PERT) Consortium™ is again honored to host this supplement to *Endovascular Today*. The National PERT Consortium™, a 501(c)(3) organization founded in 2015, is the only multinational organization dedicated to the multidisciplinary, team-based approach in the treatment of pulmonary embolism (PE). Since its inception, The PERT Consortium™ has changed the landscape of PE treatment through innovative research, comprehensive guidelines, the largest and most in-depth registry, and the establishment of PERTs across the globe. This year marks a significant milestone for The Consortium™ as we celebrate 10 years of progress, life-saving initiatives, and a commitment to improving patient outcomes. As we continue to revolutionize PE care, we encourage the participation and input of individuals in allied health fields and welcome collaborative efforts benefitting PE patients.

In this supplement to *Endovascular Today*, readers will learn about the many and noteworthy National PERT Consortium™ initiatives, including the most impactful papers of the year, long-term management of the PERT patient, outcomes from the APEX-AV trial with the AlphaVac system (AngioDynamics, Inc.), the growth of PERTs throughout the world with PERT International, and the launch of our Trainee Council—a platform to engage trainees.

Showcasing the global reach of The PERT Consortium™, board members Drs. Ranade, Elder, and Konstantinides discuss PERT International and the ongoing efforts to improve outcomes around the world.

In addition, Drs. Keeling, Ranade, and Sokol highlight the recent findings from the APEX-AV study, which demonstrated both safety and efficacy of the AlphaVac multipurpose mechanical aspiration F18^{85} system in patients who present with acute intermediate-risk PE. Their results support the use of this device in clinical practice and expand the available treatment options for the management of PE.

In their article on post-PE management, Drs. Khosla, Mina, and Samant discuss the importance of establishing follow-up care for patients who experience PE and outline the components and timeline of that care. Assessing the patient's clinical status, anticoagulation adherence, symptom burden, and quality of life are important during the early follow-up visits and the steps of screening for post-PE impairment constituents are essential to address within a few months of PE diagnosis. Ultimately, the establishment of a post-PE care pathway aims to improve the morbidity and mortality associated with PE.

There have been many notable papers published in the last year, dealing with all manner of issues in acute PE. Here, Dr. Giri with the University of Pennsylvania and his coauthors showcase several of the most important, giving insights into gender-based outcome differences, high-risk PE, and costs across different health care systems.

In addition to our notable initiatives, The PERT Consortium™ will host the 10th Annual Pulmonary Embolism Scientific Symposium in Boston, Massachusetts, on September 12-14, 2024, where we are bringing together world thought leaders in the diagnosis, treatment, and research in PE. In addition to our symposium, we are pleased to announce our "Night to Inspire" Gala, which will take place on the evening of September 13th in Boston. The Gala will not only celebrate a decade of ground-breaking advancements in PE care and research, but also honor the visionary leadership and tireless dedication of Dr. Kenneth Rosenfield, Founder of The PERT Consortium™. We encourage everyone to attend this momentous occasion.

We remain honored to partner with *Endovascular Today* to host this annual supplement. We hope that the articles contained within reflect our passion and dedication to the treatment of PE. Please go to pertconsortium.org to learn more about us and how to join. ■

Rachel P. Rosovsky, MD, MPH
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Board of Directors

Michelle Lanno
Executive Director, The PERT Consortium™
Executive Team

John Moriarty, MD
President-Elect, The PERT Consortium™
Board of Directors

Impactful Papers in Pulmonary Embolism

Summaries of recent analyses of The PERT Consortium™ Registry, including investigation of sex-based differences in PE management, outcomes of high-risk PE, and cost modeling of catheter-directed treatment in the United States and Europe.

With Jay Giri, MD, MPH; Elizabeth Bruno, MD; Frances Greathouse, MD; Amir Darki, MD, MSc; Taisei Kobayashi, MD; and Katharina Mohr, MA

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Since its inception, leadership of The National Pulmonary Embolism Response Team (PERT) Consortium™ recognized that a key pillar in advancing care and outcomes in pulmonary embolism (PE) lay in the development of a formal structure for clinical innovation and research. The Consortium™ has sought to act on this principle through partnerships with clinical trialists aiming to perform prospective studies of novel PE therapeutics as well as through retrospective research based on data acquired through The PERT Consortium™ Registry. The Registry is a quality assessment platform that aggregates data from PERT activations at > 30 programs across the United States. Details regarding patient characteristics, presentation, and outcomes are entered by participating sites, which allows for quantitative assessment of hospital performance in the care of PE as well as benchmarking against other participating centers. This platform naturally allows for observational research characterizing modern care and outcomes in hospitalized patients with acute PE. Hence, a formalized research proposal process was developed and funded by The Consortium™, allowing for competitive analytic grants to be awarded to research teams aiming to further the collective knowledge about PE through independent investigation within the PERT Registry. Currently over 10,000 individual PE patient hospitalizations are included in The PERT Consortium™ Registry, making it arguably the richest resource available worldwide for observational PE research.

The Influence of Patient Sex on Pulmonary Embolism Evaluation, Treatment Modality, and Outcomes

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Over the past several decades, trends in pulmonary embolism (PE) incidence, morbidity, and mortality have shown dynamic shifts attributable to improvements in diagnostic imaging and treatment approaches.[1-4] The literature also describes epidemiologic differences between male and female patients, although often with variable results.[5-8] A recent review of Nationwide Inpatient Sample (NIS) data from 2003 to 2018 found that, while case fatality rates decreased for all patients, more improvements were seen for male patients.[5] As the field of PE care evolves with the increased use of advanced therapies, it is unclear how the complex roles of sex and gender may influence management decisions and ultimately clinical outcomes.

STUDY DESIGN

To evaluate differences in contemporary PE evaluation, management, and outcomes between male and female patients, we performed a retrospective analysis of acute PE patients using the multicenter Pulmonary Embolism Response Team (PERT) Consortium™ Registry. The National PERT Consortium™ Registry encompasses a comprehensive collection of over 400 data elements collected on patients presenting with acute PE. These data elements include patient demographics, comorbidities, medications, clinical characteristics at presentation, diagnostic imaging, laboratory data, PERT recommendations, therapies received, and clinical outcomes.

The PERT Consortium™ Registry includes 5,722 eligible patients for analysis, with 2,838 females and 2,884 males. Both groups demonstrate a similar distribution of PE risk categories (25% high, 52% intermediate, 15% low, and 8% unknown risk; Figure 1).

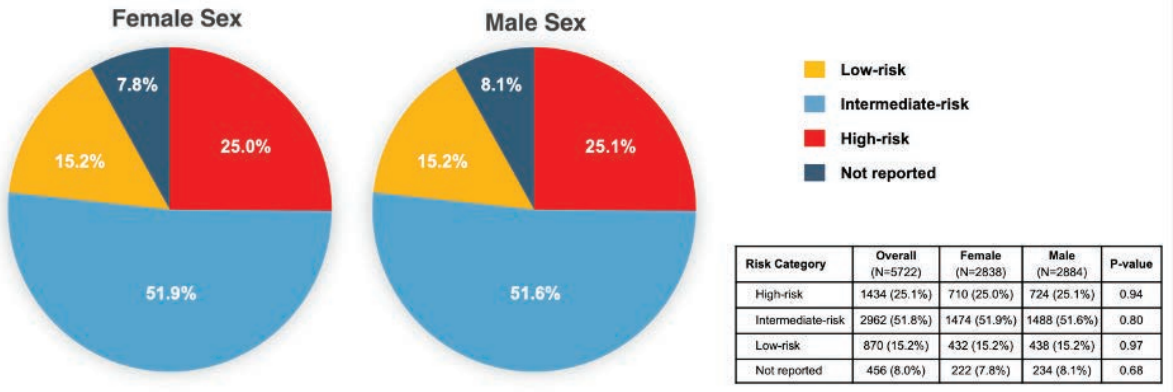
The primary outcomes of interest in our study included the treatment type prior to PERT consultation, the treatment type recommended by PERT, and the treatment type administered after PERT consultation. Secondary outcomes include diagnostic imaging modality, imaging characteristics, major bleeding events, and in-hospital mortality rates. We plan to perform a multivariable analysis to identify predictors of major bleeding outcomes and in-hospital mortality. The results of the study are pending, but outcomes of interest are summarized in Figure 2.

RESULTS AND POTENTIAL IMPACT

In this large cohort of patients from a prospective, multicenter quality assurance database, we aim to identify disparities in the evaluation and management of acute PE based on patient sex. Previous studies exploring sex differences in PE have been limited to clinical outcomes or utilization of single-treatment modalities such as thrombolysis.[5-9] Furthermore, many of these studies predate contemporary approaches to PE management and catheter-directed therapies. Our study is uniquely designed to comprehensively evaluate differences across various phases of PE care. Our analysis will incorporate treatments administered before and after PERT activation as well as recommendations provided by PERT.

The results of our study will provide clarity on whether PE treatments vary based on patient sex, detailing the specific types of treatments and phases of care where potential differences occur. Additionally, our analyses will allow us to identify whether there are delays in treatment initiation, differences in diagnostic imaging, and disparities in recommendations for advanced therapies. The granularity of our results will inform our understanding of the complex factors that may contribute to disparities in clinical outcomes.

In addition to exploring differences in PE evaluation and treatment strategies, our study also aims to investigate potential sex-based disparities in clinical outcomes,



Risk Category	Overall (N=5722)	Female (N=2838)	Male (N=2884)	P-value
High-risk	1434 (25.1%)	710 (25.0%)	724 (25.1%)	0.94
Intermediate-risk	2962 (51.8%)	1474 (51.9%)	1488 (51.6%)	0.80
Low-risk	870 (15.2%)	432 (15.2%)	438 (15.2%)	0.97
Not reported	456 (8.0%)	222 (7.8%)	234 (8.1%)	0.68

Figure 1. Distribution of PE risk categories by patient sex. Pie charts demonstrating proportions of high-risk PE (red), intermediate-risk PE (light blue), low-risk PE (yellow), and unknown risk category (dark blue) for patients of each sex. There are no differences in the distribution of PE risk categories between female and male patients.

PERT CONSORTIUM®

GALA

CELEBRATING OUR 10TH ANNIVERSARY

HONORING OUR FOUNDER
DR. KENNETH ROSENFIELD

This night to inspire will celebrate our achievements, pay tribute to our founder and partners, and raise funds for future initiatives. The evening will feature a cocktail reception, dinner, and live entertainment, with all proceeds supporting the mission of The PERT Consortium™.

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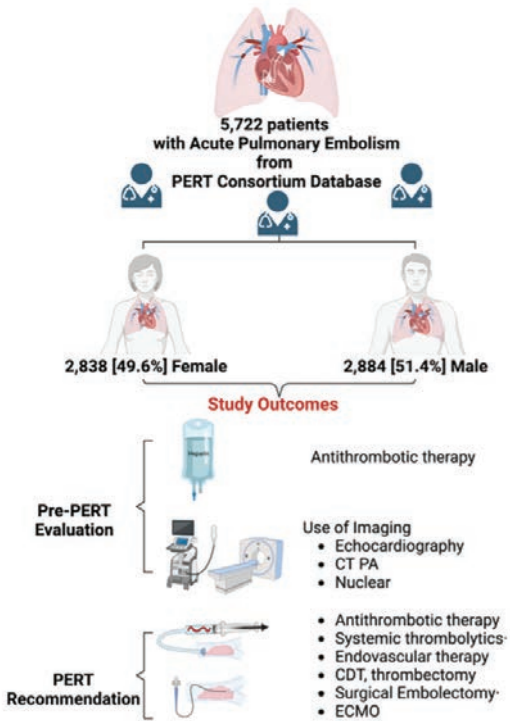

Figure 2. Study outcomes. CTPA, CT pulmonary angiography; CDT, catheter-directed thrombolysis.

particularly major bleeding events and in-hospital mortality between male and female patients in the PERT Registry. Historically, literature describing sex-based differences in mortality among PE patients have shown variable results. A 2015 analysis of NIS data found improvements in mortality rates among male patients, which may be attributable to advancements in PE treatment.[5] A subsequent NIS study reported higher mortality rates among females, although data on disease severity in these patients was not accounted for.[10] Our current study will compare in-hospital mortality rates and major bleeding events in the largest PE-specific database to date. The male and female patients in this cohort have a similar distribution of disease severity. In addition to comparing overall bleeding and mortality rates, we will be performing multivariable analyses to identify predictors of these events in each group. The results of our study will provide valuable insight into sex-based disparities in PE care, guiding clinician practices and informing future research efforts aimed at mitigating these disparities.

1. Lilienfeld D. Decreasing mortality from pulmonary embolism in the United States, 1979–1996. Int J Epidemiol. 2000;29:465-469.
2. Horlander K, Mannino D, Leeper K. Pulmonary embolism mortality in the United States, 1979-1998: an analysis using multiple-cause mortality data. Arch Intern Med. 2003;163:1711-1717. doi: 10.1001/archinte.163.14.1711
3. Martin K, Molsberry R, Cuttica M, et al. Time trends in pulmonary embolism mortality rates in the United States, 1999 to 2018. J Am Heart Assoc. 2020;9:e016784. doi: 10.1161/JAHA.120.016784
4. Wiener R, Schwartz L, Woloshin S. Time trends in pulmonary embolism in the United States: evidence of overdiagnosis. Arch Intern Med. 2011;171:831-837. doi: 10.1001/archinternmed.2011.178
5. Agarwal S, Clark D, Sud K, et al. Gender disparities in outcomes and resource utilization for acute pulmonary embolism hospitalizations in the United States. Am J Cardiol. 2015;116:1270-1276. doi: 10.1016/j.amjcard.2015.07.048
6. Jarman A, Mumma B, Singh K, et al. Crucial considerations: sex differences in the epidemiology, diagnosis, treatment, and outcomes of acute pulmonary embolism in non-pregnant adult patients. J Am Coll Emerg Physicians Open. 2021;2:e12378. doi: 10.1002/emp2.12378
7. Kourlaba G, Relakis J, Kontodimas S, et al. A systematic review and meta-analysis of the epidemiology and burden of venous thromboembolism among pregnant women. Int J Gynaecol Obstet. 2016;132:4-10. doi: 10.1016/j.ijgo.2015.06.054
8. Rosovsky R, Elgendy I, Cannegieter S, et al. Sex differences in risk factors, clinical presentation, treatment and outcomes of patients presenting with acute pulmonary embolism. Blood. 2019;134(Supplement_1):2429-2429. doi: 10.1182/blood-2019-131090
9. Barrios D, Morillo R, Guerassimova I, et al. Sex differences in the characteristics and short-term prognosis of patients presenting with acute symptomatic pulmonary embolism. PLoS One. 2017;12:e0187648. doi: 10.1371/journal.pone.0187648
10. Agarwal M, Dhaliwal J, Yang E, et al. Sex differences in outcomes of percutaneous pulmonary artery thrombectomy in patients with pulmonary embolism. Chest. 2023;163:216-225. doi: 10.1016/j.chest.2022.07.020

Contemporary Management and Outcomes of High-Risk Pulmonary Embolism: Insights From The PERT Consortium™ Registry

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Disclosures: Institution receives research funding from Inari Medical and Endovascular Engineering.

High-risk PE is defined as patients presenting with a PE and the concurrent presence of systemic hypotension with sustained systolic blood pressures (SBPs) < 90 mm Hg, the need for vasopressor support, or cardiac arrest.[1] These patients traditionally carried high mortalities estimated between 30% and 50% in prior observational trials.[2-4] Despite such a high mortality, this population has been understudied, with only one therapeutic randomized trial of eight patients to date and the largest multicenter, observational analyses reporting treatment patterns and outcomes in 108 and 115 patients, respectively.[2,5] As a result, current guidelines and risk stratification models are extrapolated from studies on more stable patient populations. The National PERT Consortium™ Registry is a prospective registry compiling data from a wide range of United States centers focused on providing multidisciplinary care to PE patients. This registry contains information on mortality, treatment complications including major bleeding, and the wide array of rapidly evolving

therapeutic options for acute PE. The goal of this study was to investigate contemporary United States practice patterns and outcomes in this high-risk PE population.[6]

METHODS

Data within The PERT Consortium™ Registry were analyzed between 2015 and 2022, which included data compiled from 35 United States sites. The European Society of Cardiology criteria were used to categorize patients into severity of PE risk: intermediate-risk as defined as patients with SBP > 90 mm Hg with evidence of right ventricular strain and/or biomarker abnormalities at the initial assessment; or high-risk which include patients with hemodynamic collapse, hypotension, sustained BP < 90 mm Hg, or the need for vasopressor support.[1] Hemodynamic collapse was defined as those necessitating the use of high-dose vasopressors due to concern for impending cardiac arrest or those experiencing cardiac arrest with or without cardiopulmonary resuscitative efforts. Patients within the high-risk PE cohort who also had hemodynamic collapse were also selected out into a new stratum labeled as catastrophic PE given that these patients likely represented the highest-risk cohort.

Baseline demographics were compiled for each cohort and analyzed. The use of advanced therapies for PE were also abstracted and were defined as the use of systemic thrombolysis, catheter-directed thrombolysis (ultrasound assisted and non–ultrasound assisted) catheter-based embolectomy, surgical embolectomy, and/or mechanical circulatory support including extracorporeal membrane oxygenation (ECMO). Identified clot-in-transit was defined as an intracardiac mobile clot noted to be present by transthoracic echocardiography or CT findings. When not identified, this was noted as being absent.

The primary outcomes were in-hospital mortality and in-hospital major bleeding. Major bleeding events were defined according to the International Society on Thrombosis and Haemostasis major bleeding criteria.[7] Hospital lengths of stay were also abstracted. There was a total of 5,790 patients in The PERT Consortium™ Registry during the study period. In this cohort, 1,442 patients were categorized as high risk (24.9%), and 2,976 patients (51.4%) were categorized as intermediate risk. Of the 1,442 high-risk patients, 197 of these patients presented with catastrophic PE (13.7%) and 1,245 patients presented with noncatastrophic high-risk PE.

RESULTS

We found that high-risk patients were significantly more likely to undergo advanced therapies for PE (41.9%)

versus those that presented with intermediate-risk PE (30.2%). ECMO, surgical embolectomy, and systemic thrombolysis were more likely to be utilized in high-risk patients. Catheter-based therapies were utilized with similar frequencies between intermediate- and high-risk PE patients.

When noncatastrophic versus catastrophic high-risk PE patients were compared, the overall rates of advanced therapies used were similar between groups (41.2% vs 45.3%, respectively) with ECMO and systemic thrombolytics more frequently utilized in catastrophic PE patients, while catheter-based therapies were used more frequently in noncatastrophic PE patients.

Unadjusted in-hospital mortality rates were 20.6% in high-risk patients and 3.7% in intermediate-risk patients. High-risk PE patients had higher in-hospital major bleeding events (10.5% vs 3.5%) and longer in-patient hospital stays (10.2 vs 6.8 days). Multivariable regression modeling demonstrated vasopressor use, ECMO utilization, identified clot-in-transit, hypoxia at time of presentation, and malignancy were associated with higher rates of in-hospital mortality. The in-hospital mortality for catastrophic PE patients was 42.1% versus 17.2% in noncatastrophic PE patients with a higher risk of in-hospital bleeding and lengths of stay.

CONCLUSION

This study represents the largest multicenter experience focusing on patients presenting with high-risk PE and shows that, despite higher utilization rates of advanced therapies for PE in this subgroup, these patients still had a 20.6% rate of in-hospital mortality. Further, those that presented with catastrophic PE or those that also had hemodynamic instability within this high-risk cohort represented the highest-risk subgroup and had a 42.1% mortality despite similar use of advanced therapies for PE in comparison to the noncatastrophic high-risk PE group. This study underlines the importance and opportunity to improve outcomes in these high-risk patient populations.

1. Konstantinides SV, Meyer G, Becattini C, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). Eur Heart J. 2020;41:543-603. doi: 10.1093/eurheartj/ehz405
2. Kucher N, Rossi E, De Rosa M, Goldhaber SZ. Massive pulmonary embolism. Circulation. 2006;113:577-582. doi: 10.1161/CIRCULATIONAHA.105.592592
3. Goldhaber SZ, Visani L, De Rosa M. Acute pulmonary embolism: clinical outcomes in the International Cooperative Pulmonary Embolism Registry (ICOPER). Lancet. 1999;353:1386-1389. doi: 10.1016/s0140-6736(98)07534-5
4. Torbicki A, Galié N, Covezzoli A, et al. Right heart thrombi in pulmonary embolism: results from the International Cooperative Pulmonary Embolism Registry. J Am Coll Cardiol. 2003;41:2245-2251. doi: 10.1016/s0735-1097(03)00479-0
5. Silver MJ, Gibson CM, Giri J, et al. Outcomes in high-risk pulmonary embolism patients undergoing FlowTriever mechanical thrombectomy or other contemporary therapies: results from the FLAME study. Circ Cardiovasc Interv. 2023;16:e013406. doi: 10.1161/CIRCINTERVENTIONS.123.013406
6. Kobayashi T, Pugliese S, Sethi SS, et al. Contemporary management and outcomes of patients with high-risk pulmonary embolism. J Am Coll Cardiol. 2024;83:35-43. doi: 10.1016/j.jacc.2023.10.026
7. Schulman S, Angerås U, Bergqvist D, et al. Definition of major bleeding in clinical investigations of antihemostatic medicinal products in surgical patients. J Thromb Haemost. 2010;8:202-204. doi: 10.1111/j.1538-7836.2009.03678.x

Catheter-Directed Treatment of PE: How The PERT Consortium™ Registry in the United States Can Help Model the Costs in a European Health Care System

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Disclosures: None.

Catheter-directed treatment (CDT), encompassing local low-dose fibrinolysis and thromboaspiration/thrombectomy, has recently emerged as an effective and safe reperfusion option for patients with acute PE in need of advanced reperfusion treatment. The candidates for CDT are patients belonging to the high- and intermediate-high–risk PE category based on their clinical findings and hemodynamic status at presentation.[1-3] Several CDT systems have received approval by the United States FDA and the European Medicines Agency.[1,4,5] In the United States, use of CDT has continuously increased in the past decade,[6,7] and although the results of ongoing randomized controlled trials are yet to confirm the clinical benefits of this type of treatment,[4,5] decisions in current clinical practice are facilitated by the establishment of multidisciplinary PERTs, which combine local expertise and optimize resource allocation in each hospital.[3,8] On the other hand, in Germany, integration of CDT procedures into the diagnosis-related groups–based hospital reimbursement system occurred only recently, and thus the use of CDT in this country has just begun to enter an early growth phase.

METHODS AND RESULTS

We analyzed the past trends of CDT use in the United States and used them as the basis for estimating the future (2025-2030) rate of CDT penetration and PE hospitalization costs in the German health care system.[9] For this purpose, we built two statistical models to generate an upper and a lower estimate of monthly CDT use in patients with intermediate- and high-risk PE. The first model used data from United States hospitals that developed an early expertise in CDT and were thus expected to yield the upper estimate. These data were

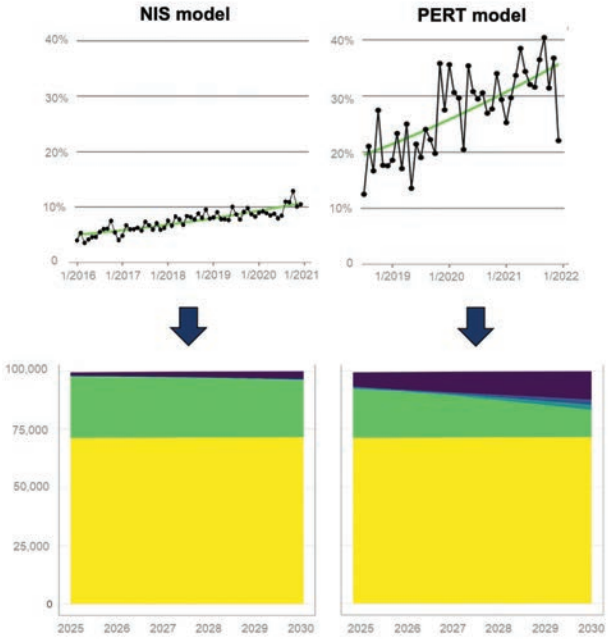

Figure 1. Trends in the use of CDT in the United States and the corresponding number of patients with PE estimated to receive CDT in Germany in 2025-2030. The left panels show the results of the conservative, NIS-based model, and the right panels the model based on The PERT Consortium™ Registry. In the upper panels, connected black dots represent observed monthly proportions; green lines show modeled proportions. In the lower panels, the blue zone indicates annual numbers of patients with intermediate-high– or high-risk PE forecast to receive CDT in Germany depending on each model, with different shades of blue exhibiting the 95% CI of the estimate. The green zone shows the remaining patients in this risk category expected to continue to be treated conservatively. Finally, the lower, yellow zone represents the numbers of patients with low- or intermediate-low–risk PE, in whom anticoagulation alone is, and will remain adequate treatment, with no need for CDT. Adapted from Mohr K, Keeling B, Kaier K, et al. Modelling costs of interventional pulmonary embolism treatment: implications of US trends for a European healthcare system. Eur Heart J Acute Cardiovasc Care. Published online February 13, 2024.

obtained from The United States PERT Consortium™ Quality Assurance Database registry, spanning from 2018 to 2021. Intermediate- or high-risk PE was defined based on current European guidelines[2]; in cases in which no explicit risk classification by the PERT was recorded,

patients were classified into one of the above PE risk categories if one or more of the following criteria were fulfilled: hemodynamic collapse or need for vasopressors; simplified Pulmonary Embolism Severity Index ≥ 1; elevated troponin or natriuretic peptide levels; elevated RV/LV (right ventricular/left ventricular) diameter ratio on the CTA; and echocardiographic signs of RV pressure overload or dysfunction. Our second model was based on data from the National Inpatient Sample (NIS) from 2016 to 2020. This database represents an unselected sample of all United States hospital admissions and was thus suitable for yielding the lower estimate of CDT use. We calculated the time trend using a binomial (logistic) model with calendar month as a continuous explanatory variable. Indeed, and as shown in by comparing the two upper panels in Figure 1,[9] the PERT-based model displayed both higher absolute penetration of CDT and faster growth of CDT use over time compared to the NIS model.

Subsequently, we obtained the annual incidence of hospitalizations for PE from the German Federal Statistical Office for the most recent years available (2016-2020),[10] along with the Office's publicly available forecast for the entire German population size in a scenario with moderate development of natality, life expectancy, and immigration for 2025-2030. By applying the United States PERT and NIS model to the predicted number of high- and intermediate-high–risk PE cases in Germany for this future period, we could provide a high and a low estimate for the expected CDT penetration in Germany in the following years (Figure 1; compare left with right lower panel). This allowed us to predict a cumulative increase of total hospitalization costs for PE ranging 3.8% to 12.4% until the end of 2030.

CONCLUSION

Our estimates do not take into account possible future changes in CDT reimbursement in Germany, which are extremely difficult to predict at this early stage. Moreover, increases in direct costs may be offset by cost savings related to the reported and anticipated benefits of CDT in terms of reducing early adverse outcomes (mostly major bleeding), a shorter stay in the intensive care unit, earlier discharge from the hospital, return to work and productivity, and prevention of late PE complications such as chronic thromboembolic pulmonary disease

and the broader spectrum of the so-called post-PE syndrome.[11-13] Ongoing prospective randomized trials with a focus on both early and late clinical outcomes[4,14] will inform not only the recommendations of future guidelines on the indications of CDT but also the decisions of policymakers in further countries regarding its reimbursement and broader availability. ■

1. Giri J, Sista AK, Weinberg I, et al. Interventional therapies for acute pulmonary embolism: current status and principles for the development of novel evidence: a scientific statement from the American Heart Association. Circulation. 2019;140:e774-e801. doi: 10.1161/CIR.0000000000000707
2. Konstantinides SV, Meyer G, Becattini C, et al. 2019 ESC guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). Eur Heart J. 2020;41:543-603. doi: 10.1093/eurheartj/ehz405
3. Kobayashi T, Pugliese S, Sethi SS, et al. Contemporary management and outcomes of patients with high-risk pulmonary embolism. J Am Coll Cardiol. 2024;83:35-43. doi: 10.1016/j.jacc.2023.10.026
4. Gotzinger F, Lauder L, Sharp ASP, et al. Interventional therapies for pulmonary embolism. Nat Rev Cardiol. 2023;20:670-684. doi: 10.1038/s41569-023-00876-0
5. Pruszczyk P, Klok FA, Kucher N, et al. Percutaneous treatment options for acute pulmonary embolism: a clinical consensus statement by the ESC Working Group on Pulmonary Circulation and Right Ventricular Function and the European Association of Percutaneous Cardiovascular Interventions. EuroIntervention. 2022;18:e623-e638. doi: 10.4244/EIJ-D-22-00246
6. Raghupathy S, Barigidad AP, Doorgen R, et al. Prevalence, trends, and outcomes of pulmonary embolism treated with mechanical and surgical thrombectomy from a nationwide inpatient sample. Clin Pract. 2022;12:204-214. doi: 10.3390/clinpract12020024
7. Abumoawad A, Shatla I, Behrooz L, et al. Temporal trends in the utilization of advanced therapies among patients with acute pulmonary embolism: insights from a national database. Eur Heart J Acute Cardiovasc Care. 2023;12:711-713. doi: 10.1093/ehjacc/zuad092
8. Rosovsky R, Chang Y, Rosenfield K, et al. Changes in treatment and outcomes after creation of a pulmonary embolism response team (PERT), a 10-year analysis. J Thromb Thrombolysis. 2019;47:31-40. doi: 10.1007/s11239-018-1737-8
9. Mohr K, Keeling B, Kaier K, et al. Modelling costs of interventional pulmonary embolism treatment: implications of US trends for a European healthcare system. Eur Heart J Acute Cardiovasc Care. Published online February 13, 2024. doi: 10.1093/ehjacc/zuae019
10. Mohr K, Hobohm L, Kaier K, et al. Drivers and recent trends of hospitalisation costs related to acute pulmonary embolism. Clin Res Cardiol. Published online April 2, 2024. doi: 10.1007/s00392-024-02437-y
11. Pasha AK, Siddiqui MU, Siddiqui MD, et al. Catheter directed compared to systemically delivered thrombolysis for pulmonary embolism: a systematic review and meta-analysis. J Thromb Thrombolysis. 2022;53:454-466. doi: 10.1007/s11239-021-02556-7
12. Sullivan AE, Holder T, Truong T, et al. Use of hospital resources in the care of patients with intermediate risk pulmonary embolism. Eur Heart J Acute Cardiovasc Care. Published online November 27, 2020. doi: 10.1177/2048872620921601
13. Klok FA, Ageno W, Ay C, et al. Optimal follow-up after acute pulmonary embolism: a position paper of the European Society of Cardiology Working Group on Pulmonary Circulation and Right Ventricular Function, in collaboration with the European Society of Cardiology Working Group on Atherosclerosis and Vascular Biology, endorsed by the European Respiratory Society. Eur Heart J. 2022;43:183-189. doi: 10.1093/eurheartj/ehab816
14. Klok FA, Piazza G, Sharp ASP, et al. Ultrasound-facilitated, catheter-directed thrombolysis vs anticoagulation alone for acute intermediate-high-risk pulmonary embolism: Rationale and design of the HI-PEITHO study. Am Heart J. 2022;251:43-53. doi: 10.1016/j.ahj.2022.05.011

Enhancing Pulmonary Embolism Treatment: Insights From the APEX-AV Study on the AlphaVac F18[85] Catheter

A summary of the study's findings and their implications on managing patients with acute intermediate-risk PE.

By Brent Keeling, MD; Mona Ranade, MD; and Seth Sokol, MD

Pulmonary embolism (PE) poses significant challenges in clinical management, necessitating innovative approaches for effective treatment. Endovascular interventions have emerged as promising strategies for selected patients, and the AlphaVac multipurpose mechanical aspiration (MMA) F18[85] system (AngioDynamics, Inc.) represents a novel addition to this armamentarium. The APEX-AV study was pivotal in evaluating the safety and efficacy of the AlphaVac MMA F18[85] catheter system in patients with acute intermediate-risk PE, shedding light on its potential role in improving patient outcomes.

STUDY DESIGN AND OBJECTIVES

The APEX-AV study (NCT05318092), a single-arm, prospective, multicenter investigational device exemption trial, aimed to assess the safety and effectiveness of the AlphaVac MMA F18[85] system in patients with acute intermediate-risk PE. The primary effectiveness endpoint focused on the reduction in right ventricular/left ventricular (RV/LV) ratio within 48 hours postprocedure compared to a predefined performance goal based on literature data. Safety endpoints included major adverse events (MAEs) within 48 hours, with comparisons to established benchmarks. Secondary endpoints encompassed various clinical parameters and outcomes related to safety and effectiveness, providing a comprehensive assessment of the device's performance.

RESULTS

The APEX-AV study enrolled 122 patients across 25 United States clinical sites, meeting inclusion criteria consistent with acute intermediate-risk PE. A significant reduction of 0.45 in RV/LV ratio (the primary effectiveness endpoint) was demonstrated, surpassing the predefined performance goal ($P < .001$). Additionally, the mean intensive care unit and overall hospital stays were 1.4 and 5.2 days, respectively, indicative of favorable postprocedural recovery. Furthermore, there was a notable 35.5% reduction in clot burden, as measured by the modified Miller Index, within 48 hours postprocedure. Notably, the study revealed a statistically significant decrease in mean pulmonary artery pressure pre- to postprocedure ($P < .001$), particularly notable in patients with pulmonary hypertension.[1]

In terms of safety, the analysis of the primary endpoint demonstrated a MAE rate of 4.1% within 48 hours, significantly lower than the predefined performance goal ($P < .001$). MAEs observed were consistent with expectations for the patient population, with no reported deaths during the study period. Noteworthy MAEs included five major bleeding events, one instance of clinical deterioration, and one pulmonary vascular injury.[1] These findings underscored the extremely favorable safety profile of the AlphaVac MMA F18[85] system in treating acute intermediate-risk PE.

CONCLUSION

The APEX-AV study substantiated the safety and efficacy of the AlphaVac MMA F18[85] system in patients with acute intermediate-risk PE. By achieving significant reductions in RV/LV ratio and clot burden while demonstrating a favorable safety profile, this endovascular approach presents a minimally invasive alternative for PE management. The volume of clot removed may be superior to competing thrombectomy devices. The study outcomes support the integration of the AlphaVac F18[85] catheter into clinical practice, offering potential benefits in improving patient outcomes and enhancing the therapeutic armamentarium for PE treatment. ■

1. Keeling B. Evaluating the safety and efficacy of the AlphaVac F1885 system in acute intermediate-risk PE patients: APEX-AV trial. Presented at the Society for Cardiovascular Angiography & Interventions (SCAI) 2024 scientific sessions; May 2-4, 2024; Long Beach, California.

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Post–Pulmonary Embolism Care

From short-term to long-term management.

By Akhil Khosla, MD; Bushra Mina, MD; and Maanasi Samant, MD

Acute pulmonary embolism (PE) remains the third leading cause of cardiovascular deaths in the United States. Each year, there is an estimated 900,000 cases of venous thromboembolism (VTE) as well as 150,000 to 250,000 PE-related hospitalizations per year in the United States.[1] Recently, there has been increasing efforts to prevent, diagnose, and treat PE with a focus on the acute management of PE including risk stratification, anticoagulation (AC) strategies, and advanced therapy options during initial hospitalization.[2] There is less guidance on the management of patients in the outpatient setting after hospitalization for acute PE. Post-PE evaluation requires multiple facets and may require subspecialty evaluation. For example, AC type, duration, and tolerance; post-PE dyspnea and impairment; etiology of PE; management of concomitant deep vein thrombosis; lifestyle modifications; quality of life (QoL); and mental health all need to be considered. This article reviews considerations for post-PE care during outpatient follow-up within the first month of diagnosis, care between the 3- to 6-month period, and reviews screening for chronic thromboembolic disease (CTED) and chronic thromboembolic pulmonary hypertension (CTEPH).

FOLLOW-UP IN THE FIRST MONTH

Early follow-up visits within the first 3 to 7 days postdischarge are essential to assess the patient's clinical status, adherence to therapy, any new or ongoing symptoms, ensuring patient safety, and managing potential complications. This approach is associated with low rates of 30-day adverse events, indicating that early follow-up is crucial.[3] Follow-up clinics specifically for PE patients provide a structured environment for monitoring and managing ongoing care. These clinics ensure that patients receive the necessary medical evaluations, adjustments to AC therapy, and other supportive measures.[4] Educating patients about the signs and symptoms of PE recurrence (sudden shortness of breath, chest pain, or leg swelling), the importance of medication adherence, and lifestyle changes is vital. Providing psychological support and addressing anxiety related to the risk of recurrence is also important.[5] Additionally, direct oral anticoagulants improved patient compliance and reduced the need for hospital readmissions.[6]

Assessing the QoL in patients after a PE is crucial for understanding the long-term impacts of the condition and for improving patient care. Several studies have developed and validated tools specifically for this purpose, such as the Pulmonary Embolism QoL (PEmb-QoL) questionnaire. Patients with a history of acute PE often experience impaired QoL, with scores significantly lower than the general population across several dimensions, including physical functioning, social functioning, and vitality. The PEmb-QoL questionnaire provides valuable insights and has been validated across different cultures.[7]

Biomarker monitoring (eg, D-dimer levels) can also help predict recurrence and guide ongoing treatment decisions.[8] N-terminal pro-brain natriuretic peptide is essential in accessing resolution of cardiac strain and may guide decisions on continued AC and heart failure management.[9] During follow-up, the etiology of the PE should be considered and certain patients may meet criteria for thrombophilia workup. The American Society of Hematology published guidelines on the management of thrombophilia testing, which may help clinicians determine when to order or refer for thrombophilia testing.[10]

FOLLOW-UP WITHIN 3 TO 6 MONTHS

Patients who follow up after 3 to 6 months should be evaluated for possible AC discontinuation if presenting after provoked PE.[11] Candidates for long-term AC should have their bleeding risk assessed. This can be done using clinical gestalt and validated bleeding risk prediction scores. Ultimate decisions on duration of AC should also include shared patient decision-making.[12] Regardless of proposed duration, it is important to assess bleeding risk and tolerance of anticoagulant therapy at every follow-up visit.[13] Patients who had an inferior vena cava filter placed as part of their treatment should be assessed for timely removal if able to tolerate AC or the patient is no longer at risk for additional PE.[12]

Patients should also be evaluated for persistent symptoms.[1] These symptoms can range from cardiopulmonary complaints, exercise intolerance, and

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cognitive and psychological complaints.[14] There are several screening algorithms that can be employed to help evaluate the symptomatic patient post-PE. The goal of these step-wise approaches is to identify whether symptoms are secondary to residual thrombus burden or an alternate etiology.[13,15,16] These patients should receive further imaging studies to assess for presence of residual PE using ventilation/perfusion (V/Q) scanning.[17] Other modalities such as single-photon emission CT (SPECT) can also be considered.[18] CT pulmonary angiography (CTPA) can also be used to evaluate for the presence of chronic thrombi (though distal lesions may be missed), signs of pulmonary hypertension, and assessment of the lung parenchyma.[19,20] Transthoracic echocardiography (TTE) is also a useful tool to assess for the presence of right ventricular (RV) dysfunction, pulmonary hypertension, or additional cardiac pathology (ie, diastolic dysfunction, cardiomyopathy, valvular disease).[21] Cardiopulmonary exercise testing (CPET) can also be used to distinguish between persistent functional limitations secondary to persistent PE versus another comorbidity. Although useful, this tool is not as widely available and requires expertise in interpretation.[22] Six-minute walk testing could be easily employed to assess functional status and heart rate recovery.[23]

PE survivors can have persistent symptoms for multiple reasons.[12] Additionally, assessment can be difficult in the presence of comorbidities such as chronic obstructive pulmonary disease, heart failure, arrhythmia, valvular heart disease, malignancy, age, and deconditioning.[24] When evaluating for these alternate etiologies of dyspnea, additional testing that may be helpful includes laboratory work (such as assessing for anemia and thyroid disease), pulmonary function testing, and radiographic assessment for parenchymal lung disease. AC is generally continued until these investigations are completed.

Treatment of the symptomatic patient post-PE should focus on optimization of previously known or newly diagnosed comorbidities and referral for assessment of possible CTED or CTEPH. Providing psychological/mental health support and enrollment in pulmonary or cardiac rehab would likely also be useful.[12]

Screening for CTED and CTEPH

Post-PE impairment (PPEI) is defined as new or persistent dyspnea, exercise limitation, or impaired functional status 3 months after appropriate AC use from the time of diagnosis of initial PE.[25] CTED and CTEPH are subtypes of PPEI that require screening to make a formal diagnosis. Early screening, diagnosis, and referral to centers who specialize in CTED and CTEPH is imperative, as treatment strategies can improve underlying pulmonary hypertension, morbidity, and mortality.[26] The diagnosis of PPEI is traditionally made after 3 to 6 months of effective AC to allow for thrombi to resolve with initial therapies.[27,28] Exceptions to waiting for 3 months post-PE include if there are radiographic features of CTED or CTEPH at the time of initial diagnosis, significantly elevated pulmonary pressures (estimated systolic pulmonary artery pressure [PAP] > 60 mm Hg) or RV wall hypertrophy.[20,29] PPEI is thought to represent a spectrum of disease with increasing severity from post-PE syndrome (PPES) to CTED to CTEPH (Figure 1). The true incidence of PPES, CTED, and CTEPH remains difficult to determine,

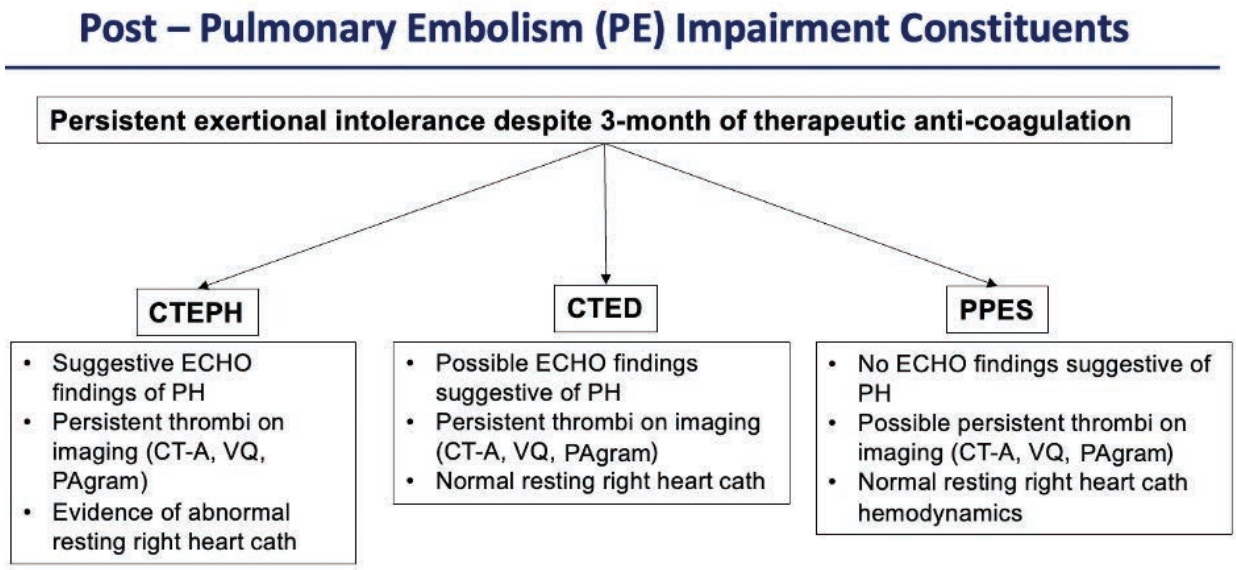

Figure 1. Diagnostic criteria for CTEPH, CTED, and PPES.

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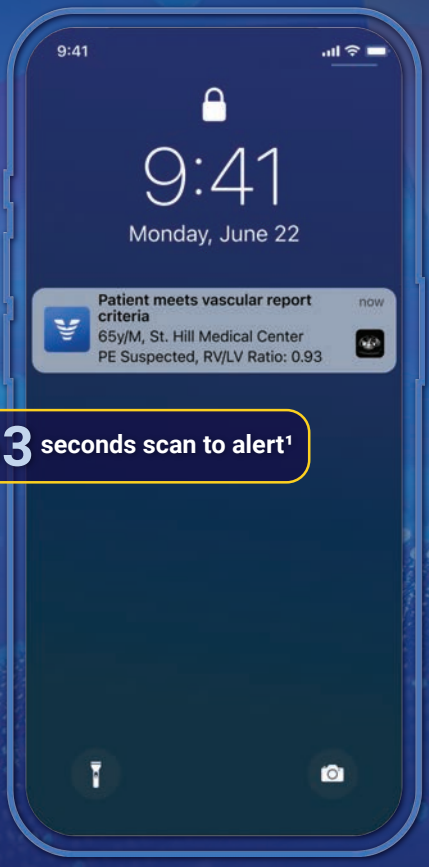

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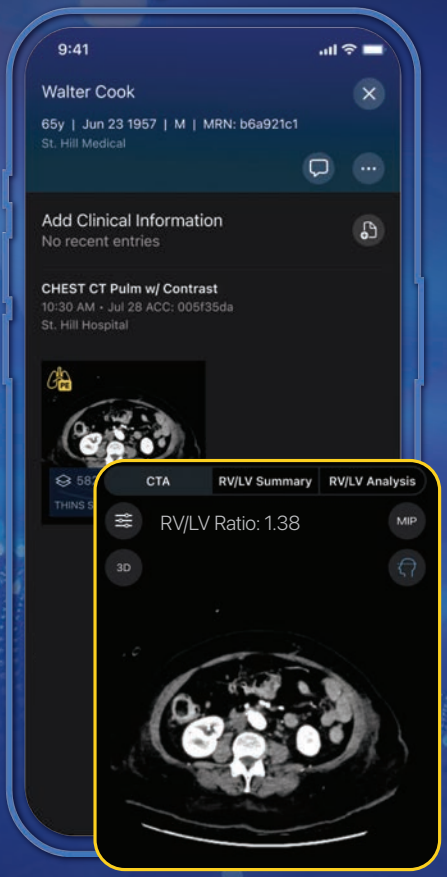

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[1] FDA Letter K210237 mean time-to-notification for PE with a mean of 63 seconds and a max time of 122 seconds.
[2] Shapiro, J., Reichard, A. and Muck, P.E. (2024) 'New Diagnostic Tools for Pulmonary Embolism Detection', Methodist DeBakey Cardiovascular Journal, 20(3), p. 5-12. Available at: https://doi.org/10.14797/mdcvj.1342

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but prior studies have indicated approximately 50% of patients will have exercise limitation at 1 year that adversely influences their QoL.[22]

The diagnosis and treatment for PPEI can be complex, and treatment is best carried out at centers specialized in the management of PPEI.[26] Dedicated screening for PPEI should be performed to identify patients who may benefit from referral to specialized centers for ongoing treatment management. Treatment options for PPEI continue to evolve and can lead to improvements in morbidity and mortality. Treatment options for CTED and CTEPH include targeted medications aimed at lowering pulmonary pressures, procedures to remove or reduce residual thrombi such as balloon pulmonary angioplasty (BPA) and pulmonary thromboendarterectomy (PTE). The choice of treatment is determined based on a combination of thrombi location, burden, accessibility, and operable candidacy. The definitive treatment for CTED and CTEPH is PTE; however, patients who are not surgical candidates may be treated with BPA and/or medical therapies. Therapy should include a multimodal approach, as some patients may require a combination of advanced treatment options to manage their disease process.[26]

There is currently limited consensus on screening guidelines for PPEI. Screening should focus on the following areas: presence of symptoms, evidence of abnormal pulmonary hemodynamics, and evidence of residual pulmonary vascular obstruction (RPVO). Figure 1 reviews the diagnostic criteria of CTEPH, CTED, and PPES. Criteria for diagnosis of CTEPH include symptoms with evidence of RPVO in the setting of resting pulmonary hypertension (elevated mean PAP > 20 mm Hg, pulmonary capillary wedge pressure < 15 mm Hg, and pulmonary vascular resistance [PVR] > 2 woods units), whereas the criteria for CTED include symptoms as well as findings of RPVO with pulmonary pressures that do not clearly meet the diagnosis of resting pulmonary hypertension but may have abnormal cardiopulmonary response during exercise.[26] PPES manifests as ongoing symptoms in patients who may or may not have RPVO but no evidence of resting or exercise pulmonary hypertension.

There are multiple ways to identify the presence and severity of symptoms in a post-PE patient as noted previously. Additional workup is required to determine if ongoing symptoms are primarily due to sequelae of PE or are secondary to other potential etiologies such as heart failure, chronic obstructive pulmonary disease, obesity, deconditioning, and interstitial lung disease (ILD). Patients whose symptoms are thought to be related to PPEI should undergo testing to evaluate for abnormal pulmonary hemodynamics. Abnormal pulmonary hemodynamics may be suggested by several tests such as CPET, including submaximal CPET, conventional CPET, and invasive CPET (ICPET). ICPET is considered the gold standard in diagnosis of dyspnea and offers additional advantages over other exercise testing because it can determine cardiac filling pressures, PAPs, and cardiac output during exertion.[30] Abnormal exercise testing parameters such as increased dead-space, decreased stroke volume, and increased PVR/decreased PA compliance are suggestive of CTED and CTEPH.[30]

A number of studies can be completed to detect RPVO. Historically, V/Q scans (planar or SPECT) and CTPA have been the tests of choice to determine if residual disease is present. V/Q imaging is more sensitive in identifying obstructions at the segmental and subsegmental levels compared to CTPA.[31] CTPA has the benefit of identifying other findings that may be suggestive of CTEPH (ie, web-like defects, bands, pouch defects, bronchial artery hypertrophy, and heterogeneous lung parenchyma) as well as rule out other etiologies of pulmonary disease (ie, emphysema, ILD, bronchiectasis).[32] Other imaging studies such as cardiac MRI and dual-energy CTPA are emerging as testing modalities to help identify findings suggestive of RPVO and CTEPH.[31] Digital subtraction angiography can be used to confirm findings of V/Q and/or CTPA and allows one to determine potential treatment targets for patients undergoing consideration for BPA or PTE. Given that this testing is invasive, it should be reserved for those centers who specialize in the diagnosis and management of CTED and CTEPH.

Right heart catheterization (RHC) is completed to confirm the presence and degree of underlying pulmonary hypertension. RHC can differentiate CTEPH and CTED based on the presence of underlying resting pulmonary hypertension (CTEPH) versus normal resting pulmonary hemodynamics with abnormal exercise pulmonary hemodynamics (CTED).[15] RHC should be completed at experienced centers or those who specialize in pulmonary hypertension management.[26] TTE can be a helpful adjunct to assess RV function and other cardiac pathology as noted previously.

Given the limited consensus on post-PE screening, it is reasonable to screen all patients who are symptomatic after 3 months of AC post-PE or those with high clinical suspicion of CTED/CTEPH for PPEI. Some centers have algorithms to assist in a standardized evaluation for post-PE patients. Morris et al recently published a stepwise approach to identify patients with CTED/CTEPH using the SEARCH (symptom screening, exercise testing, arterial perfusion, resting echocardiography, confirmatory chest imaging, and hemodynamics measured by RHC) criteria.[15] Post-PE patients who have clinical workup that is suggestive of post-PE impairment should be referred

to a center that specializes in post-PE care for further diagnosis and treatment.

CONCLUSION

Post-PE follow-up continues to evolve and the focus of care can change depending on the time frame from diagnosis. Follow-up should be completed within the first month after PE treatment to assess for appropriate AC, including adherence and complications, symptom burden, lifestyle modification, and psychological health. Follow-up within the 3- to 6-month period includes reviewing the care from the 1-month follow-up in addition to assessing for possible AC discontinuation, symptom burden, workup for alternative or concomitant etiologies of symptoms, and screening for PPEI. Screening for PPEI should be completed to evaluate the presence of ongoing symptoms, RPVO, and abnormal pulmonary hemodynamics. Patients with symptoms and workup concerning for CTED or CTEPH should be referred to a center that specializes in CTED/CTEPH for formal diagnosis and management. Given the complexity of post-PE care, dedicated post-PE clinics are emerging to help manage the care for these patients. Post-PE care continues to be an area of focus to help improve the morbidity and mortality associated with PE. ■

1. Heit JA, Spencer FA, White RH. The epidemiology of venous thromboembolism. J Thromb Thrombolysis. 2016;41:3-14. Published online January 19, 2016. doi: 10.1007/s11239-015-1311-6
2. Rivera-Lebron B, McDaniel M, Ahrar K, et al. Diagnosis, treatment and follow up of acute pulmonary embolism: consensus practice from the PERT Consortium. Clin Appl Thromb Hemost. Published online June 13, 2019. doi: 10.1177/1076029619853037
3. Vinson DR, Ballard DW, Huang J, et al. Timing of discharge follow-up for acute pulmonary embolism: retrospective cohort study. West J Emerg Med. 2015;16:55-61. doi: 10.5811/westjem.2014.12.23310
4. Rosovsky R, Borges J, Kabrhel C, Rosenfield K. Pulmonary embolism response team: inpatient structure, outpatient follow-up, and is it the current standard of care? Clin Chest Med. 2018;3:621-30. doi: 10.1016/j.ccm.2018.04.019
5. Frank Peacock W, Coleman CI, Diercks DB, et al. Emergency department discharge of pulmonary embolus patients. Acad Emerg Med. 2018;25:995-1003. doi: 10.1111/acem.13451
6. Singer AJ, Xiang J, Kabrhel C, et al. Multicenter trial of rivaroxaban for early discharge of pulmonary embolism from the emergency department (MERCURY PE): rationale and design. Acad Emerg Med. 2016;23:1280-1286. doi: 10.1111/acem.13072
7. Klok FA, Cohn DM, Middeldorp S, et al. Quality of life after pulmonary embolism: validation of the PEmb-QoL questionnaire. J Thromb Haemost. 2010;8:523-532. doi: 10.1111/j.1538-7836.2009.03726.x
8. Jen WY, Kristanto W, Teo L, et al. Assessing the impact of a pulmonary embolism response team and treatment protocol on patients presenting with acute pulmonary embolism. Heart Lung Circ. 2020;29:345-53. doi: 10.1016/j.hlc.2019.02.190
9. den Exter PL, Zondag W, Klok FA, et al. Efficacy and safety of outpatient treatment based on the hestia clinical decision rule with or without N-Terminal Pro-Brain natriuretic peptide testing in patients with acute pulmonary embolism. A randomized clinical trial. Am J Respir Crit Care Med. 2016;194:998-1006. doi: 10.1164/rccm.201512-2494OC
10. Middeldorp S, Nieuwlaat R, Baumann Kreuziger L, et al. American Society of Hematology 2023 guidelines for management of venous thromboembolism: thrombophilia testing. Blood Adv. 2023;7:7101-7138. doi: 10.1182/bloodadvances.2023010177
11. Stevens SM, Woller SC, Baumann Kreuziger L, et al. Executive summary: antithrombotic therapy for VTE disease: second update of the CHEST guideline and expert panel report. Chest. 2021;160:2247-59. doi: 10.1016/j.chest.2021.07.056

12. Klok FA, Ageno W, Ay C, et al. Optimal follow-up after acute pulmonary embolism: a position paper of the European Society of Cardiology Working Group on Pulmonary Circulation and Right Ventricular Function, in collaboration with the European Society of Cardiology Working Group on Atherosclerosis and Vascular Biology, endorsed by the European Respiratory Society. Eur Heart J. 2022;43:183-189. doi: 10.1093/eurheartj/ehab816
13. Konstantinides SV, Meyer G, Becattini C, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). Eur Heart J. 2020;41:543-603. doi: 10.1093/eurheartj/ehz405
14. Luijten D, de Jong CMM, Ninaber MK, et al. Post-pulmonary embolism syndrome and functional outcomes after acute pulmonary embolism. Semin Thromb Hemost. 2023;49:848-860. doi: 10.1055/s-0042-1749659
15. Morris TA, Fernandes TM, Channick RN. Evaluation of dyspnea and exercise intolerance after acute pulmonary embolism. Chest. 2023;163:933-941. doi: 10.1016/j.chest.2022.06.036
16. Rivera-Lebron B, McDaniel M, Ahrar K, et al. Diagnosis, treatment and follow up of acute pulmonary embolism: consensus practice from the PERT Consortium. Clin Appl Thromb Hemost. Published online June 13, 2019. doi: 10.1177/1076029619853037
17. Galiè N, Humbert M, Vachiery JL, et al. 2015 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension: the joint task force for the diagnosis and treatment of pulmonary hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS): endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC), International Society for Heart and Lung Transplantation (ISHLT). Eur Heart J. 2016;37:67-119. doi: 10.1093/eurheartj/ehv317
18. Ma RZ, Han PP, Tao XC, et al. A feasibility study on using single-photon emission computed tomography pulmonary perfusion/ventilation imaging for the diagnosis of chronic thromboembolic pulmonary hypertension and patient risk assessment. Int J Gen Med. 2021;14:8029-8038. doi: 10.2147/IJGM.S335051
19. Remy-Jardin M, Ryerson CJ, Schiebler ML, et al. Imaging of pulmonary hypertension in adults: a position paper from the Fleischner Society. Eur Respir J. 2021;57.2004455. doi: 10.1183/13993003.04455-2020
20. Boon G, Ende-Verhaar YM, Beenen LFM, et al. Prediction of chronic thromboembolic pulmonary hypertension with standardised evaluation of initial computed tomography pulmonary angiography performed for suspected acute pulmonary embolism. Eur Radiol. 2022;32:2178-2187. doi: 10.1007/s00330-021-08364-0
21. Dzikowska-Diduch O, Kostrubiec M, Kurnicka K, et al. "The post-pulmonary syndrome - results of echocardiographic driven follow up after acute pulmonary embolism". Thromb Res. 2020;186:30-35. doi: 10.1016/j.thromres.2019.12.008
22. Kahn SR, Hirsch AM, Akaberi A, et al. Functional and exercise limitations after a first episode of pulmonary embolism: results of the ELOPE prospective cohort study. Chest. 2017;151:1058-1068. doi: 10.1016/j.chest.2016.11.030
23. Danielsbacka JS, Hansson PO, Mannerkorpi K, Olsen MF. Physical activity and respiratory symptoms after pulmonary embolism. A longitudinal observational study. Thromb Res. 2020;189:55-60. doi: 10.1016/j.thromres.2020.02.014
24. Mameli A, Palmas MA, Antonelli A, et al. A retrospective cohort study of patients with pulmonary embolism: the impact of comorbidities on patient's outcome. Eur Respir J. 2016;48:555-557. doi: 10.1183/13993003.02193-2015
25. Pugliese SC, Kawut SM. The post-pulmonary embolism syndrome: real or ruse? Ann Am Thorac Soc. 2019;16:811-814. doi: 10.1513/AnnalsATS.201901-061PS
26. Humbert M, Kovacs G, Hoeper MM, et al. 2022 ESC/ERS guidelines for the diagnosis and treatment of pulmonary hypertension. Eur Respir J. 2022;61:2200879. doi: 10.1183/13993003.00879-2022
27. Nijkeuter M, Hovens MMC, Davidson BL, Huisman MV. Resolution of thromboemboli in patients with acute pulmonary embolism: a systematic review. Chest. 2006;129:192-197. doi: 10.1378/chest.129.1.192
28. Humbert M, Kovacs G, Hoeper MM, et al. 2022 ESC/ERS guidelines for the diagnosis and treatment of pulmonary hypertension. Eur Heart J. 2022;43:3618-3731. doi: 10.1093/eurheartj/ehac237
29. Barco S, Mavromanoli AC, Kreitner KF, et al. Preexisting chronic thromboembolic pulmonary hypertension in acute pulmonary embolism. Chest. 2023;163:923-932. doi: 10.1016/j.chest.2022.11.045
30. Jain CC, Borlaug BA. Performance and interpretation of invasive hemodynamic exercise testing. Chest. 2020;158:2119-2129. doi: 10.1016/j.chest.2020.05.552
31. Wang M, Wu D, Ma R, et al. Comparison of V/Q SPECT and CT angiography for the diagnosis of chronic thromboembolic pulmonary hypertension. Radiology. 2020;296:420-429. Epub 2020/05/20. doi: 10.1148/radiol.2020192181. PubMed PMID: 32427559.
32. Grosse A, Grosse C, Lang IM. Distinguishing chronic thromboembolic pulmonary hypertension from other causes of pulmonary hypertension using CT. AJR Am J Roentgenol. 2017;209:1228-1238. doi: 10.2214/AJR.17.17871

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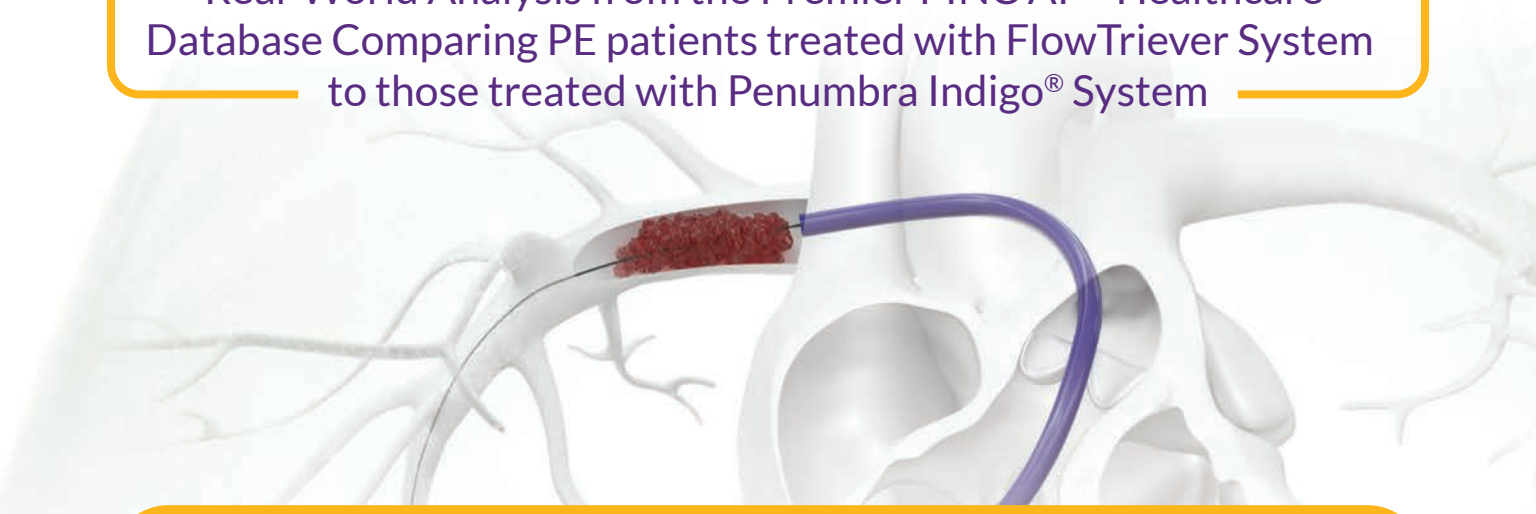

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STUDY BACKGROUND

7,000+ real-world interventional PE patients treated with FlowTriever or Penumbra Indigo were analyzed using a national all-payer database. Patients treated between January 2018 and June 2023. Results were adjusted for population differences.*

References:
1. Gandhi, RT, Gibson CM, and Jaber WA. "A cross-sectional study of outcomes for patients undergoing mechanical thrombectomy for pulmonary embolism during 2018–2022: Insights from the PINC AI Healthcare Database." Health Science Reports 7.4 (2024): e2031.
2. Abstract presented live at SIR 2024 by Gandhi, RT. "Comparison of Outcomes in Pulmonary Embolism Patients undergoing Mechanical Thrombectomy: Analysis from the PINC AI Healthcare Database." Updated with additional patients from March 2022 through June 2023

*Logistic regression models were adjusted for age, sex, ethnicity/race, chronic PE, COVID-19, cancer, obesity, peripheral vascular disease,chronic pulmonary disease, and sepsis. Hospital characteristics and point of origin assessed but found to have no impact on the included outcomes.

Indications for Use:
The FlowTriever® Retrieval/Aspiration System is indicated for (1) the non-surgical removal of emboli and thrombi from blood vessels and (2) the injection, infusion and/or aspiration of contrast media and other fluids into or from a blood vessel. The FlowTriever Retrieval/Aspiration System is intended for use in the peripheral vasculature and for the treatment of pulmonary embolism.

For indications for use of non-Inari products, please refer to the manufacturer.
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PERT International: Enhancing Patient Outcomes Globally

Establishing National PERT networks in Europe and around the world.

By Mona Ranade, MD; Mahir Elder, MD, FACC, FSCAI; and Stavros Konstantinides, MD

Pulmonary embolism (PE) is a life-threatening, acute cardiovascular disorder and remains a significant cause of morbidity and mortality worldwide.[1] The concept of the Pulmonary Embolism Response Team (PERT) aims at establishing a multidisciplinary, multispecialty team of experts involved in the care of acute PE at each hospital, with a clear focus on challenging, potentially life-threatening cases and clinical scenarios.[2] After a centralized activation process, the team convenes to provide rapid risk assessment of the patient with acute PE and reach consensus on the best individualized diagnostic and therapeutic approach, taking into account the expertise and resources available on site. This article aims to summarize the added clinical value of multidisciplinary PERTs and advocate for the establishment of National PERT networks in countries outside the United States, with the ultimate goal of building an international PERT community and collaboration.

A recent scoping review and meta-analysis suggested that PERT implementation may lead to greater use of advanced therapies and shorter in-hospital stay.[3] The authors reported that, when focusing on patients with "severe" intermediate- or high-risk PE, the effect estimates for mortality tended to be lower for patients treated in the PERT era compared to those treated before PERT implementation (risk ratio, 0.71; 95% CI, 0.45-1.12). In line with these findings, an observational cohort study in the United States reported an association between the implementation of a PERT and a sustained reduction (from 24% to 14%) in mortality at 6 months for patients with submassive (intermediate-high–risk) and massive (high-risk) PE.[4] Post-PERT patients received more efficient care, defined as reduced time from triage to diagnosis, from diagnosis to anticoagulation administration, and from triage to hospital admission. Post-PERT patients also had a reduced hospital length of stay (9.1 vs 6.5 days; $P = .07$).[4] Meanwhile, favorable trends in patients' outcomes in the PERT era compared to earlier, pre-PERT periods have also been reported from centers outside the United States.[5]

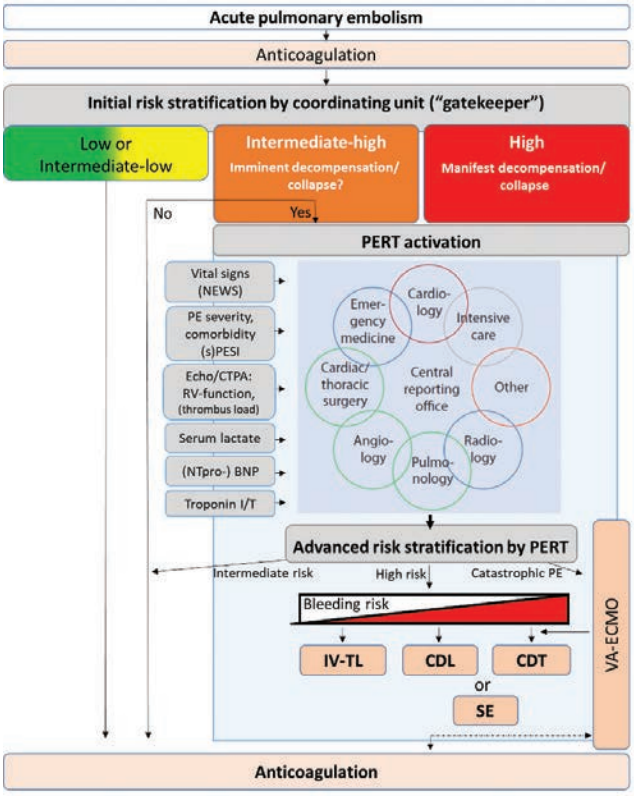

Figure 1. Proposal of the German Cardiac Society for the structure, activation, and decision-making criteria for multidisciplinary PERTs. These must be adjusted based on locally available expertise and resources. Reproduced with permission from: Ghanem A, Andrassy M, Dürschmied D, et al. Interventionelle Therapie und multidisziplinäre Managementstrategien für die akute Lungenembolie. Die Kardiologie. 2023;17:141-159. Published by Springer Medizin Verlag GmbH, a member of Springer Nature Group. CDL, catheter-directed lysis (fibrinolysis); CDT, catheter-directed thrombectomy; IV-TL, intravenous thrombolysis; LV, left ventricular; NEWS, National Early Warning Score; RV, right ventricular; SE, surgical embolectomy; sPESI, simplified Pulmonary Embolism Severity Index; VA-ECMO, venoarterial extracorporeal membrane oxygenation.

ADVANTAGES OF IMPLEMENTING NATIONAL AND INTERNATIONAL PERTs

Although the existing evidence does not yet directly "prove" a clear mortality benefit of PERTs for the prognosis of patients with acute PE, it has become clear that the implementation of a National PERT offers several compelling advantages in the management of PE. First, it promotes standardized care protocols and guidelines, ensuring consistency and quality across health care facilities nationwide. By leveraging the collective expertise of diverse specialists, including interventional cardiologists, radiologists, intensivists, pulmonologists, hematologists, and vascular surgeons, a National PERT can optimize resource utilization and streamline decision-making processes, particularly in cases of high-risk and intermediate-high–risk PE where time is of the essence.[6-8] Moreover, a National PERT fosters collaboration and knowledge exchange among health care professionals, facilitating ongoing education and training initiatives to enhance clinical proficiency in PE management. This collaborative model also promotes research and innovation, driving advancements in diagnostic techniques and therapeutic interventions.

Finally, a National PERT serves as a vital platform for data collection and analysis, enabling continuous quality improvement and benchmarking efforts to evaluate the efficacy of interventions and refine best practices in PE management. By harnessing real-world data and insights,[8] health care stakeholders can identify trends, address disparities, and implement targeted interventions to optimize patient outcomes and reduce the burden of PE-related morbidity and mortality nationwide.

The aim of PERT International is to disseminate knowledge gleaned from the formation of The National PERT Consortium™ and PERT database and allow for other countries to easily adapt the existing model and strategies to their own local environment. By advocating for the establishment of a PERT International, health care leaders can leverage interdisciplinary collaboration, standardized protocols, and data-driven strategies to enhance the quality and efficiency of PE care delivery at a global level.

FOSTERING INTERNATIONAL, MULTIDISCIPLINARY COLLABORATION: THE EUROPEAN PERSPECTIVE

In Europe, implementation of PERTs in hospitals began only recently,[5,9] but it is now progressing at an increasing pace and is strongly advocated in a recently published

consensus statement by working groups of the European Society of Cardiology (ESC).[6] At the national level, the German Cardiac Society has published a position paper on the interventional treatment and multidisciplinary management strategies for acute PE.[10] The Society acknowledged the fact that the availability of a growing number of innovative treatment options, notably catheter-directed pharmacomechanical fibrinolysis and mechanical thrombectomy, presents unprecedented opportunities for more effective and safer management of intermediate- and high-risk PE. At the same time, this innovation represents a major challenge for physicians involved in the treatment of PE in daily practice and is expected to have a major socioeconomic impact on health care systems. Accordingly, the question addressed in this consensus document was, among others, "How should a multidisciplinary PE team be structured at the local hospital level for acute situations, and what standardized processes should it use for its decisions and actions?"[10] The document provides information and guidance for clinical practice based on the existing evidence, and strongly supports the implementation of multidisciplinary, multispecialty PE teams with clear activation and decision-making protocols (Figure 1).

The German Society has further endorsed the initiation of PERT-DACH, a prospective, multicenter, German-Austrian-Swiss quality assurance database registry, with a concept and design analogous to that of the United States PERT Consortium™ Registry[11,12]; as of June 2024, funding has been secured and patient enrollment will commence shortly. Close collaboration with The PERT Consortium™ in the United States has been established, and a recent publication highlights how the United States experience with a National PERT can help generate models for the future impact of technologic innovations in PE treatment on European health care systems.[13]

Finally, and importantly, a new "EXPERT-PE" study group has been established within the Acute CardioVascular Care Association of the ESC.[14] Its objectives are to[15]:

- Create a European multidisciplinary network focused on care for the PE patient with hemodynamic or respiratory compromise
- Support the establishment of multidisciplinary teams of experts across Europe
- Identify and map existing hospital and national PERTs, surveying for local practice patterns
- Disseminate knowledge on the multimodality management of PE
- Define quality indicators and levels of care for EXPERT-PE teams
- Harmonize parameters (common data elements) for use in PE clinical practice and research
- Engage in advocacy activities

The overarching aim of the new study group, which maintains close transatlantic collaboration with The PERT Consortium™ in the United States, is thus to provide a prototype of multidisciplinary and quality assurance in the practice and science of PE management. It is expected that this guidance will, as a next step, be adapted and endorsed

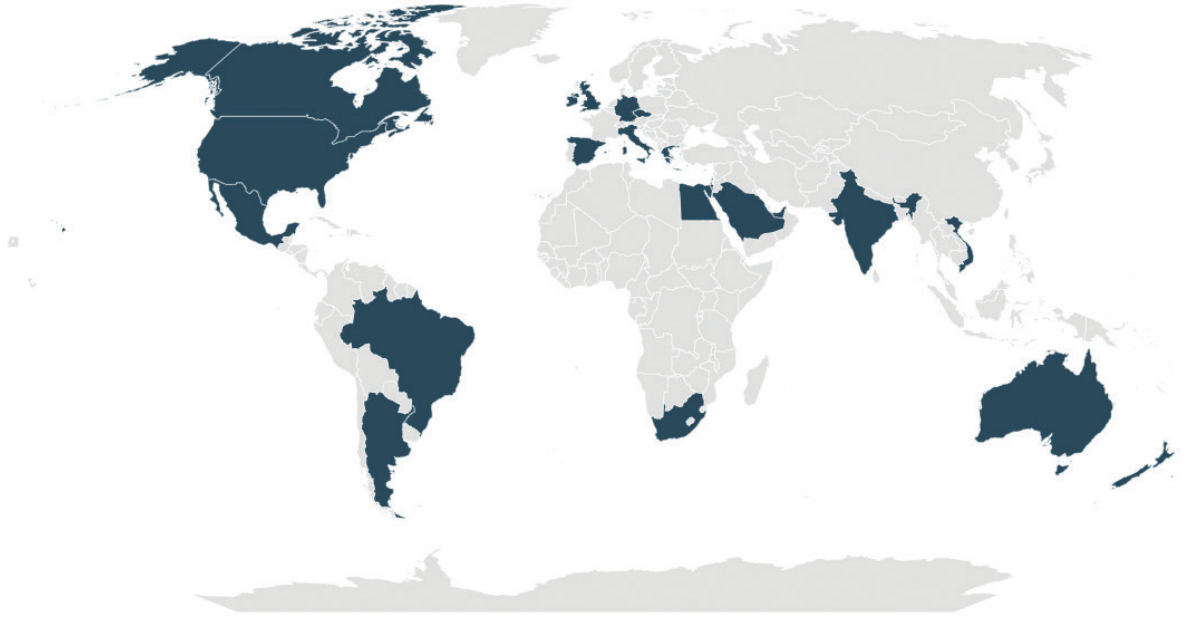

Figure 2. Countries that have expressed interest in a National PERT.

by the European, Central Asian, North African, and Middle East scientific societies comprising the ESC and promoted for implementation at each country's national level (Figure 2).

Several private groups/doctors from these regions have approached the leadership at The National PERT Consortium™ to see ways in which we can collaborate, share strategies, guide in creation of centers of excellence, and address international membership to the nonprofit organization. This is still an evolving process as the interest abroad increases and certainly an incredible opportunity for international collaboration. We are excited to see how this process unfolds in the next coming years and hopefully allows us to move the needle on mortality associated with this disease state. ■

1. Barco S, Valerio L, Ageno W, et al. Age-sex specific pulmonary embolism-related mortality in the USA and Canada, 2000-18: an analysis of the WHO Mortality Database and of the CDC Multiple Cause of Death database. Lancet Respir Med. 2021;9:33-42. doi: 10.1016/S2213-2600(20)30417-3
2. Porres-Aguilar M, Rosovsky RP, Rivera-Lebron BN, et al. Pulmonary embolism response teams: Changing the paradigm in the care for acute pulmonary embolism. J Thromb Haemost. 2022;20:2457-2464. doi: 10.1111/jth.15832
3. Hobohm L, Farmakis IT, Keller K, et al. Pulmonary embolism response team (PERT) implementation and its clinical value across countries: a scoping review and meta-analysis. Clin Res Cardiol. 2023;112:1351-1361. doi: 10.1007/s00392-022-02077-0
4. Wright C, Goldenberg I, Schleede S, et al. Effect of a multidisciplinary pulmonary embolism response team on patient mortality. Am J Cardiol. 2021;161:102-107. doi: 10.1016/j.amjcard.2021.08.066
5. Sagoschen I, Scibior B, Farmakis IT, et al. A multidisciplinary pulmonary embolism response team (PERT): first experience from a single center in Germany. Clin Res Cardiol. 2024;113:581-590. doi: 10.1007/s00392-023-02364-4
6. Pruszczyk P, Klok FA, Kucher N, et al. Percutaneous treatment options for acute pulmonary embolism: a clinical consensus statement by the ESC Working Group on Pulmonary Circulation and Right Ventricular Function and the European Association of Percutaneous Cardiovascular Interventions. EuroIntervention. 2022;18:e623-e638. doi: 10.4244/EIJ-D-22-00246
7. Giri J, Sista AK, Weinberg I, et al. Interventional therapies for acute pulmonary embolism: current status and principles for the development of novel evidence: a scientific statement from the American Heart Association. Circulation. 2019;140:e774-e801. doi: 10.1161/CIR.0000000000000707
8. Kobayashi T, Pugliese S, Sethi SS, et al. Contemporary management and outcomes of patients with high-risk pulmonary embolism. J Am Coll Cardiol. 2024;83:35-43. doi: 10.1016/j.jacc.2023.10.026
9. Araszkiewicz A, Kurzyna M, Kopec G, et al. Pulmonary embolism response team: A multidisciplinary approach to pulmonary embolism treatment. Polish PERT Initiative Report. Kardiol Pol. 2021;79:1311-1319. doi: 10.33963/KP.a2021.0130
10. Ghanem A, Andrassy M, Dürschmied D, et al. Interventionelle Therapie und multidisziplinäre Managementstrategien für die akute Lungenembolie. Die Kardiologie. 2023;17:141-159. https://doi.org/10.1007/s12181-023-00610-7
11. Rosovsky R, Chang Y, Rosenfield K, et al. Changes in treatment and outcomes after creation of a pulmonary embolism response team (PERT), a 10-year analysis. J Thromb Thrombolysis. 2019;47:31-40. doi: 10.1007/s11239-018-1737-8
12. Kabrhel C, Rosovsky R, Channick R, et al. A multidisciplinary pulmonary embolism response team: initial 30-month experience with a novel approach to delivery of care to patients with submassive and massive pulmonary embolism. Chest. 2016;150:384-393. doi: 10.1016/j.chest.2016.03.011
13. Mohr K, Keeling B, Kaier K, et al. Modelling costs of interventional pulmonary embolism treatment: implications of US Trends for a European healthcare system. Eur Heart J Acute Cardiovasc Care. Published online February 13, 2024. doi: 10.1093/ehjacc/zuae019
14. Pöss J, Ahrens I. The new acute cardiovascular care association study group EXPERT-PE on acute pulmonary embolism. Eur Heart J Acute Cardiovasc Care. 2023;12:411-412. doi: 10.1093/ehjacc/zuad046
15. European Society of Cardiology. ACVC Study Group EXPERT-PE on acute pulmonary embolism. https://www.escardio.org/Sub-specialty-communities/Association-for-Acute-CardioVascular-Care-(ACVC)/About/acvc-study-group-expert-pe-on-acute-pulmonary-embolism. Accessed June 16, 2024.

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The PERT Consortium™ Inaugural Trainee Council

A new era for trainee development in venous thromboembolism care.

By Kathryn McGregor, BA, BSE; Jamie Reed, BS, MS; James M. Horowitz, MD, FACC, FAHA, FCCP; and Frances Mae West, MD, MS, FACP

The National Pulmonary Embolism Response Team (PERT) Consortium™ is excited to announce the formation of its Inaugural Trainee Council, a landmark initiative designed to foster the growth and development of trainees within the field of venous thromboembolism (VTE) care and The Consortium™ itself. This Council aims to create a multidisciplinary platform where trainees can collaborate, share insights, and inform The Consortium™ on issues pertinent to their career development.

LAYING THE GROUNDWORK FOR SUCCESS

The Trainee Council's establishment marks a significant milestone in The PERT Consortium™'s ongoing mission to support and develop the next generation of VTE specialists. Out of a large and excellent applicant pool, six inaugural members were selected for the 2024 class. In 2025 the council will be expanded to 12 members. All members will serve 2-year terms, with staggered appointments between the classes to ensure continuity and the integration of fresh perspectives.

Council members will gain invaluable experience and guidance under the mentorship of faculty leaders from The PERT Consortium™. These faculty members will be diverse members of several active committees, including the Board of Directors. This mentorship is pivotal in nurturing emerging talent and ensuring a bright future for the field of VTE and The Consortium™.

The Trainee Council has several core goals and objectives designed to enrich the trainee experience and contribute to the broader mission of The PERT Consortium™, which include:

- **Educational Program Development:** Trainee Council members will collaborate with The Consortium™'s Executive and Committee leaders to develop resources and opportunities tailored specifically for trainees. This includes planning and executing educational events such as The Consortium™'s Physicians-in-Training Bootcamp, which takes place each year during the week of the Annual PE Scientific Symposium. Member input will be instrumental in guaranteeing that future iterations of the Bootcamp remain focused on the needs of physicians in training and include novel content each year. Trainees will also assist in the development of and participate in several PERT Webinars and PERTCast podcasts, specifically designing a webinar targeted to trainees. In addition to gaining planning experience, they will also have opportunities to be speakers during these educational events.
- **Trainee Engagement and Dissemination:** The Council will be instrumental in producing trainee-specific articles and announcements for The PERT Consortium™, ensuring that our current global trainee audience remains well-informed and engaged, while simultaneously growing the audience interested in VTE care and The Consortium™. Council members will also have an opportunity to engage trainees at The PERT Consortium™ Annual Meeting, encouraging participation in trainee-focused educational programs and in committee membership. Council members will also actively promote The Consortium™'s initiatives and events on social media, fostering a sense of community and collaboration. Through social media, Trainee Council members will continue to engage the medical community throughout the year.
- **Promoting Diversity and Inclusion:** A steadfast commitment to fostering an environment of diversity, equity, and inclusion is paramount. The Council aims to recruit members who are diverse in terms of ethnicity, gender, geographic location, and specialty. We believe that by creating an inclusive environment we will be able to meet the needs of many trainees interested in venous thromboembolic disease across specialties and countries. The Council will work to uphold these values within its operations and among the broader trainee membership.

- **Program Management and Professional Development:** By organizing the Physicians-in-Training Bootcamp, PERT Webinars and PERTCast Podcasts, the Council will gain valuable leadership, networking, communication, resource utilization, and time management skills. Trainee Council events will be supervised by PERT Consortium™ faculty members who have expertise in these domains and will provide mentorship to Council members. These skills will not only prove useful to escalate to faculty leadership positions with The PERT Consortium™ but also within their home institutions, hospitals, and clinical departments. By creating an inclusive environment, trainees will gain experience in cultural responsiveness and fostering equitable opportunities for all trainee members.
- **Committee Service:** Trainees will also be appointed to full membership on various active PERT Committees, acting as liaisons to represent trainee needs and perspectives, as well as the goals of the Trainee Council. We have no doubt that their insight will provide unique and invaluable feedback to each PERT Committee. Committee work will again afford trainees the opportunity to network with PE experts and faculty leaders within The PERT Consortium™. Trainees will become the common link for several programs that intersect committees, such as PERT Webinars which are a joint venture between the Education and Communications committees, among others.
- **Research:** With a focus on diversity-centered research, trainees will work under the mentorship of PERT Consortium™ leadership faculty. Council members will develop a hypothesis and clinical question that focus on the following issues: outcomes disparities of patients from underrepresented and minority populations, social determinants of health, accessibility to advanced PE therapies, and diversity among PE care providers.

RECRUITMENT AND SELECTION OF THE INAUGURAL PERT CONSORTIUM™ TRAINEE COUNCIL

Trainees with a strong interest in VTE who exhibit leadership qualities, organizational skills, and are role models for their peers are encouraged to apply. Eligible applicants must be entering or continuing in a fellowship training program through the forthcoming academic year. Medical students and PhD students with a strong interest or a research focus in VTE are encouraged to apply. To ensure accountability, Trainee Council candidates will be asked to provide a letter of recommendation from their program director, research, or clinical mentor.

INAUGURAL PERT CONSORTIUM™ TRAINEE COUNCIL MEMBERS

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Mayo Clinic

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Pulmonary and Critical Care Fellow
University of Vermont Medical Center

Lynden Lee, MD
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Eligible training programs include but are not limited to: anesthesia, cardiovascular disease, cardiothoracic surgery, critical care medicine, emergency medicine, hematology, hospital medicine, internal medicine, interventional cardiology, interventional radiology, medical students, pediatrics and subspecialities, PhD students, postdoctoral fellows, pharmacy students and residents, pulmonary disease, radiology, surgery, vascular medicine, and vascular surgery.

The selection process involves a thorough review of the candidates' application and an interview with two members of the Board of Directors or a faculty leader within The PERT Consortium™. After this rigorous process, six candidates were selected as the Inaugural PERT Consortium™ Trainee Council Members (see Sidebar).

The Council members have already completed their orientation and gotten to work! After preliminary monthly meetings this spring and summer, they will meet in person at The PERT Consortium™ Annual Scientific Symposium in September in Boston, Massachusetts. At this meeting, they will vote on a Council Chair and

focus on creating an outline of additional objectives for the year. They will also begin work on their research proposals along with ideas for PERT Webinars and PERTCast podcasts.

EMPOWERING THE NEXT GENERATION AND LOOKING FORWARD

The creation of the Trainee Council is a testament to The PERT Consortium™'s commitment to empowering the next generation of VTE specialists. Council members will have the opportunity to network with peers, committee members, and executive leadership, deepening their understanding of VTE and the field's ongoing scientific advancements.

Establishing the Trainee Council is pivotal in nurturing emerging talent and driving innovation in VTE care. As the Council grows and evolves, it will continue to be a cornerstone of trainee development, ensuring excellence and advancement in VTE research and treatment.

We are excited for our inaugural Trainee Council members and are excited for the anticipated growth of the program to the full complement of twelve members in 2025. We are confident that these trainees will one day be leaders of the field and within The PERT Consortium™. ■

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