Pulmonary embolism response team: A multidisciplinary approach to pulmonary embolism treatment. Polish PERT Initiative Report

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ABSTRACT

Background: A pulmonary embolism response team (PERT) is a multidisciplinary team established to improve clinical care for patients with pulmonary embolism (PE). However, data regarding detailed institutional experience and clinical outcomes from such teams are sparse.

Aims: We aim to assess the frequency of activations, patients' characteristics, PE severity, applied treatments, and outcomes of PE patients treated by Polish PERTs.

Methods: The survey registry was conducted between June 2018 and July 2020. All consecutive PERT activations of four institutionalized PERTs in Poland were analyzed. Patients' characteristics, therapies applied, and in-hospital outcomes were evaluated.

Results: There were 680 unique PERT activations. Most activations originated from Emergency Departments (44.9%), and the remaining originated from internal medicine/cardiology units (31.1%), surgery/orthopedics (9.1 %), oncology (6.3%), intensive care units (6.0%), and others (2.5%). The origin of activation varied significantly among institutions (P <0.01). Most PERT cases were patients with intermediate-high risk PE (42.9%), whereas high-risk PE occurred in 10% of patients. Anticoagulation alone was delivered to 80.3% of patients, and 23.3% of patients received at least one advanced therapy: catheter-directed therapies (11.3%), systemic thrombolysis (5.3%), surgical embolectomy (2.4%), vena cava filter placement (3.7%), and extracorporeal membrane oxygenation (0.6%). In-hospital mortality in the whole study group was 5.1%, with significant differences between institutions (P = 0.01).

Conclusions: The frequency of PE severity, type of delivered catheter-directed treatment, and in-hospital mortality vary between institutions without significant discrepancies in PERT activations. This variation between expert centers highlights the local differences in PERTs' organizational and operational forms.

Key words: anticoagulation, catheter-directed therapy, pulmonary embolism, pulmonary embolism response team

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WHAT'S NEW

Pulmonary embolism (PE) is the third leading cause of cardiovascular-related mortality globally. Depending on patients' estimated early mortality risk, a variety of therapeutic options is now available for PE management, including anticoagulation, systemic thrombolysis, catheter-directed therapies, surgical embolectomy, or a combination of these strategies. However, the optimal therapeutic strategy for PE, especially for patients in the intermediate-high risk group, remains unclear due to the heterogeneity of the clinical course. To provide rapid and expert-based individualized care, the multidisciplinary pulmonary embolism response team (PERT) model has been adopted. Several PERTs have already been developed in Poland. This is the first multicenter national report on the PERT-guided treatment of PE.

INTRODUCTION

Acute pulmonary embolism (PE), as a form of venous thromboembolism (VTE), is the third leading cause of death from cardiovascular diseases globally [1]. The estimated incidence of PE is 35–119 per 100 000 person-years, with nearly 500 000 deaths annually in Europe [1–3]. PE has a variety of clinical manifestations: from mild impairment of exercise tolerance (low-risk PE) and severe dyspnea accompanied by signs of right ventricular (RV) overload (intermediate-risk PE) to hemodynamic collapse, shock (high-risk patients), and death caused by massive obstruction of pulmonary vessels [3]. Although most patients with PE can be successfully treated with anticoagulants, hemodynamically compromised patients require more advanced treatment modalities. These include intensive treatments such as systemic thrombolysis (ST), cardiac surgery, or catheter-directed therapies (CDT), sometimes assisted by extracorporeal circulatory support (ECMO) or a combination of these strategies [4–8]. The heterogeneity of the clinical course of PE and comorbidities cause significant difficulties in the diagnosis and selection of appropriate therapeutic approaches [3, 9]. Simultaneously, significant progress can be observed in both pharmacological and interventional treatment of PE [4–8]. It has been demonstrated that PE management strategies vary between institutions, medical specialties, and clinicians' experiences [10]. The complexity of diagnosis, the clinical course, and treatment options of PE in real-time integrated clinical care require coordinated multispecialty consultation and decision-making. To facilitate this, the institutionally based pulmonary embolism response team (PERT) model of PE management was recently developed in the United States and across Europe [10–15]. PERT consists of specialists from different disciplines, including cardiologists, interventional cardiologists, cardiac surgeons, vascular surgeons, radiologists, and anesthesiologists, who rapidly evaluate, coordinate, and provide a full range of advanced treatment modalities for complex PE ceases. PERT members, in cooperation with referring physicians, determine the most appropriate treatment strategy individually for each patient. The strategy consists of anticoagulation alone or systemic thrombolysis, surgical embolectomy (SE), or CDT [10–15]. Several PERTs have already been established in Poland [17–19]. An agreement between Polish PERTs was signed in 2019, called the Polish PERT Initiative, whose mission is to facilitate cooperation among centers with a mutual exchange of experiences, standardize PE clinical care, and collect and share data on the diagnosis and treatment of PE [20]. This study provides the first national, multicenter analysis of patients cared for by four Polish PERTs.

METHODS

Logistics of the pulmonary embolism response teams

The structure and organization of PERTs have been described in detail previously [19–21]. In brief, referring physicians activate PERTs by contacting a PERT coordinator via a 24-hour/7-day-a-week telephone number. Subsequently, the patient's relevant clinical data and radiological images are discussed by PERT members (mainly cardiologists, interventional cardiologists, cardiac surgeons, and/or other involved specialists, if necessary), and consensus opinion and treatment recommendations are reported back to the referring physician within 30 minutes [20]. The patient may be treated and observed on-site in a referring center or hospitalized in a PERT center where resources and staff are mobilized to deliver advanced therapy (CDT, SE, ECMO, inferior vena cava filter implantation [VCF], etc.) if necessary.

Data collection

The study was conducted between June 1, 2018 and July 31, 2020. All PERT activations within this period were collected as part of a quality assurance initiative. We enrolled all the consecutive patients with acute PE who were consulted and/or hospitalized in four individual centers in Poland, where institutionalized PERTs operate. These centers were as follows:

- CELZAT — Central University Hospital, Warszawa/European Health Center, Otwock;
- DJ-PERT — Infant Jesus University Hospital, Warszawa;
- JP2-PERT — John Paul II Hospital, Kraków;
- PERT-POZ — University Hospital of the Lord's Transfiguration, Poznań.

Each patient consulted by any of the abovementioned teams, aged over 18 years, who gave informed consent to participate in the local registry, was included. The only

exclusion criterion was the lack of informed consent to participate in the study. All the patients gave informed consent to participate in the registry (if they were unconscious, family members approved the treatment).

The study protocol was approved by the institutional bioethics committee (KBE No 271/2021). The study was also registered in the ClinicalTrials.gov database (NCT04879069). We analyzed the following parameters: (1) the frequency and origin of each PERT activation; (2) patient characteristics such as presenting symptoms, predisposing factors, and comorbidities; (3) PE severity; (4) delivered therapies; and (5) outcomes with in-hospital mortality rate. All concomitant diseases were diagnosed according to the current guidelines of the relevant international societies, and the appropriate therapy recorded in medical records confirmed the diagnosis of a specific illness.

The severity of pulmonary embolism

The diagnosis of PE was objectively confirmed in all patients by computed tomography pulmonary angiography. The localization and embolic burden were also assessed by PERT members. The Pulmonary Embolism Severity Index and the simplified Pulmonary Embolism Severity Index were initially calculated for each normotensive patient with PE [3]. The presence of the RV dysfunction was identified by imaging studies (transthoracic echocardiography and/or computed tomography pulmonary angiography). Elevated cardiac troponin concentration was defined by institution-specific cut-offs. The PE risk was stratified into low, intermediate-low, intermediate-high, and high risk according to the current guidelines of the European Society of Cardiology (ESC) [3].

Treatment strategies and outcomes

Depending on the patients' mortality risk estimated in accordance with the ESC guidelines, a specific therapeutic approach was recommended [3]. Treatment strategies included anticoagulation alone or together with some form of advanced therapy such as ST, SE, CDT (aspiration or mechanical thrombectomy [CDThro]), local thrombolysis (CDF), a combination of CDThl + CDF, inferior VCF placement, or ECMO implementation. The details concerning the qualification criteria for percutaneous techniques were published elsewhere [20, 21]. Briefly, CDT was recommended for patients with high-risk PE and contraindications to ST or its failure (refractory circulatory collapse) who were not eligible for SE, and/or for patients with intermediate-high risk PE with persistent factors of RV dysfunction during at least 24 hours of anticoagulation, or in case of clinical deterioration.

The recommendations of each PERT and the clinical course were recorded. The in-hospital outcomes included mortality, the occurrence of hemodynamic instability, respiratory failure, shock, cardiac tamponade, distal systemic embolization, and minor or major bleeding, defined according to the International Society on Thrombosis and Hemostasis criteria [22]. Specific causes of death were determined via autopsy or according to death certificates.

All relevant clinical data were entered into databases in individual centers and then initially summarized in order to preserve patients' anonymity. Then, the data were transferred to the coordinating center where the statistical analysis was subsequently performed.

Statistical analysis

Descriptive characteristics are presented as a number of cases and percentages for categorical variables or as the median and interquartile range (IQR) for continuous variables without normal distribution. Differences among PERT centers were compared using the $\chi 2$ test or Fisher's exact test for categorical variables. Continuous variables were compared using the Kruskal-Wallis analysis of variance along with the multiple-comparison post hoc correction. A 2-tailed α of 0.05 was considered significant. To provide comparable estimates, the number of PERT activations was adjusted for the size of each institution (number of all registered hospitalizations by the National Health Service during PERT operation). Statistical analysis was performed using Statistica 13.7 version (StatSoft Inc., Tulsa, OK, USA).

RESULTS

PERT activations and characteristics of patients

There were 688 unique PERT activations across all four institutions. Among them, the diagnosis of PE was finally confirmed in 680 patients (98.8%). Non-confirmed PE was ruled out in 8 patients (1.2%) using imaging studies. There was no significant difference between the number of adjusted PERT activations across participating institutions ($P = 0.4$). Details of PERT activations in each institution are shown in Table 1.

The majority of activations originated from Emergency Departments: ER (305; 44.9%), and the remaining originated from internal medicine/cardiology units (212; 31.1%), surgery or orthopedics (62; 9.1%), oncology (43; 6.3%), intensive care units (41; 6.0%), and other departments including neurology (17; 2.5%). The origin of activation varied significantly between the institutions ($P < 0.001$). The source of PERT activations is presented in Figure 1.

Demographics, comorbid diseases, and PE risk factors of patients for all PERT activations are presented in Table 2. For all PERT activations, the median age was 60 (IQR, 18–95) years and both sexes were equally represented (F = 50.6%; M = 49.4%).

Most PERT cases were patients with intermediate-high risk PE (292/680; 42.9%), whereas high-risk PE patients accounted for a smaller proportion (69/680; 10.1%). However, the spectrum of PE severity differed significantly among PERTs ($P < 0.001$). Detailed data are displayed in Figure 2.

The vast majority of patients (560/680; 82.4%) had central PE. Interestingly, central PE was detected in 79.7% (55/69) of the high-risk patients and 81.3% (126/155) of

Table 1. Number of PERT activations across the participating institutions

Institution	N (%)	Number of PERT activations/month/1000 hospitalizations	*P*-value
All	680 (100)	1.1	0.4[a]
CELZAT	140 (20.6)	0.8	
DJ-PERT	282 (41.5)	1.9	
JP2-PERT	113 (16.6)	0.6	
PERT-POZ	145 (21.3)	1.5	

[a]Adjusted PERT activations

Abbreviations: CELZAT, Central University Hospital, Warszawa/European Health Center, Otwock; DJ-PERT, Infant Jesus University Hospital, Warszawa; JP2-PERT, John Paul's II Hospital, Kraków; PERT-POZ, University Hospital of the Lord's Transfiguration, Poznań; PERT, pulmonary embolism response team

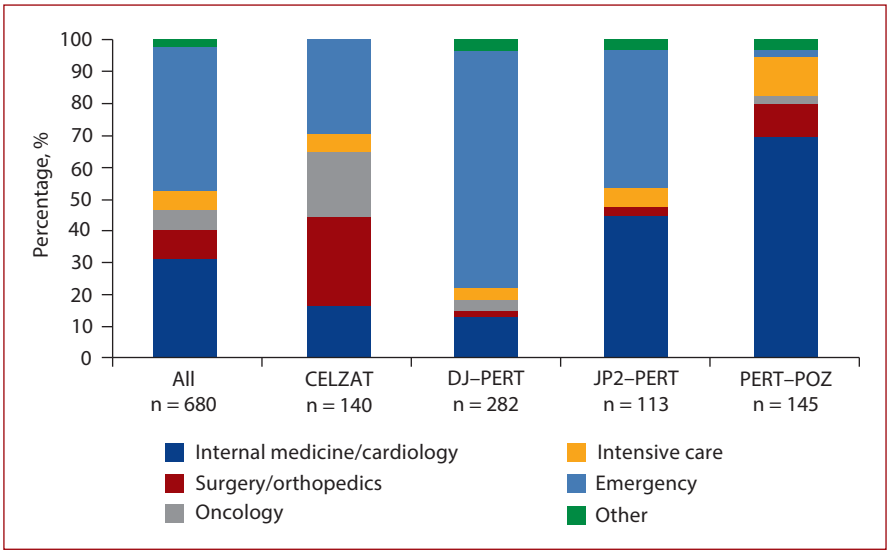

Figure 1. Origin of all PERT activations stratified by institutions

Abbreviations: see Table 1

Table 2. Basic characteristics, comorbidities, and risk factors among all PERT patients

Characteristic	All (n = 680)	CELZAT (n = 140)	DJ-PERT (n = 282)	JP2- PERT (n = 113)	PERT-POZ (n = 145)	*P*-value
Age, years, median (IQR)	60 (18–95)	62 (18–92)	58 (18–93)	65 (24–95)	62 (18–92)	0.2
Sex male/female, n (%)	336/344 (49.4/50.6)	79/61 (56.4/43.6)	142 /140 (50.3/49.7)	45/68 (40.2/59.8)	70/75 (48.3/51.7)	0.18
Concomitant diseases:						
Chronic coronary syndrome, n (%)	86 (12.6)	25 (17.4)	30 (10.6)	16 (14.3)	15 (10.3)	0.14
Chronic obstructive pulmonary disease, n (%)	57 (8.4)	19 (13.6)	25 (8.9)	5 (4.5)	8 (5.5)	0.03
Arterial hypertension, n (%)	229 (33.7)	50 (35.7)	91 (32.3)	33 (29.5)	55 (37.9)	0.44
Diabetes mellitus, n (%)	95 (14)	13 (9.3)	45 (16)	13 (11.6)	24 (16.6)	0.18
Obesity, n (%)	129 (19)	11 (7.9)	70 (24.8)	11 (9.8)	37 (25.5)	<0.0001
Chronic kidney disease, n (%)	62 (9.1)	12 (8.6)	22 (7.8)	13 (11.6)	15 (10.3)	0.57
Previous stroke, n (%)	30 (4.4)	4 (2.9)	8 (2.8)	12 (10.7)	6 (4.1)	0.43
Cigarette smoking, n (%)	90 (13.2)	39 (28)	40 (14.2)	3 (2.7)	8 (5.5)	<0.001
Prothrombotic risk factors:						
Mobility limitation, n (%)	239 (35.1)	35 (25)	123 (43.6)	13 (11.6)	68 (46.9)	<0.001
Recent hospitalization, n (%)	125 (18.4)	36 (25.7)	54 (19.1)	7 (6.3)	28 (19.3)	<0.001
Recent surgical procedures, n (%)	84 (12.4)	22 (15.7)	28 (9.9)	3 (2.7)	14 (9.7)	<0.001
Recent trauma, n (%)	68 (10)	18 (12.9)	25 (8.9)	9 (8)	16 (11)	0.05
Previous PE, n (%)	52 (7.6)	5 (3.6)	29 (10.3)	2 (1.8)	16 (11)	0.003
Previous DVT, n (%)	60 (8.8)	11 (7.9)	24 (7)	13 (11.6)	12 (8.3)	0.74
Hormonal therapy, n (%)	38 (5.6)	17 (12.1)	10 (3.5)	6 (5.4)	5 (3.4)	0.002
Neoplastic disease, n (%)	144 (21.2)	53 (37.9)	38 (13.5)	24 (2.1)	29 (20)	<0.001

Abbreviations: DVT, deep vein thrombosis; IQR, interquartile range; PE, pulmonary embolism; other — see Table 1

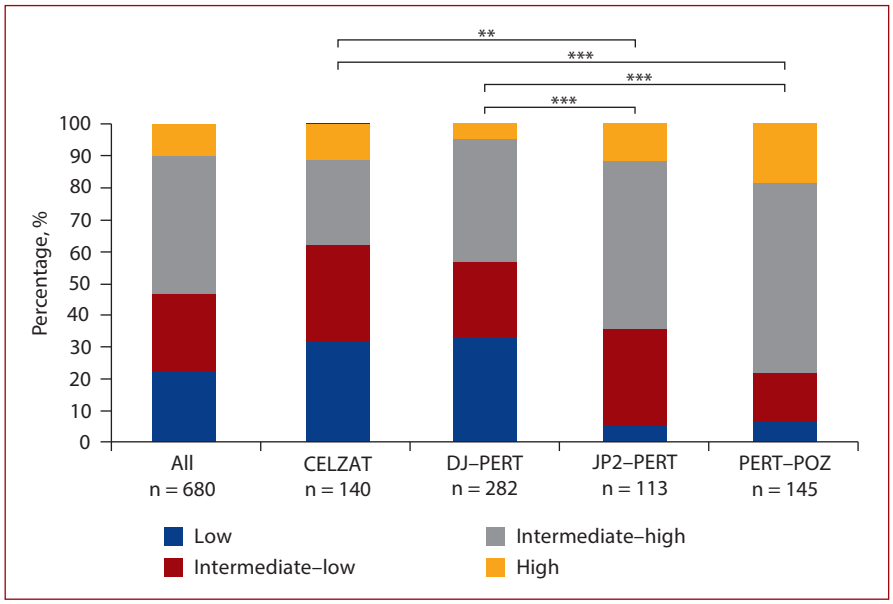

Figure 2. Risk stratification of patients with confirmed pulmonary embolism

**P <0.001; ***P <0.0001
Abbreviations: see Table 1

Table 3. Clot localizations among PERT patients

Institution	Saddle, n (%)	Another central (main or right/left, or lobar pulmonary artery), n (%)	Segmental, n (%)	Unknown, n (%)
All (n = 680)	155 (22.8)	405 (59.6)	119 (17.5)	1 (0.15)
CELZAT (n = 140)	22 (15.7)	72 (51.4)	46 (32.9)	—
DJ-PERT (n = 282)	57 (20.2)	182 (64.5)	43 (15.25)	—
JP2-PERT (n = 113)	28 (24.8)	76 (67.3)	8 (7.1)	1 (0.9)
PERT-POZ (n = 145)	48 (33.1)	75 (51.7)	22 (15.2)	—

Abbreviations: see Table 1

the low-risk patients. In the intermediate-risk group, the proportion of central PE was 382/459 (83.2%). Table 3 shows the proportion of patients with central PE (intracardiac, saddle, main pulmonary artery [PA], right/left PA, or lobar) vs. distal PE (segmental or subsegmental) among subjects with confirmed PE and available imaging.

Treatment of patients with PE

Anticoagulation alone was the most common therapy recommended to 546/680 (80.3%) patients with PE. Overall, 158/680 (23.2%) patients received at least one advanced therapy, including CDT (77/680; 11.3%), ST (36/680; 5.3%), SE (16; 2.4%), VCF placement (25/680; 3.7%), and ECMO (4; 0.6%). There were no significant differences in the applied treatment modalities between institutions (P = 0.57). Figure 3 shows the treatments delivered to PERT patients stratified by the institution. The detailed characteristics with the frequency of specific anticoagulants administrated initially by different PERTs are provided in Supplementary material, *Figure S1*. There was a significant difference between the types of applied CDT in PERTs (P <0.01). CDThro was most frequently performed by PERT-POZ (80% of invasive procedures), whereas CDF was most frequently applied by JP2-PERT (91% of invasive procedures) (P = 0.017 in post-hoc analysis). Pharmaco-mechanical therapy (CDThro + CDF) was the most common standard of care in DJ-PERT (57.8%). The precise data are shown in Figure 4.

Outcomes of patients with PE

The in-hospital bleeding rate was 3.8% (26 of 680) overall. Major bleeding occurred in 1.4% of patients (10 of 680), and minor bleeding was observed in 2.4% of patients (16 of 680). Stroke occurred in 4 patients (0.6%) in the entire study group. Details are presented in Table 4. The overall in-hospital death rate in the whole study group was 5.1% (35 of 680) and differed significantly among institutions (P = 0.011). The mortality rate was 7.9% in CELZAT PERT, 6.2% in both PERT-POZ and JP2-PERT while only 2.8% in DJ-PERT. Acute right ventricular failure related to PE was the most frequent cause of mortality among all PERT patients, i.e. 2.8% (19 of 680). The detailed characteristics with specific causes of death among the PERT patients are provided in Supplementary material, *Table S1*.

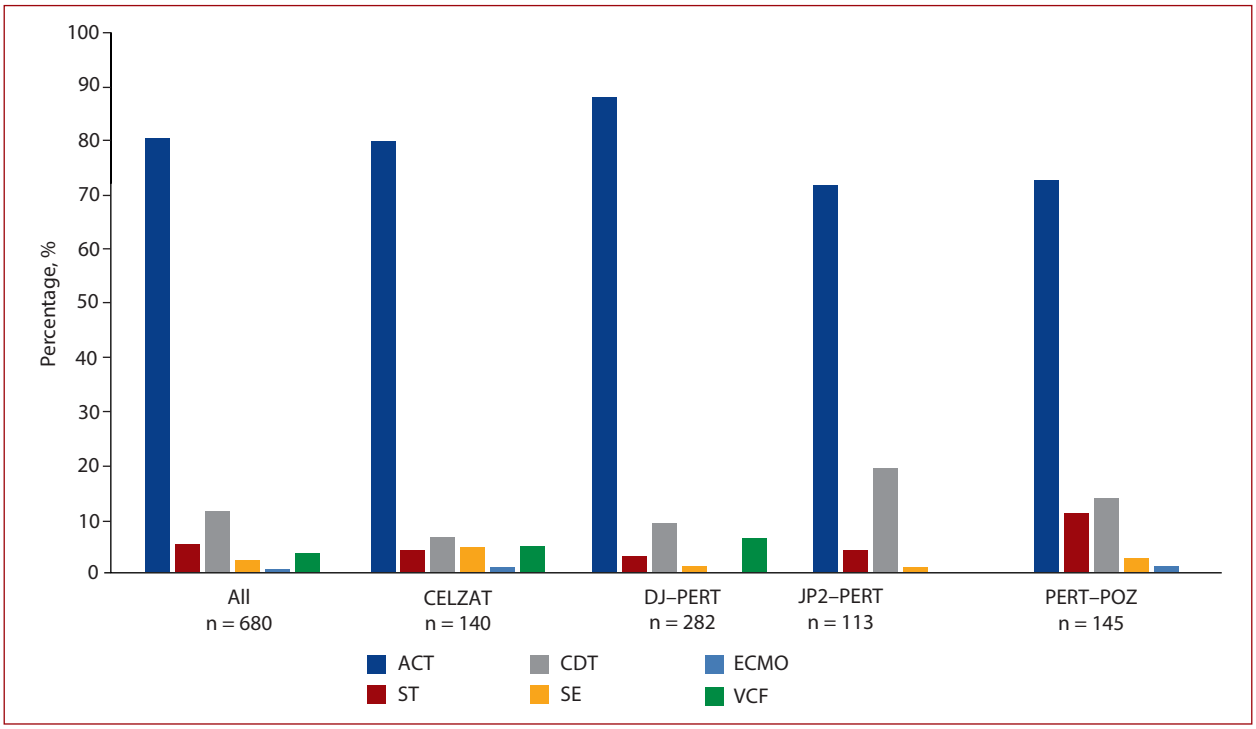

Figure 3. Distribution of therapies delivered by PERTs in patients with PE

Abbreviations: ACT, anticoagulation therapy alone; CDT, catheter-directed therapies; ECMO, extra-corporeal membrane oxygenation; PE, pulmonary embolism; SE, surgical embolectomy; ST, systemic thrombolysis; VCF, inferior vena cava filter; other — see Table 1

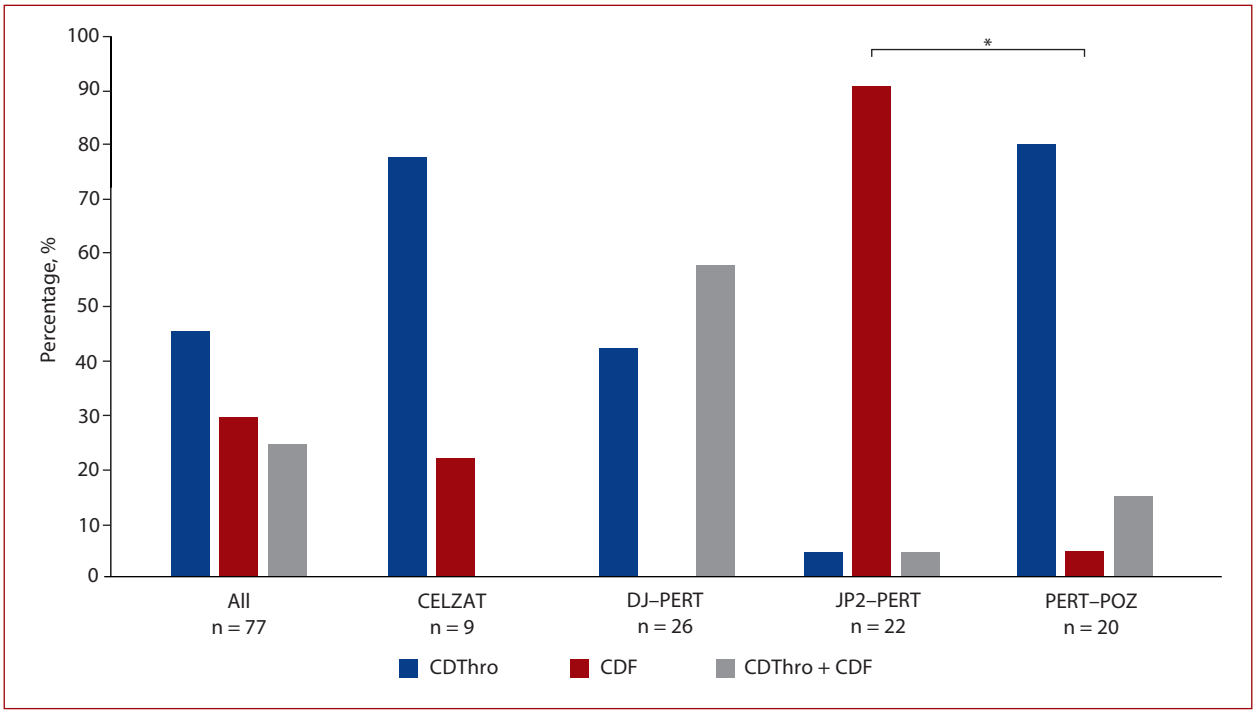

Figure 4. Distribution of different catheter-directed therapies

*P = 0.017 (post-hoc analysis)
Abbreviations: CDF, catheter-directed thrombolysis; CDThro, catheter-directed thrombectomy; other — see Table 1

Table 4. In-hospital outcomes of PERT patients

	All (n = 680)	CELZAT (n = 140)	DJ-PERT (n = 282)	JP2-PERT (n = 113)	PERT-POZ (n = 145)	*P*-value
Mortality, n (%)	35 (5.1)	11(7.9)	8 (2.8)	7 (6.2)	9 (6.2)	0.011
Stroke, n (%)	4 (0.6)	2 (1.4)	0 (0)	0 (0)	2 (1.3)	0.43
Major bleeding, n (%)	10 (1.4)	5 (3.6)	1 (0.4)	3 (2.7)	1 (0.7)	0.038
Minor bleeding, n (%)	16 (2.4	8 (5.7)	5 (1.8)	0 (0)	3 (2)	0.018
All bleedings, n (%)	26 (3.8)	13 (9.3)	6 (2.2)	3 (2.7)	4 (2.8)	0.002

Abbreviations: see Table 1

DISCUSSION

We performed the multicenter analysis of PERT activity including 680 unique PERT recommendations from four institutions in Poland. To the best of our knowledge, this survey study is the first report of the activity of organized PERTs in Europe. This study demonstrated a similar frequency of multidisciplinary team activations and applied treatment modalities. However, patient characteristics, PE severity, delivered CDT, and outcomes differed significantly among institutions.

The results of our study are in line with the results from the United States PERT Consortium presenting the experiences of 8 centers. Schultz et al. [10] showed substantial variations between institutions in terms of organization of centers, frequency of activations, PE severity, applied treatments, as well as in-hospital mortality. Nevertheless, we also reported significant differences in the number of PERT activations and the type of therapy delivered. These differences may result from the experience of PERT teams and patient risk profiles.

Most PERT activations in our report came from ER (45%). This is in line with previous reports [10, 16]. The PERT Consortium reported that almost 60% of PERT activations originated from ER, but with significant differences among centers. In our study, many consultations were dedicated to patients from internal and cardiology departments, which was uncommon in the referrals in the American registry. We have also noticed some discrepancies among institutions, demonstrating significant differences in their organization and structure. There was no visibly apparent trend toward the lower mortality rate in institutions with more activations from ER (resulting from, for example, shorter duration from PE diagnosis to PERT decision and treatment). This is probably because most of the consulted cases were intermediate-risk PE; in such patients, the significance of rapid interventional treatment is not so critical compared with high-risk PE or patients with ST-elevation myocardial infarction. Therefore, in the case of PE, the decision to activate PERT is often made some time after the diagnosis and after an initial attempt at stabilization of patient clinical status at the hospital ward.

The results of the present study indicate that institutional PERT implementation led to a significant increase in the availability of the so-called "advanced therapies" (CDT, SE, ECMO, and VCF implantation) [23, 24, 17]. In our report, percutaneous treatments were applied in as many as 11% of patients. Similar results were reported by the PERT in Massachusetts General Hospital [14]. Researchers noted that the implementation of PERT resulted in more than a 10-fold increase in the frequency of CDT use as compared to the period before the introduction of PERT [14]. The creation of PERT may, therefore, contribute to the popularization of CDT use, particularly now during the era of fast development of transcatheter techniques.

Generally, the reported in-hospital mortality was relatively low, especially after taking into consideration that PERTs are used to treat more complicated cases of PE [21]. On the other hand, a relatively high proportion of consulted patients were low-risk patients (especially in CELZAT and DJ-PERT centers). However, most of them had central PE, which caused concern for referring physicians and prompted them to consult PERT members. Similar conclusions could be drawn from a more detailed analysis conducted by Sławek-Szmyt et al. [19]. Nevertheless, similar to other registries, intermediate-risk patients constituted the predominant group of patients [25–28]. They seem to be the most complicated cases in terms of diagnosis and selection of a therapeutic strategy.

In our study, total mortality was 5.1%, and the mortality directly related to a PE occurrence was 2.8%. Although we were unable to perform a comparative analysis, the effect of PERT implementation on mortality reduction seems to be noticeable. The previously published ZATPOL report from the largest Polish PE registry indicated the total in-hospital death rate as 7.1% (79 out of 1112 patients) [29, 30]. It is undoubtedly difficult to make a direct comparison to the present study, especially since PERT patients underwent careful risk stratification with clinical, imaging, and cardiac biomarkers analysis. However, the differences might be due to improved access to advanced therapies and the involvement of different specialists after institutional PERT creation. In the ZATPOL registry, only 0.27% of patients were qualified for percutaneous treatment as compared to 11.3% in our report. Recently, Chaudhury et al. [31] demonstrated significant inpatient mortality in the PERT-era cohort, especially in intermediate and high-risk patients. Nonetheless, comparisons to previous registries are difficult, so future prospective studies should focus on whether PERT operation represents an improvement in short- and long-term outcomes.

Lastly, we also found some variations in mortality across institutions. While this could be a result of the treatments provided, we did not have sufficient tools to account for comorbidities or other potential confounders. For example, a high percentage of cancer patients observed in CELZAT-PERT may explain increased mortality, which is not directly related to the severity of PE. Aharoni et al. [32] demonstrated a 30.9% early mortality rate among patients with malignancy-related PE, but only 10.6% in those with unprovoked PE.

The difference in the mortality rate is of particular interest because all of the participating institutions are academic medical centers with similar experiences and quality of care. While differences from large academic hospitals to small remote hospitals could be expected, the reason for this variation among university hospitals of similar size and PE expertise needs further investigation.

Limitations of the study

This study has obvious limitations. First, our study was a survey and had a retrospective character; thus, it may include biases based on selective inclusion. Although participating PERT centers are expected to enter data on all consulted patients, we were not able to confirm that the data of all consecutive patients were entered at each site. Most PERT guidelines focus on patients with complicated intermediate- or high-risk PE. This selection bias should be taken into account when comparing patient characteristics, treatment, and outcomes with the general PE population. Some of the patients consulted by PERT stayed and were then treated in the referring hospitals; subsequently, their data were reported to PERT centers. The data on outcomes from these centers may be less reliable.

Although this study aimed to highlight the current clinical practice and determine whether differences exist across PERT institutions, we acknowledge that we were unable to clearly indicate the impact of different management strategies and diverse risk profiles of patients with PE. Moreover, we are unable to evaluate the effects of the implementation of PERTs on treatments or outcomes in this report as we did not obtain pre-PERT data.

All included centers are large university hospitals. However, our data do not presently allow us to answer detailed questions about why PERT members offered a particular type of therapy. Particularly, we are unable to answer why some high or intermediate-high PE patients did not receive "advanced" therapy. We do not have data on any randomized clinical trials that would prove that CDT is more effective than anticoagulation in intermediate-high risk PE patients and that the choice of treatment in more complicated cases is based on the experience of the center and individual specialists.

CONCLUSIONS

The frequency of PE severity, percutaneous treatment delivered, and in-hospital mortality varies between institutions. These differences between expert centers highlight the local variations in PERTs' organizational and operational forms, as well as the challenges in the evolving field of acute PE treatment.

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/kardiologia_polska.

Article information

Conflict of interest: None declared.

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