# PERT Activation with Al Improves Time to Intervention and Survival in High-Risk Pulmonary Embolism

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#### BACKGROUND

- High-risk pulmonary embolism is associated with exceedingly high mortality rates. Pulmonary embolism response teams (PERT) allow rapid evaluation and triage of these patients
- With integration of artificial intelligence (AI), PERT activations should improve speed and quality of communication between teams allowing for more rapid treatment and improved survival
- We predicted that time to intervention and mortality would improve after integration of AI PERT activation due to improvement in communication and multidisciplinary involvement

## METHODS

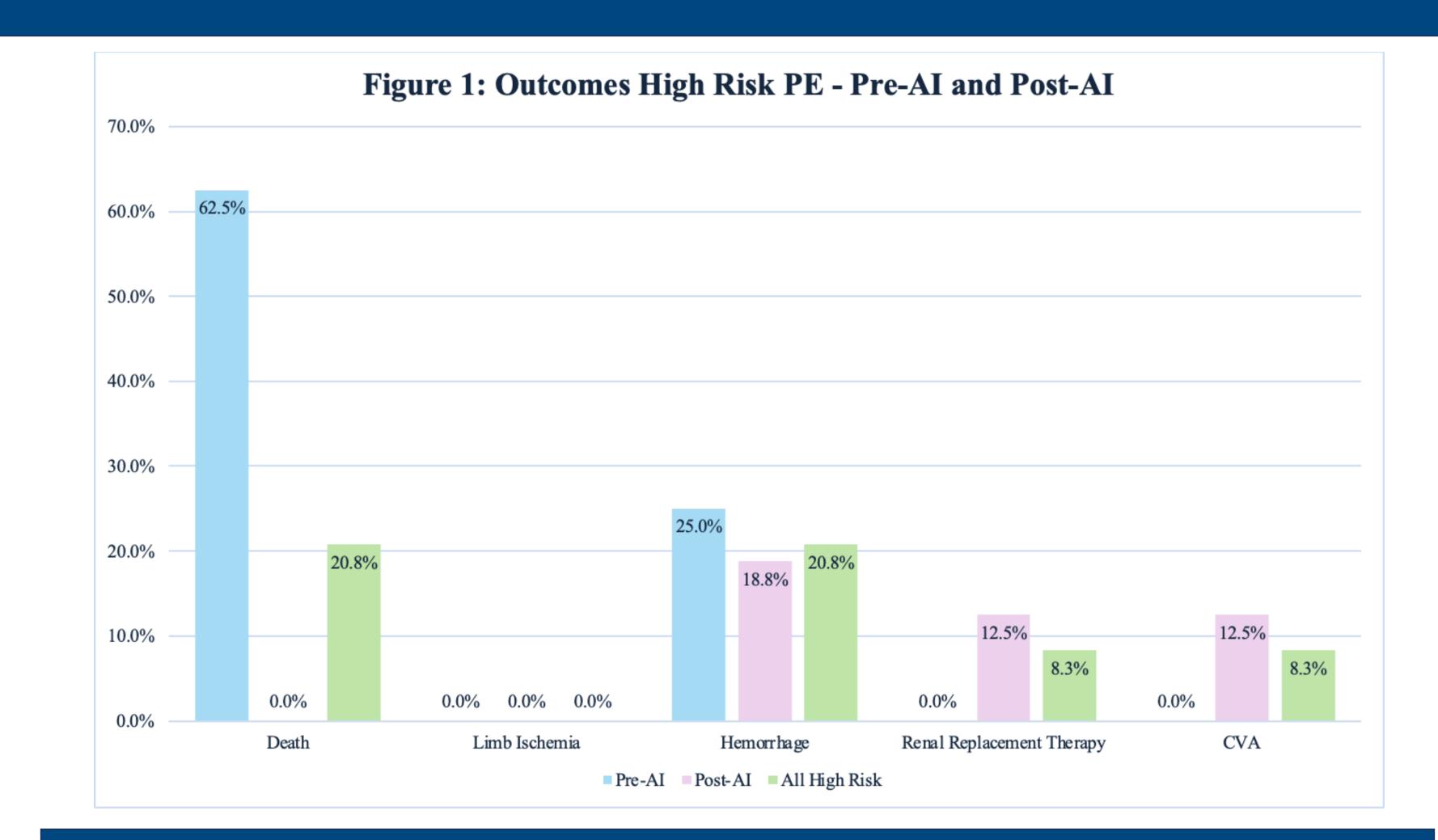
- Single center retrospective review of operative high-risk PE patients from 2018 through 2025. Artificial Intelligence providing identification and notification of PE was integrated in 12/2022 with an overhaul of our PERT
- Primary outcomes: In-hospital mortality, time to Intervention
- Secondary outcomes: Limb Ischemia, major hemorrhage, renal replacement therapy, cerebrovascular accident (CVA)
- Continuous variables were analyzed using t-test. Categorical variables reported using percentages; compared using Fishers Exact Test.
   Preoperative patient factors were evaluated using Spearman's Rank Correlation
- 2. Author has a financial relationship with Penumbra Inc.

**Table 1: Patient Demographics and Outcomes** 

Patients (n)         24         8         16         N/A         16           Age (Avg Years)         58.2         63         55.75         N/A         16           Intrahepatic Reflux of Contrast         59.1%         62.5%         57.1%         0.8         6           Severe RV Dysfunction         75%         62.5%         83.3%         3         6           RV:LV         1.86         1.875         1.85         N/A         0           Thrombolysis         20.8%         50%         6.25%         0.067         0.           VA-ECMO Utilization         54.2%         25%         68.8%         6.6         0.           Mortality         21.7%         62.5% (5 of 8)         0% (0 of 16)         N/A         0.           Limb Ischemia         0%         0% (0 of 8)         0% (0 of 16)         N/A         0.           Hemorrhagic         20.8%         25% (2 of 8)         18.75% (3 of 16)         0.54         0.           Complications         20.8%         25% (2 of 8)         12.5% (2 of 16)         0.53         0           Acute Renal Failure         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Cerebrovascular							
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Age (Avg Years)         58.2         63         55.75         N/A         1           Intrahepatic Reflux of Contrast         59.1%         62.5%         57.1%         0.8         0           Severe RV Dysfunction         75%         62.5%         83.3%         3         0           RV:LV         1.86         1.875         1.85         N/A         0           Thrombolysis         20.8%         50%         6.25%         0.067         0           VA-ECMO Utilization         54.2%         25%         68.8%         6.6         0           Mortality         21.7%         62.5% (5 of 8)         0% (0 of 16)         N/A         0           Limb Ischemia         0%         0% (0 of 8)         0% (0 of 16)         N/A         0           Hemorrhagic Complications         20.8%         25% (2 of 8)         18.75% (3 of 16)         0.54         0           Cerebrovascular Accident         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Pearson's Rho         P-Value           Female Sex         0.4055         0.049           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175 <td>Patients (n)</td> <td></td> <td>8</td> <td>16</td> <td></td> <td>N/A</td>	Patients (n)		8	16		N/A	
Intrahepatic Reflux of Contrast   59.1%   62.5%   57.1%   0.8   Contrast	` /		63			N/A	
RV:LV         1.86         1.875         1.85         N/A         C           Thrombolysis         20.8%         50%         6.25%         0.067         0.           VA-ECMO Utilization         54.2%         25%         68.8%         6.6         0.           Mortality         21.7%         62.5% (5 of 8)         0% (0 of 16)         N/A         0.           Limb Ischemia         0%         0% (0 of 8)         0% (0 of 16)         N/A         0.           Hemorrhagic         20.8%         25% (2 of 8)         18.75% (3 of 16)         0.54         0.           Complications         20.8%         25% (2 of 8)         12.5% (2 of 16)         0.53         0.           Acute Renal Failure         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0.           Cerebrovascular Accident         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0.           Correlation with Mortality           Pearson's Rho         P-Value           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209	Intrahepatic Reflux of	59.1%	62.5%	57.1%	0.8	0.69	
Thrombolysis         20.8%         50%         6.25%         0.067         0.           VA-ECMO Utilization         54.2%         25%         68.8%         6.6         0.           Mortality         21.7%         62.5% (5 of 8)         0% (0 of 16)         N/A         0.           Limb Ischemia         0%         0% (0 of 8)         0% (0 of 16)         N/A         0.           Hemorrhagic Complications         20.8%         25% (2 of 8)         18.75% (3 of 16)         0.54         0.           Acute Renal Failure         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0.           Cerebrovascular Accident         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0.           Correlation with Mortality           Pearson's Rho         P-Value           Female Sex         0.4055         0.049           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209	Severe RV Dysfunction	75%	62.5%	83.3%	3	0.34	
VA-ECMO Utilization         54.2%         25%         68.8%         6.6         0.           Mortality         21.7%         62.5% (5 of 8)         0% (0 of 16)         N/A         0.           Limb Ischemia         0%         0% (0 of 8)         0% (0 of 16)         N/A         0.           Hemorrhagic Complications         20.8%         25% (2 of 8)         18.75% (3 of 16)         0.54         0           Acute Renal Failure         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Cerebrovascular Accident         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Correlation with Mortality           Pearson's Rho         P-Value           Female Sex         0.4055         0.049           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209	RV:LV	1.86	1.875	1.85	N/A	0.94	
Mortality         21.7%         62.5% (5 of 8)         0% (0 of 16)         N/A         0.           Limb Ischemia         0%         0% (0 of 8)         0% (0 of 16)         N/A         N/A           Hemorrhagic Complications         20.8%         25% (2 of 8)         18.75% (3 of 16)         0.54         0           Acute Renal Failure         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Cerebrovascular Accident         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Correlation with Mortality           Pearson's Rho         P-Value           Female Sex         0.4055         0.049           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209	Thrombolysis	20.8%	50%	6.25%	0.067	0.027	
Limb Ischemia         0%         0% (0 of 8)         0% (0 of 16)         N/A           Hemorrhagic Complications         20.8%         25% (2 of 8)         18.75% (3 of 16)         0.54         0           Acute Renal Failure         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Cerebrovascular Accident         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Correlation with Mortality           Pearson's Rho         P-Value           Female Sex         0.4055         0.049           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209	VA-ECMO Utilization	54.2%	25%	68.8%	6.6	0.048	
Hemorrhagic Complications         20.8%         25% (2 of 8)         18.75% (3 of 16)         0.54         0.54         0.54         0.54         0.54         0.54         0.54         0.54         0.54         0.54         0.54         0.54         0.54         0.54         0.53         0	Mortality	21.7%	62.5% (5 of 8)	0% (0 of 16)	N/A	0.001	
Complications         20.8%         25% (2 of 8)         18.75% (3 of 16)         0.54         0.54           Acute Renal Failure         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Cerebrovascular Accident         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Correlation with Mortality           Pearson's Rho         P-Value           Female Sex         0.4055         0.049           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209	Limb Ischemia	0%	0% (0 of 8)	0% (0 of 16)	N/A	1.0	
Cerebrovascular Accident         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         0           Correlation with Mortality           Pearson's Rho         P-Value           Female Sex         0.4055         0.049           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209	$\mathbf{c}$	20.8%	25% (2 of 8)	18.75% (3 of 16)	0.54	0.54	
Accident         8.3%         0% (0 of 8)         12.5% (2 of 16)         0.53         Correlation with Mortality           Correlation with Mortality           Pearson's Rho         P-Value           Severale Sex         0.4055         0.049           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209	Acute Renal Failure	8.3%	0% (0 of 8)	12.5% (2 of 16)	0.53	0.53	
Pearson's Rho         P-Value           Female Sex         0.4055         0.049           RV:LV         0.1836         0.478           Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209		8.3%	0% (0 of 8)	12.5% (2 of 16)	0.53	0.53	
Female Sex       0.4055       0.049         RV:LV       0.1836       0.478         Severe RV Dysfunction       -0.3162       0.175         Severe RV Dilation       -0.2941       0.209	Correlation with Mortality						
RV:LV       0.1836       0.478         Severe RV Dysfunction       -0.3162       0.175         Severe RV Dilation       -0.2941       0.209			Pearson's Rho		P-Value		
Severe RV Dysfunction         -0.3162         0.175           Severe RV Dilation         -0.2941         0.209	Female Sex		0.4055		0.049		
Severe RV Dilation -0.2941 0.209	RV:LV		0.1836		0.478		
	Ť		-0.3162				
					0.209		
Contrast Reflux in IVC -0.3608 0.118	Contrast Reflux in I	VC	-0.3608		0.118		

### RESULTS

- Table 1 and Figure 1 summarize study data and outcomes
- 24 patients underwent embolectomy, 8 Pre-Al, 16 Post-Al
- VA-ECMO was utilized more frequently Post-AI (OR 6.6, p=0.048)
- Thrombolytics was utilized less frequently Post-AI (OR 0.067, p=0.027)
- Time to Intervention decreased significantly Post-AI (1.75 days vs. 0.56 days, p=0.018)
- Mortality decreased Post-AI (62.5% vs. 0%, p=0.001)
- Limb ischemia, major hemorrhage, renal replacement therapy, and CVA occurred at similar rates between the groups
- Female sex correlated moderately with mortality (Pearson's rho=0.4055, p=0.049)
- Preoperative RV dysfunction, RV Strain, and contrast reflux into the IVC did not correlate with mortality



#### CONCLUSIONS

- Integration of AI into PERT is associated with improved survival in high-risk PE
- Time to intervention also decreased substantially following integration
- Despite increasing utilization of VA-ECMO, complication rates have remained low
- Improved communication and multidisciplinary involvement stimulated by artificial intelligence PERT activation can have a meaningful impact on patient outcomes

