A Retrospective Review of Catheter-Directed Therapies for Patients with Intermediate Risk Pulmonary Embolisms

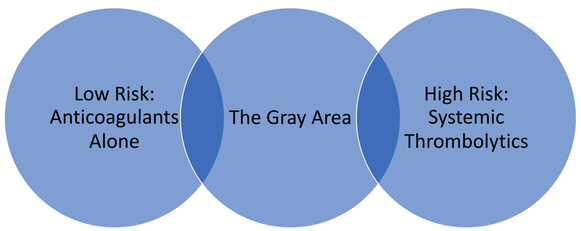
OAKLAND UNIVERSITY WILLIAM BEAUMONT

Austin Lehew[1], Michael Tucciarone, M.D.[2]

[1]Class of 2023 M.D. Candidate, Oakland University William Beaumont School of Medicine
[2]Department of Interventional Cardiology, Beaumont Health System

Introduction

- Pulmonary Embolisms are attributed to being the third leading cause of cardiovascular related deaths in the United States[1]
- Patients are classified as low risk, intermediate risk, or high risk based on clot size, location, and burden.
- There is a 15% mortality rate associated with intermediate risk pulmonary embolism patients[2](IRPE). Patients may sustain permanent right heart failure due to increased pulmonary pressures.
- The problem is that there are small sample sizes in current literature supporting use of catheter-directed therapies (CDT).
- The intended impact of this project is to internally validate the safety and efficacy of CDT and ultimately provide better health outcomes to patients at Beaumont.
- Hypothesis: CDT are effective at reducing right heart strain and are safer than systemic thrombolytics in treating patients with pulmonary embolisms.



Aims and Objectives

Aim I: Analyze the reduction in mean Pulmonary Artery Pressure (mPAP) as measured by right heart catheterization (RHC) after CDT interventions and compare these values to Right Ventricular Systolic Pressures (RVSP) obtained from echocardiography post-intervention.

Aim II: Assess safety of CDT for IRPE by establishing the incidence of intervention-related major bleeding and death within 30 days of intervention.

Methods

In this IRB approved project, we performed a retrospective chart review of patients receiving CDT at Beaumont Troy and Beaumont Royal Oak between 2018 and 2022. All patients above the age of 18 who received the specified intervention in the given time frame were included in the initial query. We were able to obtain data from 199 patients according to this search. Pre and post-intervention pulmonary pressures were obtained from the procedure note and post-intervention RVSP was obtained from follow up echocardiography. The incidence of death within 30 days of intervention as well as major bleeds requiring transfusion within 30 days of intervention were also obtained via chart review. Statistical analysis was performed with a one-sample t-test. Means and standard deviations were also calculated for continuous measures.

Results

Table 1 Summary statistics for all data collected

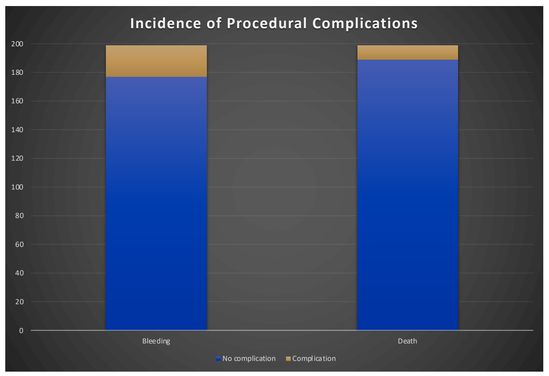
	Total (N=199)
Pre CT ratio	
N	199
Mean (SD)	1.6 (0.5)
Median	1.5
Range	0.8, 4.0
Pre CT ratio ≥1, n (%)	
No	10 (5.0%)
Yes	189 (95.0%)
Pre PA Pressure(mmHg)	
N	199
Mean (SD)	29.6 (9.7)
Median	29.0
Range	10.0, 68.0
Post Echo RSVP (mmHg)	
N	198
Mean (SD)	28.8 (12.5)
Median	20.0
Range	20.0, 77.5
Post PA Pressure (mmHg)	
N	190
Mean (SD)	21.5 (8.7)
Median	20.0
Range	2.0, 56.0

Table 2 Comparison of Pre and Post Measures

Difference	Pre Measure	Post Measure	pre - post Measure	p-value
Post PA Pressure (mmHg) – Pre PA Pressure (mmHg)	(n=190) 29.43 ± 9.38	(n=190) 21.46 ± 8.69	(n=190) -7.98 ± 6.57	<.001
Post Echo RSVP (mmHg) - Pre PA Pressure (mmHg)	(n=198) 29.67 ± 9.66	(n=198) 28.80 ± 12.51	(n=198) -0.87 ± 13.51	0.365

The average difference between the Pre and Post PA measures was -7.98 (standard deviation of 6.57) and this was a significant decrease ($p < 0.001$).
The average difference between the Pre PA and the Post Echo measures was -0.87 (standard deviation of 13.51) and this was not a significant decrease ($p = 0.365$).

Graph 1: Incidence of Procedure-Related Complications



As seen in the first bar graph, 22 patients or 11.1% (n=199)required transfusion within 30 days of intervention. As seen in the second bar graph, 10 or 5.0% (n=199) patients died within 30 days of intervention.

Conclusions

Overall, CDT significantly reduce the mPAP by 7.98mmHg ($P<0.005$) which directly correlates with a reduced right heart strain. Reducing right heart strain is the staple of IRPE treatments and is the best measure for predicting decreased overall mortality. Therefore, the hypothesis that CDT are efficacious in reducing right heart strain is validated by the data from this retrospective review. However, there was no statistically significant reduction between pre pulmonary artery pressure and follow up RVSP One explanation for this is that the RVSP better approximates the systolic pulmonary artery pressure instead of the mean pressure.

In general, we believe that CDT are also safe when compared to systemic thrombolytics. There was a 5% risk of death within 30 days of intervention that cannot be ignored. However, these are considered procedurally associated deaths as most, if not all, of these deaths were due to a direct result of thrombus burden instead of being a catastrophic result of the intervention. There was also a 11.1% risk of bleeding within 30 days of intervention. Admittedly, this risk was much higher than expected. However, we feel strongly that most bleeds were a result of pre-existing conditions and not due to vascular injury with resulting bleeding from intervention. Similar studies of CDT showed a 0.9% (n=104) risk in major bleeding. Systemic thrombolytics have a 11.5% (n=506) chance of major bleeding[1,3]as shown in the PEITHO trial. It is notable that this trial only included bleeding within 7 days of intervention while we included bleeding within 30 days. A major limitation of this study is the fact that we were only able to include the immediate reduction in right heart strain measured through mPAP. Future studies could look at mPAP obtained >30 from index event to evaluate the long-term reduction in right heart strain. In conclusion, there is a shown risk of major bleeding and death, but we still believe that the benefits of reduced heart strain significantly outweigh these risks. We feel that the results of this review should continue to encourage the use of CDT in IRPE patients within the Beaumont Health System.

References

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