Postoperative Pneumonia Characteristics following Pulmonary Thromboendarterectomy (PTE)

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Background

Pulmonary thromboendarterectomy (PTE), the gold standard treatment for chronic thromboembolic hypertension (CTEPH), can be complicated by reperfusion lung injury (RPLI) in up to 40-50% of cases.[1]

Unique features of this highly specialized surgery may predispose patients to increased risk of postoperative pneumonia (PNA) in addition to RPLI.

Rates of PNA following cardiac surgery range from 2-10%, but its rates following PTE are not as well understood with rates ranging from 17-35%.[1]

This study aims to describe the incidence of suspected/confirmed post-PTE PNA compared to RPLI, assess the diagnostic and clinical characteristics, and evaluate the outcomes of these groups.

Methods

CTEPH Registry

A research registry of CTEPH and Venous Thromboembolic Disease (VTED) subjects was created at Northwestern Memorial Hospital.

Definitions

RPLI: presence of radiographic infiltrates in region of endarterectomized tissue and hypoxemia within 48-72 hours following PTE.

Postoperative PNA: signs/symptoms (fever, leukocytosis, infiltrates on x-ray) within 7 days following PTE.

Microbiologically confirmed PNA: positive culture from a lower respiratory tract specimen with a quantitative threshold of ≥ 10^4 cfu/mL.

Data Analysis

Performed using R Studio version 4.3.1. with statistical significance defined as a p-value < 0.05.

Results

Table 1: Baseline characteristics of the study population (n=75)

Demographics	
Age in years	56 (46-64)
Female Sex	45 (60)
Body Mass Index (BMI)	33 (28-40)
Race	
White	45 (60)
Black	25 (33)
Unknown/Not Reported	5 (7)
Ethnicity	
Not Hispanic or Latino	70 (75)
Hispanic or Latino	5 (7)
History of Pneumonia (PNA) Six Months Prior PTE	4 (5)
CTEPH Comorbidities	
Antiphospholipid Syndrome (APLS)	6 (8.0)
Splenectomy	3 (4.0)
Ventriculoatrial (VA) Shunt	1 (1.3)
Prior Venous Thromboembolism (VTE)	61 (81.3)
Obesity	47 (62.7)
Additional Operative Procedure	34 (45.3)
Preoperative Hemodynamics	
Mean Right Atrial Pressure (mRAP), mmHg	10.2 ± 6.0
Mean Pulmonary Artery Pressure (mPAP), mmHg	45.8 ± 12.0
Pulmonary Capillary Wedge Pressure (PCWP), mmHg	12.7 ± 5.0
Cardiac Index (CI), L/min/m^2	2.3 ± 0.6
Pulmonary Vascular Resistance (PVR), Dynes.sec.cm^{-5}	610.5 ± 336
Clinical Risk Assessments	
NYHA FC	2.8
6MWD, m	311 ± 176
BNP, pg/mL	252.6 ± 333.7
Pulmonary Function Tests (PFTs)	
Forced Vital Capacity (FVC)	79.8 ± 14.0
Forced Expiratory Volume$_1$ (FEV_1)	74.4 ± 14.4
FVC/FEV_1 ratio	0.78
Total Lung Capacity (TLC)	87.0 ± 16.4
DLCO	64.4 ± 17.6

Values expressed as median (IQR), n (%), and mean ± SD.

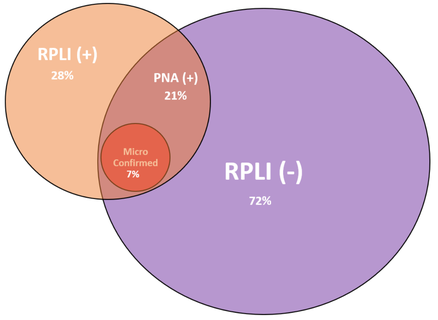

Figure 1: Characteristics of total cohort (n=75) including a breakdown of subjects with and without RPLI, subjects with PNA, and subjects with microbiologically confirmed PNA.

Results

Table 2: Microbiologic data for subjects with diagnoses of RPLI, PNA, and microbiologically confirmed PNA

RPLI	
Rate of Documented RPLI	21 (28)
History of PNA in prior 180 days	4 (19)
Time between PTE and RPLI, days	2 (1,3)
PNA	
Rate of Documented PNA	16 (21)
History of PNA in prior 180 days	0 (0)
Rate of Microbiologically Confirmed PNA	5 (7)
Time between PTE and PNA, days	5 (3,5)
Diagnostic Sampling	
Rate of Diagnostic Sampling Performed	9 (42.9)
Rate of Positive BAL/NBBAL	5 (55.6)
Haemophilus parainfluenzae	1 (20.0)
Pseudomonas aeruginosa	2 (40.0)
Staphylococcus aureus	2 (40.0)
Methicillin-resistant *Staphylococcus aureus* (MRSA)	1 (50.0)
Postoperative Antibiotics in Post-PTE PNA Subjects	
Postoperative Antibiotics	
Cefepime	3 (60.0)
Ceftriaxone	1 (20.0)
Piperacillin-tazobactam	1 (20.0)
Vancomycin	1 (20.0)
Duration of Antibiotics in Days	7.5 (2.5,8.8)

Values expressed as median (IQR), n (%), and mean ± SD.

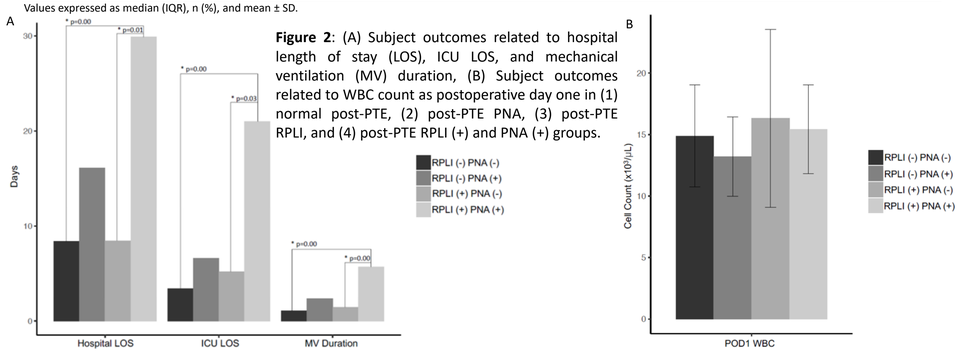

Figure 2: (A) Subject outcomes related to hospital length of stay (LOS), ICU LOS, and mechanical ventilation (MV) duration, (B) Subject outcomes related to WBC count as postoperative day one in (1) normal post-PTE, (2) post-PTE PNA, (3) post-PTE RPLI, and (4) post-PTE RPLI (+) and PNA (+) groups.

Discussion

PNA is a common finding in the setting of RPLI at the time of PTE.

Correlation between RPLI and PNA emphasizes need for comprehensive approach in evaluation, early detection, and management of PNA in patients with RPLI post-PTE.

References

[1]Kerr KM, Auger WR, Marsh JJ, et. Al. Efficacy of methylprednisolone in preventing lung injury following pulmonary thromboendarterectomy. *Chest*. 2012;141(1):27-35.