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Systemic Therapy versus Catheter Directed Techniques for the Treatment of Acute Massive Pulmonary Embolism

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Treatment Options for Acute Massive Pulmonary Embolism

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Abstract

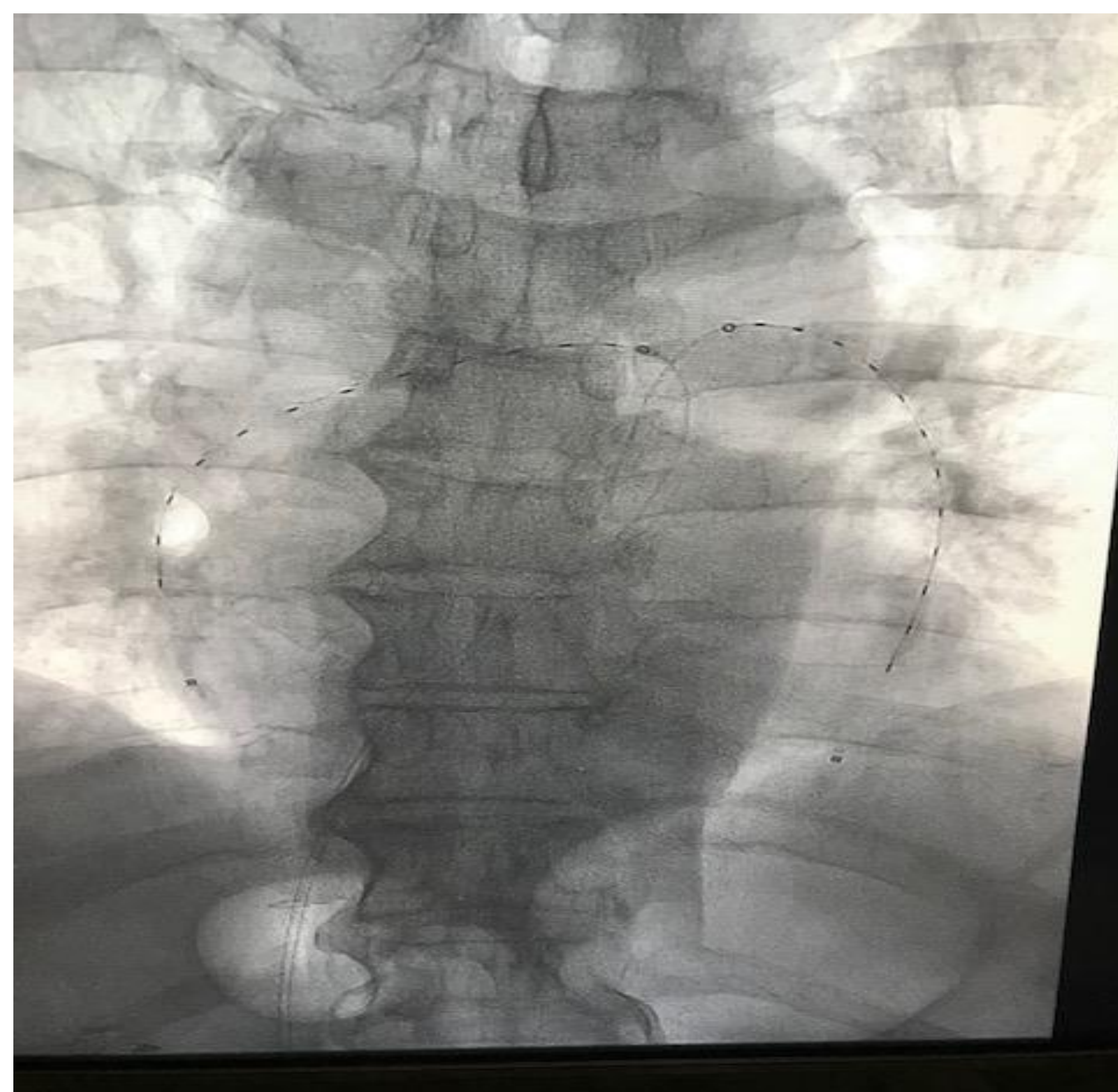
- Acute massive pulmonary embolism is characterized by obstruction of the pulmonary arterial tree that exceeds 50% of the cross-sectional area causing acute and severe cardiopulmonary failure from right ventricular overload.
- Systemic thrombolytic therapy is recommended as standard, first-line treatment in patients with massive pulmonary embolism unless contraindicated and catheter directed therapies, including low dose thrombolytic administration directly into thrombus and mechanical thrombectomy can be adjunctive or used as an alternative to systemic treatments.
- This literature review researched articles looking at both systemic thrombolysis and endovascular techniques for the treatment of acute massive pulmonary embolism with an emphasis on long term clinical outcomes.
- Study results demonstrated the efficacy and safety of systemic thrombolysis and catheter directed therapies as well as adverse effects; however, further randomized trials are needed, as acknowledged by many of the authors included in this paper, comparing both treatment options for hemodynamically unstable patients with emphasis on long term sequelae.

Introduction

- Systemic thrombolysis is standard, first-line treatment for a patient presenting with hemodynamically unstable pulmonary embolism, but data from randomized trials using catheter directed techniques is gaining attention as a viable option for patients who have contraindications to high-dose systemic thrombolysis

Statement of the Problem

- Deciding on a treatment plan for a patient presenting with an acute massive pulmonary embolism can be challenging for some clinicians. Systemic thrombolytic therapy continues to be standard, first-line therapy, but new technologies using catheter directed techniques with a combination of thrombectomy and intraclot thrombolysis are demonstrating safety and efficacy and are gaining support in the medical community.



Research Questions

- In patients presenting with acute massive pulmonary embolism, how does the use of systemic thrombolytics compare in efficacy and safety over catheter directed therapies?
- Is there improvement in quality of life, dyspnea, and functional capacity with catheter directed thrombolysis and thrombectomy compared to systemic thrombolysis?

Literature Review

Pathology of Pulmonary Embolism

- Thrombus occurs when there is a disruption in the mechanisms between blood coagulation and anticoagulation, and PE can follow when thrombus from a deep vein thrombosis (DVT) breaks off and travels to the pulmonary circulation, although non-thrombotic material like fat, tumor or air can also be the source (Giordano, Jansson, Young, Hogan, & Kabrhel, 2017).
- If the DVT forms in a large vessel, it is more likely to dislodge and embolize the pulmonary artery occluding some degree of the vasculature.
- Large thrombi can straddle the bifurcation or obstruct the entire pulmonary outflow tract, increasing the strain on the right heart and leading to severe hypotension and death (Giordano, Jansson, Young, Hogan, & Kabrhel, 2017).

Treatment Options for Pulmonary Embolism

- Depends on the hemodynamic stability of the patient and the clot burden.
- Therapy consists of anticoagulation, systemic thrombolytics and endovascular therapies including mechanical thrombectomy and intraclot thrombolysis (Chechi et al., 2009).
- Systemic thrombolysis is standard, first-line treatment with low risk for major hemorrhage in selected patients.
- Catheter directed therapies, including low dose thrombolytic administration directly into thrombus and mechanical thrombectomy can be adjunctive or used as an alternative to systemic treatments.

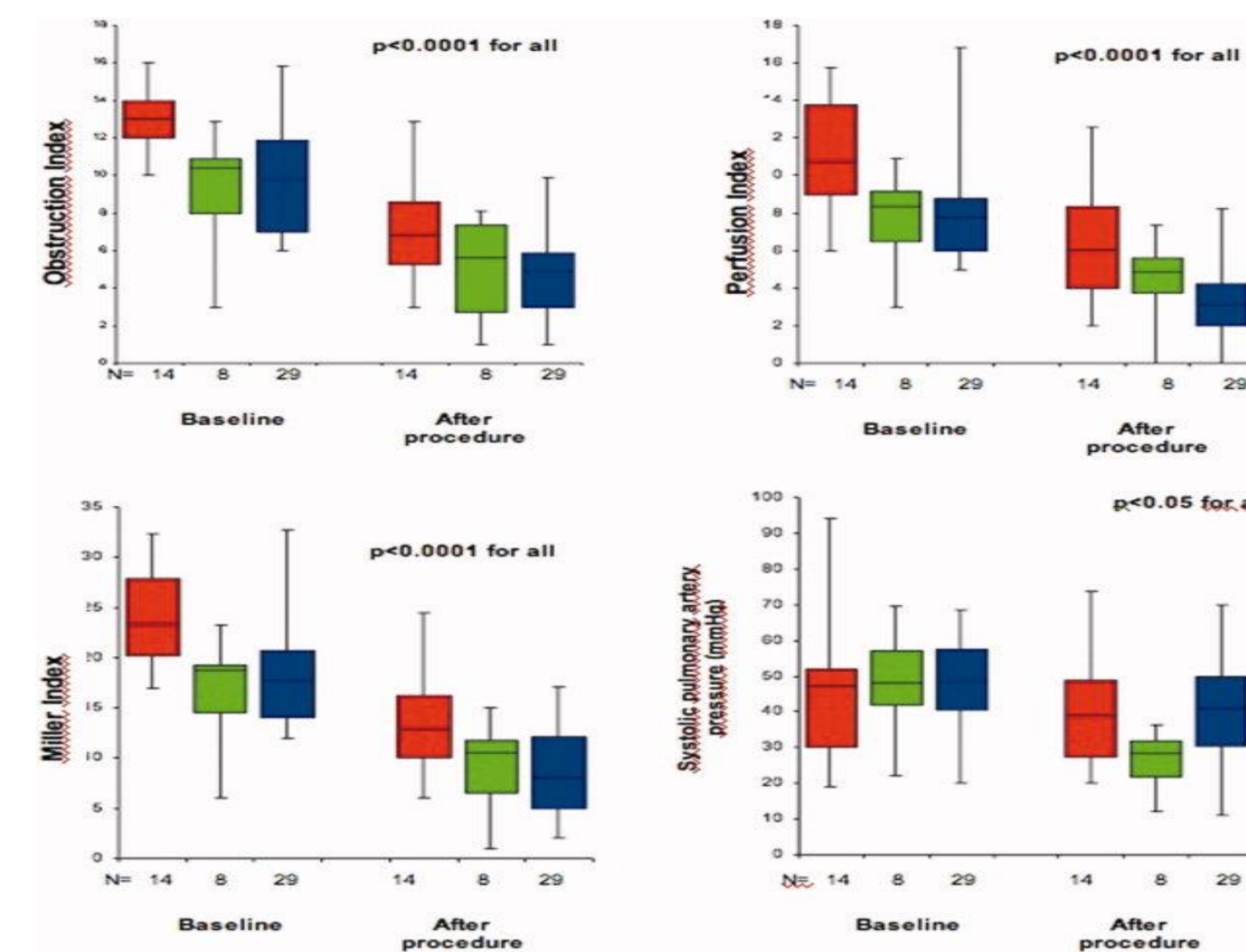
Safety of Systemic and Endovascular Therapy

- Major and minor bleeding remain a concern when using thrombolytics even though evidence suggest these agents dissolve clots more rapidly than heparin and reduce the death rate associated with PE (Hao, Dong, Yue, & Liu, 2015).
- Systemic thrombolysis demonstrates an increased risk of hemorrhage when compared to catheter directed intraclot lysis (Kuo et al., 2009).
- A meta-analysis conducted by Bloomer et al. (2017), demonstrated low bleeding complications with CDT

Long Term Sequela

- When treating hemodynamically unstable patients presenting with pulmonary embolism, it's important to consider not only the immediate threat, but also long term sequela like quality of life (Kahn et al., 2017).
- Hemodynamically unstable patients may not do well once diagnosed and treated for massive pulmonary embolism (Kahn et al., 2014).

- The ELOPE (Evaluation of Long-term Outcomes after PE) cohort study provided new information on prognosis following pulmonary embolism (Kahn et al., 2017).
- Data provided by Kahn et al. (2014) did show chronic thromboembolic pulmonary hypertension was found to range from 1 to 4% with a poor prognosis and a median survival of 12-24 months.



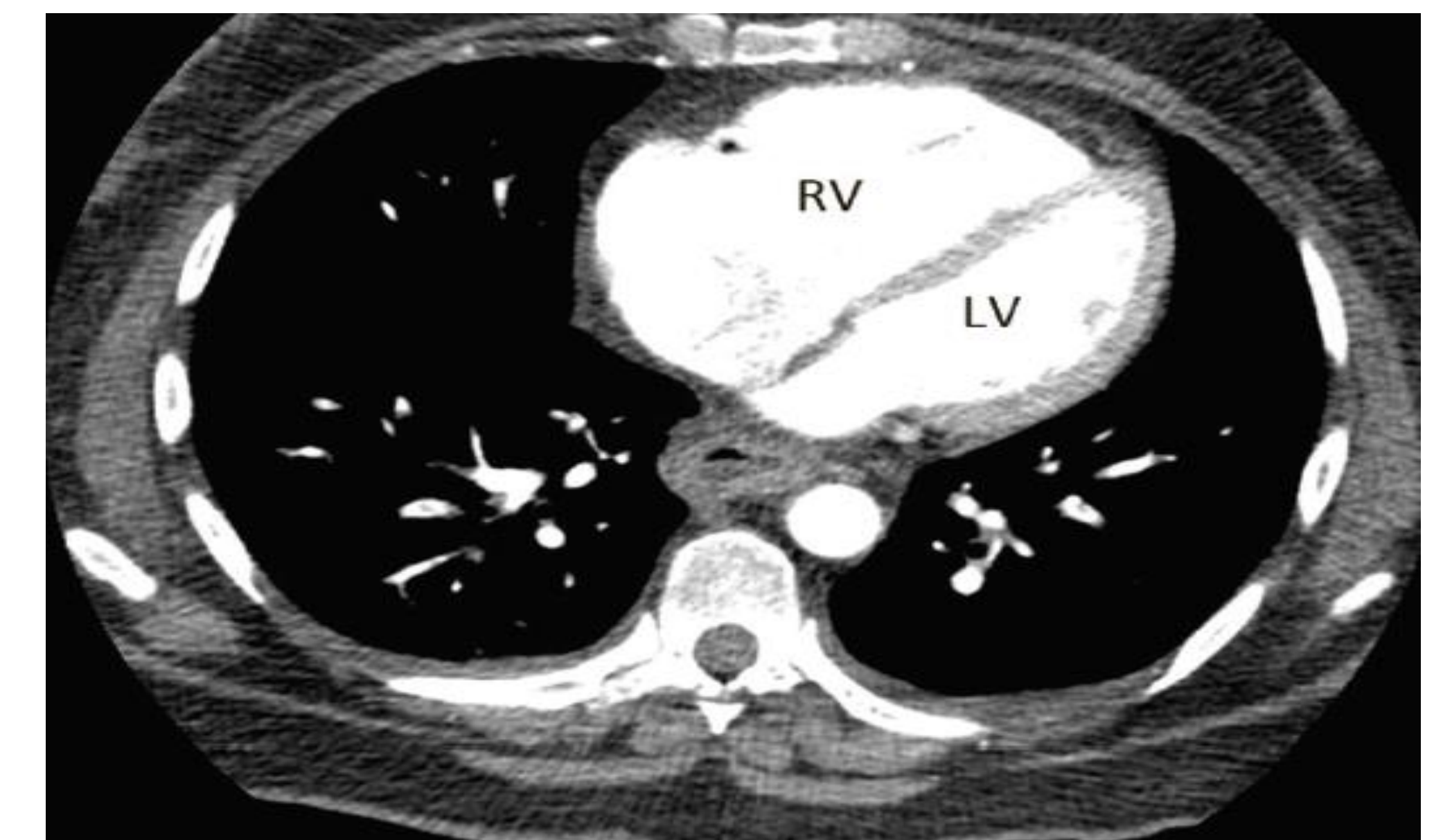
- Improvement in obstruction, perfusion, Miller indexes, and systolic pulmonary artery pressure before and after rheolytic thrombectomy according to hemodynamic compromise (i.e., shock, red bars; hypotension, green bars; right ventricular dysfunction, blue bars) Chechi et al. (2009).

Discussion

- As the first line treatment for hemodynamically unstable patients presenting with pulmonary embolism, systemic thrombolysis is well tolerated and efficacious; however, it may be contraindicated in patients with prior intracranial hemorrhage, cerebral vascular lesions, malignancy, active bleeding, bleeding diathesis or in patients older than 65.
- Systemic thrombolytics remains the gold standard for treatment of massive PE for patients without contraindications.
- Catheter directed therapies allow for both low dose intraclot thrombolytics and mechanical thrombectomy and may prove beneficial for the long-term sequela related to massive thrombus.
- Chronic thromboembolic pulmonary hypertension can be found in a small percentage of patients post pulmonary embolism which carries a poor prognosis and although the clinical significance of residual pulmonary vascular abnormalities continues to be poorly understood, the literature review determined that patients may not do well long term once diagnosed and treated with thrombolytics (Kahn et al., 2014).
- Chronic thromboembolic pulmonary hypertension was found to range from 1 to 4% with a poor prognosis and a median survival of 12-24 months (Kahn et al., 2017).
- The question of what is the best treatment option for patients presenting with hemodynamically unstable massive pulmonary embolism was not definitively answered in my review of the literature and shows that further prospective research, comparing systemic thrombolytic therapy to catheter directed treatments to include long-term outcomes, is indicated.

Applicability to Clinical Practice

- Diagnosis of PE uses a combination of techniques including a D dimer, CTA and scoring systems like Geneva, Wells, and Miniati and studies have demonstrated a low probability of pulmonary embolism if the D-dimer is normal and the scoring system used shows a low probability. This is important data for clinicians working in rural areas where access to CTA might not be available.
- The efficacy and safety of both systemic and catheter directed therapies appears comparable depending on which study you read, especially looking at short term outcomes.
- Several studies have looked at long-term sequela post pulmonary embolism and the role residual thrombus plays in quality of life measures. The clinical significance of residual pulmonary vascular abnormalities continues to be poorly understood but there is agreement that these patients may not do well long-term due to chronic thromboembolic pulmonary hypertension.



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