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Apr 7th, 9:00 AM - 12:00 PM

### Percutaneous Mechanical Right Ventricular Support

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## Introduction

•Ventricular assist devices may be used in patients with heart failure refractory to standard management. Although left ventricular assist devices are more often employed, patients with right ventricular dysfunction may also be treated with percutaneous mechanical support

## History

- A 38-year-old obese male with a medical history of alcoholism presented to the hospital with a complaint of dyspnea. He was found to have volume overload and was given intravenous diuretics. However, he had progressive renal insufficiency, hypotension requiring vasopressor support, and worsening respiratory status requiring mechanical ventilation
- Transthoracic echocardiography showed a severely enlarged right ventricle, reduced RV function, normal RV wall thickness, moderate to severe tricuspid regurgitation, a severely dilated right atrium, ventricular septal flattening, and moderate pulmonary hypertension. Left ventricular ejection fraction was 65-70%, LV diastolic function was normal, and there were no other significant valvular abnormalities
- Troponin levels were negative, and the electrocardiogram showed sinus tachycardia without ST-segment abnormalities. Computed tomography of the chest showed no evidence of pulmonary embolism, no chronic lung disease, and a dilated right ventricle
- A right heart catheterization was performed:

### Right heart catheterization

Right atrial pressure of 29 mmHg (2 – 6 mmHg)

Right ventricular pressures of 50/24 mmHg (15-25/0-8 mmHg)

Pulmonary artery pressures of 56/35/43 mmHg (15-25/8-15/10-20 mmHg)

Pulmonary capillary wedge pressure of 22 mmHg (6-12 mmHg)

Prognostic Impact of Pulmonary Artery Pulsatility Index (PAPI) score of 0.3 to 0.6 (>1).

## Hospital Course

- The percutaneous right ventricular assist device was placed, and the patient was given a trial of epoprostenol for right ventricular afterload reduction
- Glucocorticoid therapy was also provided to lessen vasopressor requirements
- The hospital course was complicated by sepsis due to pneumonia and presumed central line-associated bloodstream infection requiring antibiotic therapy, anemia secondary to device-related hemolysis requiring blood transfusions, renal failure requiring renal replacement therapy, and candidemia requiring antifungal therapy. Due to concern for device-associated infection, his central lines were removed and subsequently replaced.
- The patient was able to be weaned off the mechanical circulatory support device and it was subsequently removed
- Further cardiac imaging (CCTA, TEE) did not reveal any other structural abnormalities
- Progressive fluid volume overload, pulmonary hypertension, and alcohol toxicity were the likely causes for this patient's right heart failure



Figure 1: Right ventricular percutaneous assist device under fluoroscopy

## Discussion

### Potential etiologies of right-sided heart failure:

•Left-sided heart failure, pulmonary hypertension, chronic pulmonary disease, myocardial infarction, pulmonary embolism, myocarditis, valvular dysfunction, congenital anomalies, and others

### How Percutaneous RVADs work:

- Device pumps blood from inferior vena cava, superior vena cava, or the right atrium into the pulmonary artery thus bypassing the right ventricle
- By reducing volume overload on the right ventricle, improvement in myocardial contractility often occurs

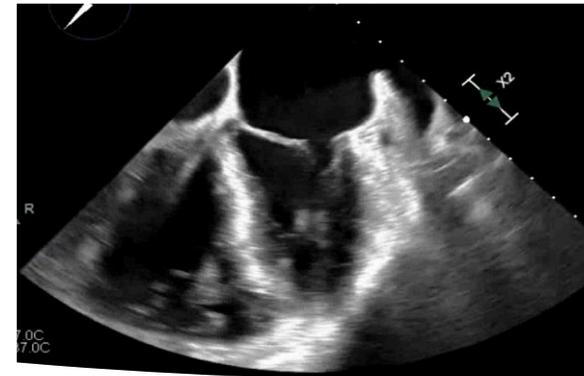


Figure 2: TEE showing a dilated right ventricle

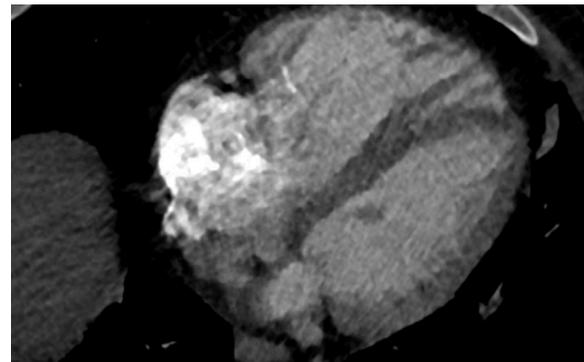


Figure 3: Coronary CT showing a dilated right ventricle

### Device indications:

- Reduction in pressure overload resulting from advanced left-sided heart failure, pulmonary hypertension, or acute pulmonary embolus
- Reducing volume overload resulting from right-sided valvular insufficiency or left-to-right shunts
- May increase cardiac output in patients with decreased contractility and shock in acute myocardial infarction or myocarditis
- Right ventricular failure after durable left ventricular assist device (LVAD) placement
- May be used in addition to inotropic agents (milrinone, epinephrine, dopamine, dobutamine)

### Potential complications:

- Venous thrombosis, infections, device malfunction, cardiac tamponade, hemolysis, bleeding complications, and cardiac arrhythmia

## Conclusion

- The addition of percutaneous RVAD support to patients with right-sided heart failure may provide additional support while medical management is performed

## References

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- Wong, A., & Sin, S. (2020). Short-term mechanical circulatory support (intra-aortic balloon pump, Impella, extracorporeal membrane oxygenation, TandemHeart): a review. *Annals of translational medicine*, 8(13), 829. <https://doi.org/10.21037/atm-20-2171>

