JACC: CASE REPORTS
PUBLISHED BY ELSEVIER ON BEHALF OF THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION. 

VOL. 2, NO. 6, 2020

EDITORIAL COMMENT

# When the Neighbor Is at Fault

## Constrictive Pericarditis After Bilateral Lung Transplantation*

Yevgeniy Brailovsky, DO, MSc,[a] Estefania Oliveros, MD, MSc,[b] Sean Pinney, MD[b]

The pericardium serves to protect the heart and preserve its normal function and mechanics. It also has immunological, paracrine, vasomotor, and fibrinolytic roles (1). The compliance of thickened pericardium is impaired in constrictive pericarditis (CP), which leads to decoupling of the intrapericardial and intrathoracic pressure and interventricular interdependence. These mechanisms underlie the pathologic manifestations, physical exam signs, and findings on diagnostic imaging (**Figure 1**) (2).

In this issue of *JACC: Case Reports,* Logan et al. (3) describe an interesting case of a 65-year-old man with idiopathic pulmonary fibrosis who underwent bilateral lung transplantation complicated by new onset heart failure. After considering a broad differential and performing extensive workup, the investigators concluded that the most likely etiology was constrictive pericarditis. CP is a rare entity (3). Risk of progression to CP is low (<1%) in viral and idiopathic pericarditis, intermediate (2% to 5%) in immune-mediated pericarditis and neoplastic pericardial diseases and high (20% to 30%) in bacterial pericarditis (4). The most common etiologies for CP are idiopathic or viral (42% to 9%), post-cardiac surgery (11% to 37%), radiation therapy (9% to 31%), connective tissue disease (3% to 7%), and post-infectious, including tuberculosis (3% to 6%) and others ( <10%) (4). There are also disease-specific risk factors pertinent to patients post-lung transplantation that Logan et al.(3) indicate: cytomegalovirus reactivation, uremia, or infections (3). Other factors involved are surgical approach and delayed removal of the chest tubes which may precipitate Dressler syndrome. Logan et al. (3) describe surgical technique of the lung transplantation where they entered the pericardium before cardiopulmonary bypass. Disruption of the pericardium in addition to delayed chest closure may have precipitated a strong inflammatory reaction.

### DIFFERENTIAL DIAGNOSIS OF DYSPNEA AFTER LUNG TRANSPLANTATION

Dyspnea after lung transplantation can be worrisome. The investigators rightfully considered infection, acute and chronic graft rejection, airway stenosis, pleural complications, thromboembolic disease, malignancy, cardiovascular disease, and renal dysfunction. It is also imperative to rule out tuberculosis, especially in patients on immunosuppression such as in this case.

### DIAGNOSTIC CONUNDRUM

The diagnosis of CP relies on demonstration of interventricular interdependence and decoupling of the intrathoracic and intrapericardial pressure. During inspiration, venous return to the right side is augmented, while pericardial restraint does not allow the right ventricle (RV) to expand outward, causing leftward bowing of the interventricular septum, thereby compromising left ventricular (LV) filling. This in turn leads to a decrease in LV stroke volume and a decrease in systemic blood pressure (2).

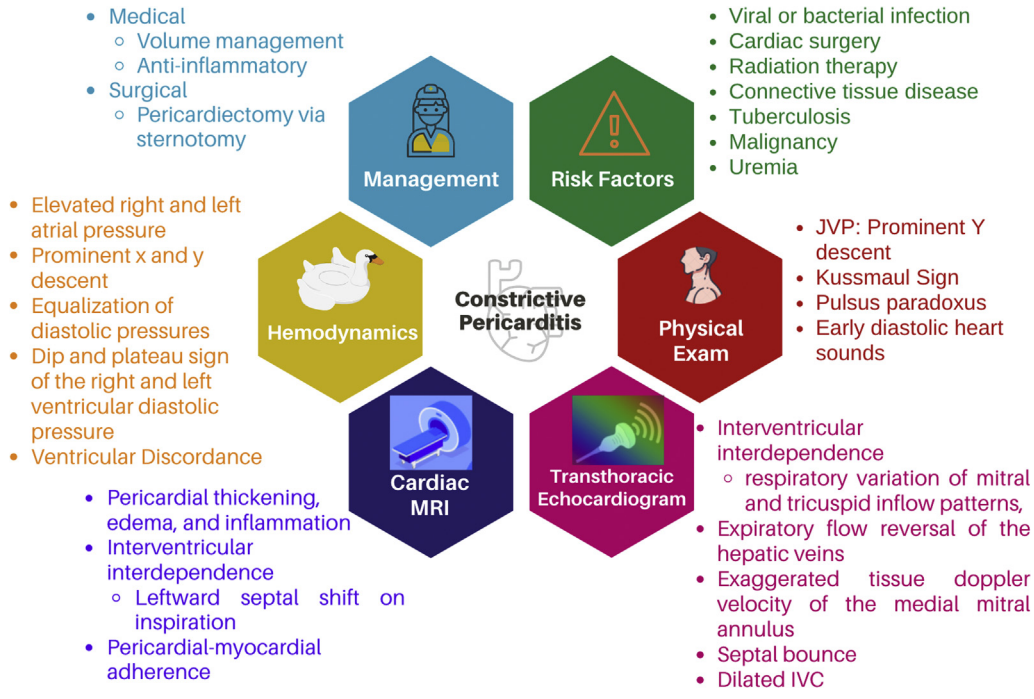
*Editorials published in *JACC: Case Reports* reflect the views of the authors and do not necessarily represent the views of *JACC: Case Reports* or the American College of Cardiology.

From the [a]Center for Advanced Cardiac Care, Columbia University Irving Medical Center, New York, New York; and the [b]Zena and Michael A. Wiener Cardiovascular Institute, Icahn School of Medicine at Mount Sinai, New York, New York. Dr. Pinney has received personal fees from Abbott Inc., CareDx Inc., Medtronic Inc., and Procyrion. Both other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC: Case Reports* author instructions page.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2020.04.047

**FIGURE 1 Approach to Clinical Suspicion, Physical Exam, Diagnostic Testing, and Management of Constrictive Pericarditis**




IVC = inferior vena cava; JVP = jugular venous pressure; MRI = magnetic resonance imaging.

The classic physical exam findings of CP are helpful but inconsistently present. These include a prominent "y" descent of the jugular venous pulse (5); Kussmaul's sign (failure of venous collapse or venous pressure increase during inspiration), which may also be present in RV failure, pulmonary embolism, and RV infarct (6); pulsus paradoxus, defined as a fall in systolic blood pressure >10 mm Hg during inspiration; and a pericardial knock, described as a high-pitched sound during ventricular filling "snapping" in character sometimes confused with an S3 (7).

Classical echocardiographic signs of CP include interventricular septal bounce, dilated inferior vena cava, respiratory variation of mitral and tricuspid inflow patterns, expiratory flow reversal of the hepatic veins, and exaggerated tissue Doppler velocity of the medial mitral annulus (e') (8). Combining ventricular septal shift, medial mitral e', and hepatic vein expiratory diastolic reversal ratio yields a favorable sensitivity (64% to 87%) and specificity (91% to 97%) for CP (9). After sternotomy, one frequently sees a septal bounce which lessens the specificity of this finding commonly associated with CP.

Lateral projection of a chest radiograph may reveal pericardial calcification, but it is present in only 20% to 30% of patients (10,11). Computed tomography can also show pericardial thickening (>4 mm) or calcification, as shown in this case, and it may be helpful to outline coronary, cardiac, and pericardial anatomy before pericardiectomy. Up to 18% of patients with confirmed CP can have normal pericardial thickness (12). Although not undertaken in this case, cardiac magnetic resonance imaging can show pericardial thickening, edema, and inflammation. Additionally, it can provide physiologic information of interventricular interdependence that is central to the diagnosis of CP, and may show pericardial-myocardial adherence (8). There has been a shift favoring noninvasive techniques for assessment of CP; however, invasive hemodynamics remains the gold standard.

## INVASIVE HEMODYNAMICS

Typical findings include elevated right and left atrial pressure, prominent x and y descent, equalization of diastolic pressures in all chambers, and dip and plateau signs of the right and left ventricular diastolic tracings (2). Discordant respiratory variation in LV and RV pressures are most useful in differentiating CP

from other pathologies with excellent sensitivity (97%) and specificity (100%) (13).

## MEDICAL MANAGEMENT

Diuretics are helpful in the management of edema and hepatic congestion but provide only partial relief. Furthermore, diuresis should be used cautiously, as patients can be dependent on adequate preload to maintain cardiac output.

CP can be transient in up to 17% of cases and therefore does not always require pericardiectomy (14). A trial of anti-inflammatory therapy can be attempted if there is evidence of pericardial inflammation on cardiac imaging or biomarkers (15). Also, unusual in this case is that most transplantation patients, particularly heart transplant recipients, infrequently develop CP because of their chronic use of steroids and other immunosuppression.

## SURGICAL MANAGEMENT

Surgical planning is important. A sternotomy allows the surgeon access to remove all the constricting pericardial layers, whereas a left anterolateral thoracotomy allows only partial resection leading some to argue against using such an approach (16,17). Furthermore, pericardiectomy in immunocompromised patients carries a high risk for bleeding, infection, and mortality. In general, pericardiectomy is associated with substantial operative mortality of 6% to 12% and it may be reasonable to perform surgery by experienced surgeons in high-volume centers (16–18). The investigators carefully weighed the risks of pericardiectomy and concluded that the benefits outweighed the risks.

## CONCLUSIONS

CP is a rare etiology of heart failure with potential curative therapy. Understanding the risk factors and underlying pathophysiologic principles is essential to maintaining high clinical suspicion, performing targeted physical exam, and diagnostic testing. Logan et al. (3) present a case that highlights diagnostic dilemmas, appropriate testing, and ultimately successful surgical intervention.

**ADDRESS FOR CORRESPONDENCE:** Dr. Estefania Oliveros, Icahn School of Medicine at Mount Sinai, One Gustave Levy Place, Box 1030, New York, New York 10029. E-mail: estefaniaoliveros@gmail.com. Twitter: @EstefaniaOS.

## REFERENCES

**1.** Mebazaa A, Wetzel RC, Dodd -OJM, et al. Potential paracrine role of the pericardium in the regulation of cardiac function. Cardiovasc Res 1998;40:332–42.

**2.** Syed FF, Schaff HV, Oh JK. Constrictive pericarditis — a curable diastolic heart failure. Nat Rev Cardiol 2014;11:530–44.

**3.** Vincent LL, Wan S-H, Steinberg ZL, Kapnadak S, Nishimura RA, Cheng RK. Constrictive pericarditis after lung transplantation. J Am Coll Cardiol Case Rep 2020;2:938–42.

**4.** Adler Y, Charron P, Imazio M, et al. 2015 ESC guidelines for the diagnosis and management of pericardial diseases. Eur Heart J 2015;36:2921–64.

**5.** Hancock EW. Differential diagnosis of restrictive cardiomyopathy and constrictive pericarditis. Heart 2001;86:343–9.

**6.** McGee S. Evidence-Based Physical Diagnosis. Fourth Edition. Philadelphia, PA: Elsevier, 2017.

**7.** Nicholson WJ, Cobbs BWJ, Franch RH, Crawley IS. Early diastolic sound of constrictive pericarditis. Am J Cardiol 1980;45:378–82.

**8.** Klein AL, Abbara S, Agler DA, et al. American Society of Echocardiography clinical recommendations for multimodality cardiovascular imaging of patients with pericardial disease: endorsed by the Society for Cardiovascular Magnetic Resonance and Society of Cardiovascular Computed Tomography. J Am Soc Echocardiogr 2013;26:965–1012.e15.

**9.** Welch TD, Ling LH, Espinosa RE, et al. Echocardiographic diagnosis of constrictive pericarditis Mayo Clinic criteria. Circ Cardiovasc Imaging 2014;7:526–34.

**10.** Austin JHM. The lateral chest radiograph in the assessment of nonpulmonary health and disease. Radiol Clin North Am 1984;22:687–98.

**11.** Ling LH, Oh JK, Breen JF, et al. Calcific constrictive pericarditis: is it still with us? Ann Intern Med 2000;132:444–50.

**12.** Talreja DR, Edwards WD, Danielson GK, et al. Constrictive pericarditis in 26 patients with histologically normal pericardial thickness. Circulation 2003;108:1852–7.

**13.** Talreja DR, Nishimura RA, Oh JK, Holmes DR. Constrictive pericarditis in the modern era: novel criteria for diagnosis in the cardiac catheterization laboratory. J Am Coll Cardiol 2008;51:315–9.

**14.** Haley JH, Tajik AJ, Danielson GK, Schaff HV, Mulvagh SL, Oh JK. Transient constrictive pericarditis: causes and natural history. J Am Coll Cardiol 2004;43:271–5.

**15.** Chang SA, Oh JK. Constrictive pericarditis: a medical or surgical disease? J Cardiovasc Imaging 2019;27:178–86.

**16.** Chowdhury UK, Subramaniam GK, Kumar AS, et al. Pericardiectomy for constrictive pericarditis: a clinical, echocardiographic, and hemodynamic evaluation of two surgical techniques. Ann Thorac Surg 2006;81:522–9.

**17.** Cho YH, Schaff HV, Dearani JA, et al. Completion pericardiectomy for recurrent constrictive pericarditis: importance of timing of recurrence on late clinical outcome of operation. Ann Thorac Surg 2012;93:1236–40.

**18.** DeValeria PA, Baumgartner WA, Casale AS, et al. Current indications, risks, and outcome after pericardiectomy. Ann Thorac Surg 1991;52:219–24.

**KEY WORDS** constrictive pericarditis, heart failure, lung transplantation, pericardium