Comparison of Outcomes of Pericardiocentesis Versus Surgical Pericardial Window in Patients Requiring Drainage of Pericardial Effusions

Samuel E. Horr, MD*, Amgad Mentias, MD, Penny L. Houghtaling, MS, Andrew J. Toth, MS, Eugene H. Blackstone, MD, Douglas R. Johnston, MD, and Allan L. Klein, MD

Comparative outcomes of patients undergoing pericardiocentesis or pericardial window are limited. Development of pericardial effusion after cardiac surgery is common but no data exist to guide best management. Procedural billing codes and Cleveland Clinic surgical registries were used to identify 1,281 patients who underwent either pericardiocentesis or surgical pericardial window between January 2000 and December 2012. The 656 patients undergoing an intervention for a pericardial effusion secondary to cardiac surgery were also compared. Propensity scoring was used to identify well-matched patients in each group. In the overall cohort, in-hospital mortality was similar between the group undergoing pericardiocentesis and surgical drainage (5.3% vs 4.4%, p = 0.49). Similar outcomes were found in the propensity-matched group (4.9% vs 6.1%, p = 0.55). Re-accumulation was more common after pericardiocentesis (24% vs 10%, p <0.0001) and remained in the matched cohorts (23% vs 9%, p <0.0001). The secondary outcome of hemodynamic instability after the procedure was more common in the pericardial window group in both the unmatched (5.2% vs 2.9%, p = 0.036) and matched cohorts (6.1% vs 2.0%, p = 0.022). In the subgroup of patients with a pericardial effusion secondary to cardiac surgery, there was a lower mortality after pericardiocentesis in the unmatched group (1.5% vs 4.6%, p = 0.024); however, after adjustment, this difference in mortality was no longer present (2.6% vs 4.5%, p = 0.36). In conclusion, both pericardiocentesis and surgical pericardial window are safe and effective treatment strategies for the patient with a pericardial effusion. In our study there were no significant differences in mortality in patients undergoing either procedure. Observed differences in outcomes with regard to recurrence rates, hemodynamic instability, and in those with postcardiac surgery effusions may help to guide the clinician in management of the patient requiring therapeutic or diagnostic drainage of a pericardial effusion. **(Am J Cardiol 2017;120:883–890)**

Drainage of a pericardial effusion can be completed by percutaneous needle insertion—pericardiocentesis—or by a surgical procedure to open the pericardium. Limited data exist on which treatment strategy is preferred when both are feasible,[1] and both are given Class I, Level of Evidence C (class IC) recommendations in the European Society of Cardiology 2015 guidelines for management of pericardial disease.[2] In this study we hypothesize that patients who undergo pericardiocentesis will have better outcomes than patients who undergo the more invasive pericardial window for treatment of a pericardial effusion. Given the large volume of cardiac surgery at our quaternary referral center, outcomes in the subset of patients with postcardiac surgery pericardial effusions will also be compared.

Methods

The study population consists of patients who underwent either percutaneous pericardiocentesis or surgical pericardial window for treatment of a pericardial effusion at the Cleveland Clinic main campus between January 1, 2000 and December 31, 2012. Patients were identified through the use of International Classification of Diseases (ICD) procedural billing codes (ICD9 codes: 37.0 and 37.12), the Cardiovascular Information Registry, and the Thoracic Surgery Database, and confirmed through chart review. Exclusion criteria were age less than 18 years and undergoing another procedure at the time of the pericardial window, such as a valve replacement or coronary artery bypass grafting. Patients who underwent an emergency procedure during a cardiac arrest without a clear diagnosis of pericardial effusion were also excluded. Patient demographics, clinical data, echocardiographic variables, laboratory values, and patient outcomes were collected by manual chart review and through the use of the Cleveland Clinic clinical and echocardiography databases. Echocardiographic results were reviewed and manual review of echocardiograms was done when variables were missing or discrepancies existed. Review was done in accordance with current American Society of Echocardiography recommendations on imaging of patients

Heart and Vascular Institute, Center for the Diagnosis and Treatment of Pericardial Disease, Department of Cardiovascular Medicine and Department of Thoracic and Cardiovascular Surgery Cleveland Clinic, Cleveland, Ohio. Manuscript received February 25, 2017; revised manuscript received and accepted June 5, 2017.

See page 889 for disclosure information.

*Corresponding author: Tel: (216) 444-5705; fax: (216) 445-6145.
E-mail address: HorrS@CCF.org (S.E. Horr).

0002-9149/$ - see front matter
http://dx.doi.org/10.1016/j.amjcard.2017.06.003

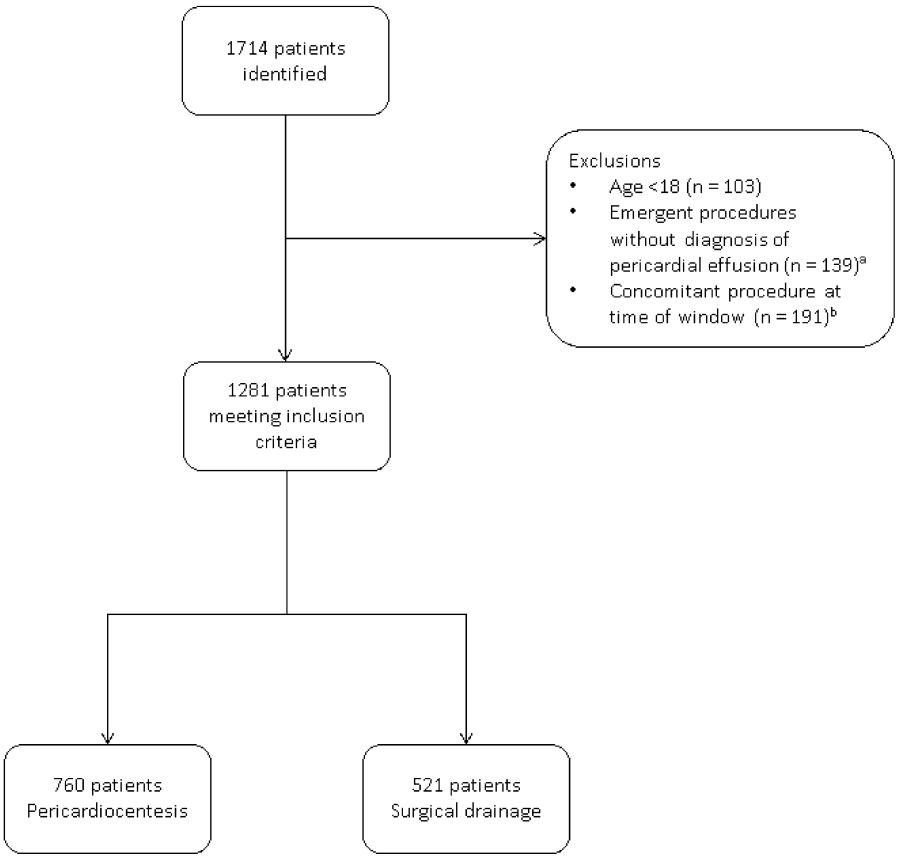

Figure 1. Patient population in this study. [a]Procedures were typically performed as an emergency during a sudden cardiac arrest without a confirmed diagnosis of pericardial effusion either before or after the procedure. [b]A surgery such as valve replacement or coronary bypass done at the time of pericardial window resulted in exclusion from this study.

with pericardial disease.[3] This study was approved by the Institutional Review Board at the Cleveland Clinic Foundation.

There were 1,714 patients identified who underwent either a percutaneous pericardiocentesis or surgical pericardial window at the Cleveland Clinic main campus between January 1, 2000 and December 31, 2012. Of these patients 1,281 patients met the inclusion and exclusion criteria (Figure 1).

Outcomes included in-hospital mortality, 30-day reaccumulation of the effusion defined as increase in size by 1 categorical variable (i.e., small to moderate) or an effusion requiring re-intervention, amount of residual effusion, and procedural success—defined as successful drainage of the effusion with resolution of tamponade or symptoms if present. Morbidity outcomes after the procedure were also recorded. These outcomes included major bleeding—defined as a decrease in hemoglobin of at least 2g/dL or any blood transfusion within the first 48 hours after the procedure—and hemodynamic instability with a systolic blood pressure <100 mmHg or the need for vasopressors within the first 48 hours.

Development of a pericardial effusion after cardiac surgery is a common complication and is frequently encountered in our center. This prespecified subgroup was assessed for a difference in outcomes following either procedure.

Descriptive data are stratified by procedure with categorical variables summarized as frequency and percentage; continuous variables are summarized as mean ± SD. Group comparisons were made using the chi-square and Wilcoxon rank-sum tests as appropriate.

Type of procedure was not allocated randomly; therefore, propensity score-based matching was used to address patient differences and reduce selection bias before comparing outcomes between the groups. Multivariable logistic regression was performed to identify factors that are associated with the pericardial window group. Demographics, symptom and clinical status, cardiac and noncardiac comorbidity, and etiology variables were considered (Appendix A). A directed stepwise approach was used with criteria of $p \leq 0.05$ for retention of variables to form an initial model. Bootstrap bagging with automated analysis of 1,000 resampled datasets was used, followed by tabulating the frequency of occurrence at $p \leq 0.05$ of both single factors and closely related clusters of factors. A parsimonious model was then constructed using the median rule, retaining factors that occurred in 50% or more of the bootstrap models. Thereafter, this model was augmented with other variables available in an attempt to account for any unrecorded selection factors, and to form a saturated model. By solving the resulting equation, a propensity score, representing the probability of having a pericardial window, was estimated for each patient. Using the propensity score, pericardial window cases were matched to pericardiocentesis cases using a greedy matching strategy.