

Title: FUNCTION OF THE PERICARDIUM IN MAN: EFFECTS ON LEFT VENTRICULAR VOLUMES, PRESSURES, AND EJECTION

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Introduction. To the anesthesiologist, the role of the pericardium is of importance in patients who have ventricular dysfunction or pericardial disease, or who undergo pericardiectomy (during cardiac surgery). Measurements of ventricular systolic function and filling pressure may change with these disease states or with pericardiectomy during or following surgery. Diagnostically and therapeutically, it is necessary to discern whether these changes are related to the pericardium or to changes in the ventricular muscle itself. Previous studies in animals indicated that the pericardium significantly affects ventricular diastolic and systolic function. However, our recent work in man demonstrated that the pericardium does not influence ventricular systolic function as measured by stroke work vs. filling pressure curves. Significant questions still remain regarding the effects of the pericardium on ventricular diastolic compliance, systolic ejection, and the more precise Starling relationship of stroke work vs. end-diastolic volume. In this study, we delineate these effects of the pericardium in man.

Methods. After receiving informed consent and approval from the committee on human research, we studied 15 patients scheduled for coronary artery surgery. No patient had valvular disease. Cardiac catheterization revealed ejection fractions (EF) ranging from 0.39 to 0.82, left ventricular end-diastolic volumes (LVEDV) from 44 to 107 ml/M², and pulmonary capillary wedge pressures (PCWP) from 1 to 14 mm Hg. Anesthesia consisted of morphine sulfate (1.5 to 3 mg/kg iv) and diazepam (0.25 to 0.50 mg/kg iv). Ventilation (with 100% oxygen) was controlled. Intraoperative EF was determined with a coaxial cardiac scintillation probe. Immediately before pericardiectomy, surgery was stopped and hemodynamic equilibrium established. Measurement of hemodynamics, cardiac output, and EF's were made at end-expiration while the patient was supine, when the lower extremities were elevated to a 45° position (relative to the chest), and when elevation was 90°. The pericardium was then incised, sutured laterally, and the heart fully exposed. The above measurements were then repeated.

Results. Hemodynamics, diastolic compliance curves (PCWP vs. LVEDV), and systolic function curves (LVSWI vs. LVEDV) were generated before and after pericardiectomy and were compared for each patient. Pericardiectomy did not significantly affect the following hemodynamic variables (table 1): blood pressure (BP); heart rate (HR); systemic vascular resistance (SVR); cardiac (CI), stroke volume (SVI), and stroke work indices (SWI); ejection fraction (EF); end-systolic (ESV) and end-diastolic volumes (EDV); and pulmonary capillary wedge pressure (PCWP). The compliance and Starling curve results for five typical patients (nos. 1, 3, 4, 7, 8) are shown in the figures. Paired-sample t-testing and analysis of variance revealed no significant difference (P > 0.05) between these curves

in any patient. These results were found for normal and moderately elevated values of filling pressures and volumes (PCWP ≤ 24 mm Hg, LVEDV ≤ 218 ml).

Discussion. In man, the pericardium does not affect general hemodynamics, left ventricular diastolic compliance, or left ventricular systolic function (Starling curves) when filling pressures and volumes are normal to moderately elevated. Measures of filling pressure and systolic performance reflect function of the ventricular muscle itself and not the pericardium. Thus, changes in diastolic or systolic function following pericardiectomy should be attributed to alterations in myocardial, and not pericardial, function. Finally, these data suggest that closure of the pericardium after myocardial revascularization is not necessary.

Table 1. Effect of Pericardiectomy on Hemodynamics

	BP	HR	SVR	CI	SVI	LVSWI	EF	LVESV	LVEDV	PCWP
Before	149.9									
pericar-	83.1	66.7	1898	2.38	36.4	48.28	0.56	62.8	131.8	7.5
dectomy	± 4.6	± 2.1	± 96	± 0.12	± 1.7	± 2.90	± 0.02	± 6.4	± 8.8	± 1.3
After	147.9									
pericar-	81.7	67.1	1784	2.41	37.2	49.10	0.54	64.4	139.1	7.3
dectomy	± 4.5	± 1.9	± 123	± 0.11	± 1.8	± 2.72	± 0.03	± 6.9	± 10.1	± 1.5
	2.3									

All values are mean ± SE. BP, mm Hg; HR, beats/min; SVR, dynes·sec·cm⁻⁵; CI, l/min/M²; LVSWI, g·m/M²; LVESV, ml; PCWP, mm Hg.

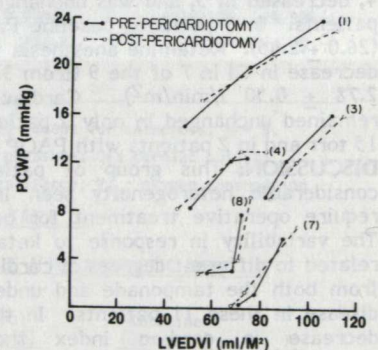


Fig. 1 Effect of the pericardium on compliance.

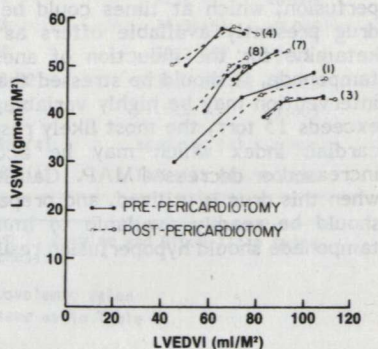


Fig. 2 Effect of the pericardium on Starling curve.