

TITLE: WEDGE PRESSURE AS A PREDICTOR OF ISCHEMIA DURING CABG

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Introduction: Since there are no universally-accepted indications for pulmonary artery (PA) catheterization during coronary artery surgery, the anesthesiologist's decision to use a PA catheter depends upon educated guesses concerning the probable usefulness of the information gained, and the risk of catheter-related morbidity. Other investigators have addressed the issue of PA catheter-related morbidity, and have found that myocardial ischemia may be a frequent complication of catheter insertion.¹ We asked whether the extra information gained--the "wedge" (W) or PA-occluded pressure--enhanced the ability to anticipate ischemic injury: 1. When elevated W is associated with normal heart rate (HR), systolic blood pressure (BP_s), central venous pressure (CVP), and electrocardiogram (EKG), and the W is not treated, how often will EKG evidence of ischemia supervene? 2. How often does EKG evidence of ischemia occur with a normal W?

Materials and Methods: We monitored nineteen coronary artery patients with a V-5 surface EKG, a radial artery catheter, and a triple-lumen PA catheter. The EKG, BP_s, CVP, and PA pressure were recorded continuously, from anesthetic induction until five minutes after sternotomy, and for ten minutes following cardiopulmonary bypass (CPB); W was recorded once each minute during these periods.

We defined ischemia as ST-segment deflections of at least one millimeter. We accepted this electrocardiographic definition of ischemia because:

1. The EKG is the only universally available clinical tool for detecting intra-operative ischemia
 2. We could find no universally-accepted single-lead ST-segment criterion for ischemia in anesthetized (or awake) man, although most investigators have accepted one or two millimeter deflections as the ischemic threshold
 3. Using less rigid ST-segment criteria (2 mm) may increase the incidence of "false-negative" ischemic episodes more than it would decrease the incidence of "false-positive" episodes²
 4. Controlled studies of pacing³ and exercise⁴ induced angina show that abnormalities of myocardial lactate metabolism, LVEDP, and ST-segments occur "at about the same time", and that the magnitude of ST-segment depression related to the degree of LVEDP elevation.
- We considered a W abnormal if greater than 15 torr, BP_s abnormal if greater than 20% above the patient's average awake value, HR abnormal if > 100, or if more than 50% above average awake value, and CVP abnormal if greater than 15 torr, or if it increased 4 torr above the pre-induction value to at least 11 torr.

Anesthesia consisted of morphine-scopolamine pre-medication, followed by nitrous oxide-halothane, with pancuronium for muscle relaxation. Ventilation was mechanically controlled. We did not intervene pharmacologically when an elevated W was the

only abnormality. We did intervene--with intravenous vasodilators or increased halothane delivery--whenever the BP or EKG became abnormal.

Findings:

1. The table describes the number of times that a single hemodynamic abnormality preceded EKG evidence of ischemia by two minutes:

Hemodynamic Abnormality	Number of Occurrences	Subsequent Ischemic Episodes	Abnormality was only warning of Ischemic Episodes
Systolic BP	77 (10 patients)	3 (2 patients)	2 (2 patients)
CVP	38 (10 patients)	5 (4 patients)	2 (2 patients)
HR	13 (3 patients)	3 (2 patients)	NONE
Wedge	73 (16 patients)	2 (2 patients)	2 (2 patients)

2. An elevated W was never the only warning of impending ischemia in our patients with normal preoperative left ventricular function.

3. An elevated W was the only abnormality preceding myocardial ischemia on one occasion in each of two patients with impaired pre-operative left ventricular function.

4. We observed a total of 150 minutes of ischemia among 14 of our patients. The W was normal during 89 of these minutes (in 10 patients).

Conclusions:

1. EKG evidence of ischemia occurs frequently in the presence of a normal W. This suggests that the W may not be the most sensitive clinical index of myocardial ischemia.

2. Ischemia was not predictable by monitoring W in our patients with normal pre-op left ventricular (LV) function.

3. An abnormal W did precede ischemia in some patients with impaired pre-op LV function. Knowing the W may be valuable in predicting ischemia in some patients with abnormal pre-op LV function.

References:

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