

**TITLE:** PULMONARY ARTERY PRESSURE MONITORING IN PATIENTS WITH PHEOCHROMOCYTOMA

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In a group of patients with pheochromocytoma, the relationship between right atrial pressure (RAP) and pulmonary artery occlusion pressure (PAOP) was studied during the perioperative period.

**Methods:** Five patients were monitored with a 7F thermidilation pulmonary artery catheter. Radial arterial, pulmonary arterial, and right atrial pressures were recorded continuously on a stripchart recorder. Intermittent inflations of the balloon on the pulmonary artery catheter allowed simultaneous recording of PAOP and RAP throughout the perioperative course. Anesthesia was maintained with ethrane and pancuronium. Nitroprusside was used intraoperatively to control hypertension and allow intravascular volume expansion prior to tumor removal. Two patients (4 and 7) had a prior history of congestive heart failure. Perioperative fluid requirements were examined in these 5 patients and in an additional 2 patients who were not monitored with PA catheters. In all seven patients, cumulative net fluid balance was determined by: total fluids administered (crystalloid, blood products) minus urine output, gastric output, and estimated blood loss. Institutional approval and informed consent was obtained. Statistical analysis utilized linear regression analysis with level of significance at  $p < .05$ .

**Results:** In the five patients (3-7) where pulmonary pressure monitoring was utilized, RAP was compared to PAOP, both in absolute values and in changes in these values ( $\Delta$ RAP,  $\Delta$ PAOP). Both comparisons demonstrated a poor linear relationship in all patients (correlation coefficients = .01 to .69; slopes = -.63 to .62; and  $r$  values = .01 to .69). (See Table.) During the operative period, the mean net fluid balance was positive  $3.3 \pm .6$  (liters  $\pm$  se). The mean cumulative net fluid balance was 4-5.3 liters positive on each day of the six day study period. Hypotension occurred after tumor removal in the two patients who were not monitored with PA catheters, and who were not aggressively volume expanded prior to tumor removal.

**Discussion:** In our study, potentially misleading information may have been obtained in any of the five patients with pulmonary artery catheters by monitoring only right-sided heart pressures.<sup>1</sup> These findings are not surprising in the two patients with congestive heart failure, since norepinephrine has been shown to induce a disparity between right and left ventricular filling pressures after

myocardial infarction and septic shock.<sup>2</sup> However, chronic catecholamine excess causes myocardial damage histologically, and may explain why the three apparently healthy patients exhibited cardiac dysfunction during the enhanced physiologic stress of the perioperative period.<sup>3</sup> Patients with pheochromocytoma may exhibit a discrepancy between right and left sided filling pressures, particularly during the perioperative period where rapid volume infusions may be required. Since this phenomena may occur in the patient with no clinically apparent cardiac dysfunction, pulmonary artery pressure monitoring should be considered in every patient with pheochromocytoma.

#### RELATIONSHIP OF RIGHT AND LEFT SIDED FILLING PRESSURES\*

Patient	n	RAP vs. PAOP			
		m	b	r	p
3	42	.54	.6	.43	<.01
4	12	-.63	20.0	.45	n.s.
5	37	.62	.3	.69	<.01
6	40	.10	3.7	.18	n.s.
7	83	.35	5.4	.38	<.01

Patient	n	$\Delta$ RAP vs. $\Delta$ PAOP			
		m	b	r	p
3	41	.01	0	.01	n.s.
4	11	.07	.4	.06	n.s.
5	36	.22	.1	.3	n.s.
6	39	.10	0	.14	n.s.
7	82	.30	0	.36	<.01

\* Linear regression analysis where  
 $y = mx + b$ ;  $y = \text{RAP}$ ,  $x = \text{PAOP}$ ,  $m = \text{Slope}$ ,  
 $b = y \text{ Intercept}$ ,  $n = \text{Sample number}$  and  
 $r = \text{Correlation coefficient}$ .

#### References.

1. Lowenstein E, Teplick R: "To (PA) catheterize or not to (PA) catheterize - that is the question." *Anesthesiology* 53(5): 361-363, 1980.
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