

Title: INFLUENCE OF HEPARIN BONDING OF PULMONARY ARTERY CATHETERS ON PLATELETS AND CLOTTING TENDENCY

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Introduction: Previous studies in dogs demonstrated that pulmonary artery catheterization with Swan-Ganz catheters are associated with thrombocytopenia and thrombus formation along the wall of the catheters. The introduction of heparin-coated catheters suggests that platelet consumption might be reduced. This study was performed to test whether the presence of heparin and method of bonding to the catheters influences platelet count, blood clotting (Activated Partial Thromboplastin Time, APTT) or hemolysis *in vivo* as well as to compare these catheters for hemodynamic monitoring.

Methods: Eighteen dogs were divided into three groups of six. Group A catheterized with non-coated Swan-Ganz catheters (NH). Group B catheterized with heparin bond I Swan-Ganz catheters (H1). Group C catheterized with heparin bond II Swan-Ganz catheters (H2). Each dog was anesthetized with thiopental 20 mg/kg body wt. The trachea was intubated and the dog ventilated with a Harvard piston ventilator maintaining alveolar CO₂ between 30-35 mmHg. Anesthesia was maintained with halothane in oxygen. An intravenous catheter was inserted via the jugular vein and the Swan-Ganz catheters inserted percutaneously via femoral vein. The catheter was flushed with non-heparinized solution. Samples for coagulation and hematological analysis were obtained prior to (30 min, 15 min, 0 min) and after (½ hr, 1 hr, 2 hr, 4 hr, 6 hr, 24 hr) insertion of the Swan-Ganz catheter catheterization. At each time interval pulmonary artery main and occlusion pressure and cardiac output were recorded. The catheter was removed six hours after its insertion, examined macroscopically, and the animal awakened. Another blood sample was obtained with the animal awake 24 hours after the time of insertion of the catheter. The data were analyzed by analysis of variance with specific comparison of means by Tukey's test ($p < 0.05$).

Results: Tables 1 and 2 show changes in the platelet count and APTT before and after catheterization. There were no statistically significant differences between the three groups of catheters. However, for all catheters, platelets count significantly decreased with time. The free plasma hemoglobin was 0 mg% at all times. Neither the time required for positioning of the catheters, the frequency response quality nor the cardiac output measurements were significantly different. Only two of the non-heparinized catheters and one of the heparin bond I catheters showed visible clots along their walls after being removed.

Discussion: None of these catheters were associated with hemolysis and the heparin-coated

Table 1
Changes in platelet count after catheterization.
(Mean \pm S.E.; Count $\times 10^3$)

Time							
Catheter	Pre-	Post-catheterization by:					
Group	Cath.	½ h	1 h	2 h	4 h	6 h	24 h
NH	401	374	374	369	358	337*	310*
	40	35	39	32	26	22	32
H1	378	356	358	360	361	329*	340
	22	13	17	16	16	16	29
H2	352	316	323	322	307	296*	302*
	15	18	15	14	14	15	27

*significant difference from the pre-catheter mean ($p < 0.05$)

Table 2
Changes in APTT after catheterization (seconds; Mean \pm S.E.)

Time							
Catheter	Pre-	Post-catheterization by:					
Group	Cath.	½ h	1 h	2 h	4 h	6 h	24 h
NH	15.4	16.2	16.8	17.8	18.2	16.8	18.2
	0.6	0.9	0.8	1.4	1.6	1.4	1.4
H1	14.8	16.5	15.3	16.4	15.8	16.7	15.5
	0.5	0.9	0.4	0.7	0.9	1.2	0.6
H2	15.9	16.4	16.8	16.6	16.8	16.7	17.8
	1.0	1.1	0.8	0.8	0.8	0.8	0.3

catheters did not interfere with coagulation of the circulating blood. The Swan-Ganz catheter is made of polyvinyl chloride, a thrombogenic material that enhances deposition of platelets and this appears to explain the thrombocytopenia observed in this study. The extent of thrombocytopenia was not altered by heparin bonding and this result is consistent with the behavior of platelets at a foreign surface. The functional effectiveness of these three catheters for ease of insertion and fidelity of the recording were not different. In summary, no differences were depicted for the consumption of platelets, blood coagulation, hemolysis, or functional effectiveness for Swan-Ganz catheter with or without heparin bonded to the surface.

References:

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