

Title : PROLONGED HEPARIN ACTIVITY DURING HYPOTHERMIC CARDIOPULMONARY BYPASS

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Introduction. There have been several studies on the intraoperative heparinization and its reversal during cardiopulmonary bypass. Dosages have been based on body weight, surface area, and on results of tests such as the whole blood activated clotting times (ACT).¹⁻⁴ Little information has been based on direct heparin assay. We observed that ACT was longer during cardiopulmonary bypass with hypothermic perfusion than during cardiopulmonary bypass with normothermic perfusion.

A study was conducted to determine whether this was associated with increased heparin levels during hypothermic perfusion.

Methods. Two groups of patients were studied: (1) A control group undergoing cardiopulmonary bypass at normothermia generally for single or double coronary artery bypass grafting. (2) A group undergoing cardiopulmonary bypass with moderate hypothermia and esophageal temperature of 28°C. Most of the latter underwent multiple grafts often combined with valve replacement. Moderate hemodilution to a hematocrit as low as 25% was used in both groups. Heparin was administered in 3 mg/kg doses and heparin was added to pump prime in doses of 1.5 mg/kg every hour in both groups. Blood samples were taken for heparin assay 5 minutes after heparin was given and, thereafter, every 30 minutes during cardiopulmonary bypass. Further samples were taken immediately before protamine was given and five minutes after. The heparin levels were assayed using a modification by John B. Miale,⁵ M. D. of the protamine neutralization test.

Results. The results of this study are shown in Table I. In both groups heparin levels were not significantly different up to 90 minutes of cardiopulmonary bypass; however after this time heparin levels were significantly higher in the hypothermic group. There was some correlation between the increased heparin activity and prolonged ACT as measured simultaneously during hypothermic perfusion.

Discussion. This study shows that the level of circulating heparin is higher during prolonged hypothermic cardiopulmonary bypass than during normothermic bypass. The increased level of circulating heparin seen after 90 minutes of hypothermic bypass is probably due to decreased metabolism of the anticoagulant. Since the heparin levels may

not only be higher in the hypothermic patients but may also vary with the degree of hypothermia. It is necessary to monitor heparin levels in individual patients and it may be misleading to generalize concerning maintenance dosage of heparin and the quantity of protamine needed to counteract its effect.

References.

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TABLE I

Normothermia	Hypothermia
Mean \pm 1 S.E.	
5' 3.90 \pm 1.16	4.30 \pm 1.70 N.S.
30' 4.1 \pm 1.10	4.0 \pm 1.62 N.S.
60' 3.2 \pm 1.13	4.6 \pm 1.70 N.S.
90' 4.2 \pm 1.24	4.6 \pm 1.55 N.S.
120' 4.52 \pm 1.22	9.76 \pm 2.14 p<0.05

heparin levels in IU/ml