TITLE: PREDICTORS OF DIFFICULT RADIAL ARTERY CANNULATION

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INTRODUCTION: Prediction of difficult radial arterial cannulation may prompt the anesthesiologist to procure special equipment, to consider alternative sites, or to employ skilled personnel. This study attempts to identify factors which predict the degree of difficulty likely to be encountered during routine radial artery cannulation.

METHODS: This institutionally approved study was performed in 80 patients scheduled for elective major cardiac or vascular surgery, in whom radial arterial catheterization was an integral part of their normal clinical care. The following factors were recorded:

(a) During the routine preoperative consultation: Age, Sex, Height, Weight, History of peripheral vascular disease, and modified Allen's test result;

(b) Just prior to cannulation: Global evaluation of expected degree of difficulty, Heart rate, Blood pressure, wrist Circumference, wrist skin Thickness, palpable Length and Diameter of the better radial artery, and patient Anxiety Level.

The history, Allen's test, global evaluation and anxiety level were ranked on a three level rating scale (0-2). Success at the time of cannulalation (with a 20 gauge angiocath) was recorded as the number of forward movements required to place the cannula successfully. With the number of attempts used as the dependent variable, multiple regression analysis was used to identify the best predictors of a difficult radial artery cannulation. A factor was included if $p < 0.05$.

RESULTS: With the number of attempts as dependent, only one of the above independent variables entered the equation: the global evaluation made prior to the other assessments at the time of cannulation (R-squared = 0.26). In an attempt to identify what might be incorporated in this global index, another multiple regression analysis showed its association with the arterial length, the arterial diameter, and the results of the Allen's test (R-squared = 0.45).

DISCUSSION: This study indicates that the clinician is able to predict the expected degree of difficulty in one-quarter of the cases, hardly a high score for a self-fulfilling prophecy. The basis for this global evaluation is not entirely clear, but relies in part on the surface anatomy of the radial artery at the time of the attempted cannulation.

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TITLE: PROTAMINE INDUCES ADVERSE METABOLIC EFFECTS

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Protamine may be associated with significant cardiovascular side effects. Recent in vitro evidence suggests that protamine can induce mitochondrial injury interfering with cellular metabolism and organ function.[1] The present study investigated the effect of rate of administration of protamine on total body oxygen consumption in patients undergoing aortic reconstructive surgery.

According to our IRB approved protocol 34 consenting adults were studied during aortic surgery. Group 1 (n=15) patients received protamine following aortic repair at a rate of 1.5 mg/kg over 3 min. Group 2 (n=15) received 1.5 mg/kg over 15 min. Group 3 (n=4) received no protamine over the observation period. Continuous recording of systemic and pulmonary blood pressures, mixed venous oxygen saturation and heart rate (hr) were obtained. Cardiac output measurements were obtained at 30-45 second intervals. Arterial oxygen tension was determined at 2.5 min intervals throughout the observation period for the calculation of dissolved oxygen. Oxygen consumption ($V0_2$) was determined by the Fick equation, oxygen delivery ($D0_2$ = CO x arterial 0_2 content).

RESULTS: Oxygen consumption fell significantly only in group 1 ($p < .0_2$ Wilcox rank sum). There was no change in oxygen consumption in the control group. While cardiac output fell in both groups 1 and 2 there was no change in mixed venous 0_2 (Fig 2,3) in either group. Cardiac output and BP fell similarly in both groups. There were no hemodynamic changes in the control group during the observation period. $D0_2/V0_2$ was greater than 5 at all time periods in all three groups.

DISCUSSION: There is an uncoupling of oxygen consumption/oxygen delivery during protamine administration following aortic reconstructive surgery. This is evidenced by the reduction in oxygen consumption (Group 1) despite $D0_2/V0_2$ ratios greater than 5. This strongly suggests adequate oxygen delivery and inadequate utilization following protamine.[2] This is the first clinical demonstration of protamine induced reduction in oxygen utilization. Therefore even if the hemodynamic responses to protamine involve direct or hormonally induced causes there appear to be important cellular effects leading to inadequate utilization of oxygen.

REFERENCES:
1. Surgery 1989;106:378-385.
2. J Surg Res 1989;47:242-247.