

Title : DOES HEPARIN AFFECT POTASSIUM VALUES?

Authors : A.B. Hill, M.D., M.L. Nahrwold, M.D., D. Noonan, M.D. and P. Northrope, M.D.

Affiliation: Department of Anesthesia, University of Michigan Medical Center,  
Ann Arbor, Michigan 48109

**Introduction.** Ward<sup>1</sup> reported peripheral venous serum potassium levels were higher than arterial plasma levels. Hill<sup>2</sup> found no significant difference in potassium values between central venous serum and arterial plasma. Due to these discrepancies we investigated the effects of (1) a tourniquet, (2) varying heparin concentrations and (3) sample dilution on potassium values.

**Methods.** Group I: 20 patients. Blood was simultaneously drawn from a radial artery cannula, a central venous catheter and a peripheral vein after three min tourniquet time. One sample from each site was heparinized with 5 I.U./ml and analyzed within 5 min for potassium. A second unheparinized sample was allowed to stand for 20 min, then centrifuged for 20 min before analyzing. Group II: 20 patients. Five syringes containing various volumes and concentrations of heparin were prepared. A sixth syringe was rinsed with heparin, then as much heparin as possible was expelled, just coating barrel and plunger (wash). Arterial blood was drawn into each syringe to make a total volume of 2 mls. Samples were analyzed within 5 min, in random order, on an Orion SS30 sodium/potassium analyzer. Statistical analysis was accomplished by student's paired t-test.

**Results.** In Group I mean plasma potassium values did not differ significantly with time of analysis (Table 1). There was no significant difference in plasma or serum potassium values regardless of site of withdrawal or use of a tourniquet. In Group II, (Figure 1) there was no significant difference in potassium values when samples prepared with 10 I.U. of heparin in 10  $\mu$ l were compared to samples collected in a syringe washed with heparin. There was a significant difference between samples prepared with 200  $\mu$ l or with 400  $\mu$ l of heparin which depended on the number of units of heparin present. Therefore, a definite effect of heparin concentration was noted. There was also a significant difference when samples containing 10 I.U. of heparin were paired on the basis of the volume of diluent.

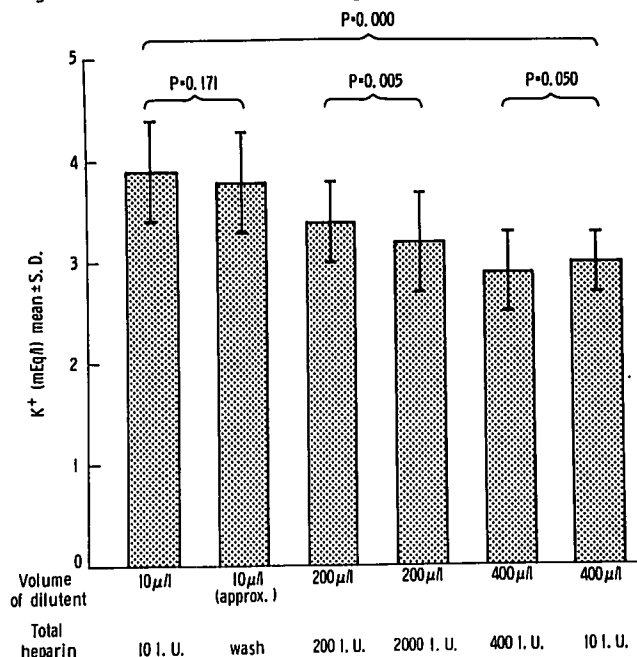
**Discussion.** These data demonstrate that site of sampling, time of analysis, and use of serum or plasma have no effect on measured potassium. The volume and concentration of heparin added to the sample markedly affect the measured values. The highest potassium values were achieved using minimal volumes and concentrations of heparin. These conditions can be achieved by rinsing a syringe with heparin 1,000 I.U./ml

and we conclude that this clinical practice has a sound scientific basis.

Table 1. The Effects of Sample Site and Time of Sampling on Potassium Values

Sample Site	Potassium (mEq/l)	
	5 min post sampling	40 min post sampling
Peripheral venous no heparin (serum)	—	4.31 $\pm$ 0.72
Peripheral venous heparinized (plasma)	4.21 $\pm$ 0.71	4.19 $\pm$ 0.65
Central venous no heparin (serum)	—	4.22 $\pm$ 0.70
Central venous heparinized (plasma)	4.16 $\pm$ 0.66	4.12 $\pm$ 0.65
Arterial no heparin (serum)	—	4.21 $\pm$ 0.65
Arterial heparinized (plasma)	4.11 $\pm$ 0.60	4.09 $\pm$ 0.62

Figure 1. Effects of Heparin Concentration



1. Ward CF, Benumof JL, Saidman LJ: Arterial vs. Venous Potassium: Clinical Implications. Abstracts of 1977 ASA Annual Meeting, p. 343
2. Hill AB, Bolles R, Nahrwold ML, Cohen PJ: A Comparison of Potassium Levels in Arterial and Venous Blood. Abstracts of 1978 ASA Annual Meeting, p. 237