

Title: LOSS OF TUBOCURARINE WITH THE WASHING OF SALVAGED AUTOLOGOUS BLOOD
 Authors: CA Shanks, M.D., MJ Avram, Ph.D., AK Ronai, M.B., B.S., Ph.D., DJ Bowsher, M.D., SL Buss, B.S.
 Affiliation: Northwestern University, Chicago, Illinois

Introduction. Reinfusion of the patient's own blood has advantages over the use of homologous donor blood. The Cell Saver® (Hemonetics, Greentree, MA) recovers blood from the operative field, then filters, washes, and concentrates it to provide packed cells for return intravenously. As most of the plasma lost during surgery is included in the fluid discarded after centrifugation in the Cell Saver, it provides the opportunity to quantitate the extent of drug removal with intraoperative blood loss. This study measured the amount of tubocurarine lost with the washing of autologous blood salvaged during surgery for the correction of scoliosis.

Methods. Ten adult patients (2 males and 8 females, 36 ± 17 (SD) yrs, 63 ± 15 kg) participated in this study after providing institutionally approved informed consent. Anesthesia was induced with thiopental and maintained with isoflurane in oxygen. Sustained muscular relaxation was provided by a pharmacokinetically-designed d-tubocurarine (d-TC) infusion consisting of an IV bolus dose of 0.6 mg/kg d-TC administered simultaneously with the commencement of an IV infusion of d-TC at 0.18 mg/hr/kg. (1) Urine samples were collected at half hourly intervals during the infusion and for at least 24 hours after the infusion, the volume was recorded, and an aliquot was stored at -20°C for later d-TC measurement. Plasma samples were obtained from blood taken at appropriate intervals until 12 hours after the infusion was discontinued and was frozen for later d-TC analysis. The volume of blood salvaged by the Cell Saver was measured and the number of units of autologous packed cells returned to the patient was recorded. An aliquot of the fluid discarded after centrifugation in the Cell Saver was frozen for later d-TC analysis after measuring the volume. Concentration of d-TC in the plasma, urine, and Cell Saver fluid were determined by a recently developed high performance liquid chromatography technique. The pharmacokinetics of d-TC were analyzed with a three-compartment open mammillary model using the SAAM-23 digital computer program. (2)

Results. The mean duration of the d-TC infusions was 3.8 ± 1.0 (SD) hrs, providing a total dose of 80 ± 23 mg. Fluid loading was commenced preoperatively; patients received a total of 6.5 ± 2.6 L. The associated minima for hemoglobin and colloid osmotic pressure were 10.0 ± 1.6 mg/dl and 11.6 ± 1.4 mm Hg, re-

spectively. Intraoperative blood loss was 2.2 ± 1.2 L during a time when the apparent steady state plasma d-TC concentration was 2.0 ± 0.3 mg/L. Only one patient was given more than one unit of bank blood as the Cell Saver returned 2.7 ± 1.4 units of packed cells. The fluid discarded from the Cell Saver contained 0.4 to 3.1 % of the dose administered. This compares with the 6.3 to 24.8% of the dose recovered from the urine intraoperatively. The amount recovered in urine during the first 24 hours, and the pharmacokinetics resemble those described by others. (3)

Discussion. Most pharmacokinetic studies examine plasma drug concentrations, focusing attention on the presence of the drug there and making it easy for some to assume that this represents a significant fraction of the dose administered. The corollary is that massive blood loss would entail significant drug loss. The blood is, however, part of the central compartment which, for most drugs, represents only a small portion of the total volume of distribution. (4) It is, therefore, not surprising that the present data do not support the above corollary.

References.

1. Ramzan MI, Triggs EJ, Shanks CA. The pharmacokinetics of d-tubocurarine administered by combined I.V. bolus and infusion. *Br J Anaesth* 1980; 52: 893-9.
2. Berman M, Weiss MF. SAAM manual (Public Health Service Publication No. 1703). Washington, D.C.: U.S. Government Printing Office, 1967.
3. Meijer DKF, Weiering JG, Vermeer GA, Scaf AHJ. Comparative pharmacokinetics of d-tubocurarine and metocurine in man. *Anesthesiology* 1979; 51:402-7.
4. Henthorn TK, Avram MJ, Frederiksen MC, Atkinson AJ, Jr. Heterogeneity of interstitial fluid space demonstrated by simultaneous kinetic analysis of the distribution and elimination of inulin and gallamine. *J Pharmacol Exp Ther* 1982; 222:389-94.

Table: Tubocurarine dosages and recovery

Total dose, mg	80 ± 23
Infusion time, hours	3.8 ± 1.0
Amount discarded from Cell Saver, mg	1.2 ± 0.8
Amount recovered from urine, mg	
Intraoperatively	13.6 ± 7.9
Postoperative 24 hours	44.7 ± 16.8