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TITLE: EVALUATION OF PLATELET FUNCTION DURING AUTOLOGOUS BLOOD DONATION
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INTRODUCTION. Alterations in platelet function by cardiopulmonary bypass (CPB) may contribute to post-operative bleeding. Previous investigators have advocated the sequestration of prebypass autologous blood to augment postbypass platelet function. At our institution following heparinization, one unit of autologous blood is routinely obtained from the aortic cannula and stored in a preservative free media. The impact of this short term storage system upon platelet function has not been specifically evaluated.

METHODS. Utilizing a protocol approved by the Human Investigational Committee, a prospective study of 22 patients undergoing elective surgery requiring CPB was performed. Anesthetic technique was standardized in all patients. Following heparinization (4 mg/kg) and aortic cannulation, a unit of whole blood was drawn into a preservative free bag (600 cc). The unit was stored at room temperature (18° C) during CPB and was not agitated. Samples for baseline platelet aggregation and activation were drawn from an arterial catheter after incision, and obtained from the autologous unit at completion of collection (Bag 1) and just prior to transfusion (Bag 2). At each sampling interval, blood was obtained for platelet count and red cell indices. Platelet aggregation was performed using a Chronolog aggregometer #540 with platelet rich plasma; ADP 2 µm EPI 5 µm. Platelet activation was determined by flow cytometry, measuring the percent of platelets binding a monoclonal antibody to GMP 140. 5,000 platelets were analyzed for each sample. All values are expressed as mean ± SD. ANOVA with Scheffes F-test was used for multiple comparisons. P<0.05 was considered to be statistically significant.

RESULTS. Data from Bag 2 revealed a statistically significant reduction in platelet aggregation to ADP when compared to baseline values. Platelet activation showed significant increases from baseline to Bag 1 and from Bag 1 to Bag 2. Hemoglobin and platelet counts remained stable throughout the storage period. The mean storage time was 118.9 ± 40.83 min. The estimated volume of blood withdrawn was 450-600 cc. Heparin dose was 330 ± 61.5 mg.

DISCUSSION. The above results demonstrated a statistically significant increase in platelet activation during storage of autologous blood. ADP induced aggregation revealed a statistically significant decrease prior to retransfusion.

Possible explanation for these alterations in platelet function may be due to exposure to the CPB circuit and plastic bag; storage without a glucose source for aerobic metabolism; absence of adequate pH buffering; lack of agitation or too cold a storage temperature for proper platelet preservation.

This method of autologous blood procurement may not ensure the maintenance of normal platelet function after retransfusion. Activated platelets, although morphologically normal, may not contribute to effective hemostasis. Activated platelets are rapidly cleared from the circulation and this, combined with the lack of participation in clot formation, may render them ineffective. In summary, despite preserved platelet count, platelet function assessed by aggregation and activation may be significantly altered in this commonly utilized form of autologous blood collection.

	BAG 1	BAG 1	BAG 2
HGB (gm)	13.6±1.5	11.1±1.8	10.9±15.9
HCT (%)	39.3±4.5	32.5±5.1	32.4±4.3
PLATELET COUNT	258.0±54.4	187.2±44.4	187.4±44.7
% AGG EPI	57.7±27.2	49.3±21.3	52.0±28.8
% AGG ADP	54.7±23.5	50.9±18.8	42.0±23.7*
% ACTIVATION	3.7±2.8*	7.1±5.7*	14.2±9.1*

* = P<0.05

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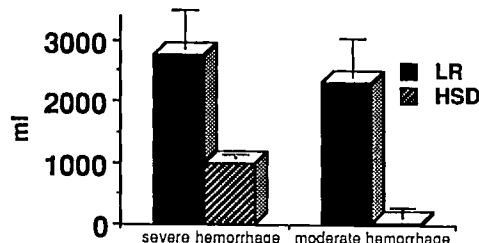
TITLE: LESS NET VOLUME LOADING WITH HYPERTONIC SALINE DEXTRAN RESUSCITATION OF INTRAOPERATIVE HYPOVOLEMIA.

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INTRODUCTION: Hypovolemia is commonly encountered during extensive intraoperative procedures. Resuscitation with conventional solutions leads to net volume retention and is associated with an increased postoperative morbidity.⁽¹⁾ An alternative to conventional fluid therapy is hypertonic solution. Hyperosmotic (7.5% NaCl)/hyperoncotic (6% dextran) solution (HSD) has been used for prehospital resuscitation of hemorrhagic hypovolemia and appears effective in exceedingly small volumes (4ml/kg).^(2,3) We tested the efficacy of HSD for volume replacement of intraoperative hypovolemia.

METHODS: Pigs (30-35 kg) were anesthetized with Isoflurane and ventilated to maintain normocarbida. Intravascular catheters were placed to measure vascular pressures and cardiac output (CO). Urine output was measured with a Foley catheter. After 30 min baseline, each pig underwent a 60 min hemorrhage to either severe or moderate shock by bleeding 30 ml/kg and 20 ml/kg, respectively, and an exploratory laparotomy. Then HSD or lactated Ringers (LR) was infused to return and maintain baseline CO for 2 hrs. A maximum of 10 ml/kg of HSD was used; if further volume was required, LR was used. After euthanasia, tissue samples were obtained for water content measurements.

RESULTS: CO was reduced to 15-30% and 35-55% of baseline in severe and moderate hemorrhage respectively, while mean arterial pressures were reduced to 20-30 mmHg and 30-40 mmHg. Both regimens were able to restore baseline CO within minutes. Both LR groups required infusions equal to 2-4x the shed blood volume or 2-4 liters. The HSD group required a total volume of 1.5-2.3 liters with severe hemorrhage and only 250 - 360 ml with moderate hemorrhage. An invariably greater diuresis with HSD resulted in less net volume loading. Figure shows net volume (infusion volume - urine output).



Water content was increased 15 - 35% in skin, duodenum and jejunum in LR vs HSD. While water content tended to be higher in heart, skeletal muscle and colon, these differences were not statistically significant.

DISCUSSION: Resuscitation of intraoperative hypovolemia was effectively performed with a smaller fluid load of HSD vs. LR. No deleterious effects of hypernatremia, 150-165 mEq/L, were observed with HSD. Differences in net volume loading were marked in the moderate shock group.

HSD may offer physiologic benefits in addition to a reduction in overall intraoperative volume requirement. Lowell concluded that significant morbidity is associated with net fluid overload secondary to decreased oxygen diffusion transport due to interstitial edema and inadequate nutrition due to fluid restriction.⁽¹⁾

In conclusion, intraoperative treatment of hypovolemia with HSD was effectively accomplished with less net volume and tissue edema than conventional LR. These data suggest that hypertonic resuscitation may be safe and effectively reduce some of the morbidity associated with fluid therapy.

REFERENCES: 1) Lowell JA, Schifferdecker C, et al: Critical Care Medicine 18:728-733, 1990. 2) Kramer GC, Perron PR, et al: Surgery 100:239-246, 1986. 3) Vassar MJ, Perry CA, et al: Archives of Surgery, in press, 1991.