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TITLE: CLINICAL EVALUATION OF THE VENOUS ARTERIAL BLOOD MANAGEMENT SYSTEM

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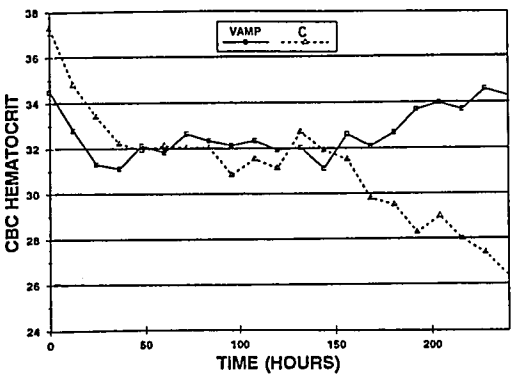
To avoid flush solution contamination of blood samples obtained from arterial catheters, a volume of blood must be discarded. This wasted blood volume (WBV) may contribute to clinically significant anemia requiring red blood cell transfusion. The Venous Arterial blood Management Protection (VAMP) System allows for blood sampling from arterial catheters without blood wastage. With the permission of the Institutional Review Board of Northwestern University Medical School, we compared the VAMP system with conventional (C) methods of blood sampling to determine whether the difference in WBV between the two systems results in a significant difference in hematocrit (HCT) and/or frequency of blood transfusion.

Patients admitted to the medical intensive care unit (MICU) who had arterial catheters placed were randomized to the VAMP or C group. The duration of ICU stay, time in the study, frequency and volume of all blood drawn for testing, WBV, daily HCT measurements, and frequency/volume of blood transfusions were recorded. Statistical analysis was accomplished using Student's unpaired t-test at discrete time intervals during the ICU course. Statistical significance was taken at $p < 0.05$.

There were 34 patients in the VAMP group and 32 patients in the C group. The mean ages of the VAMP and C groups were 66.8 ± 17.3 and 56.3 ± 19.1 years, respectively ($p = 0.02$). There were no statistically significant differences in length of ICU stay, time in the study, frequency/volume of blood transfused, volume of blood drawn for testing or blood lost due to system leaks between the two groups. The mean WBV drawn from arterial lines was significantly greater in the C group (VAMP: 3.1 ± 4.9 ml, C group: 105.6 ± 99.7 ml; $p < 0.0001$). The figure demonstrates a downward trend in the HCT values in the C group which begins at 150 hours and becomes statistically significant during the 180 hour time interval.

The gradual decline in HCT noted in the C group appears to be a function of the greater WBV since all other factors were equal between the two groups. These preliminary data suggest that use of the VAMP system in arterial catheter tubing systems can reduce WBV and may prevent significant anemia in critically ill patients during prolonged ICU stays.



A475

Title: Reactive Hyperemia Produces Superior Anatomic and Flow Characteristics for Inserting a Radial Artery Cannula

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Introduction: Reactive hyperemia induced by tourniquet occlusion of the upper arm for 10 minutes, has been shown to increase forward blood flow by 86% and increase radial artery internal diameter by 28% when compared to baseline[1]. The degree and duration of increased blood flow is in direct proportion to the total metabolic debt[2]. Using this physiologic response, we inserted radial artery catheters and compared ease of insertion with a control group.

Methods: Forty ASA Class II-IV adult patients were studied after obtaining informed consent and IRB approval. Arterial catheters were placed prior to the induction of anesthesia in a standardized fashion by one investigator (SKC) blinded to the technique being studied. An adult sphygmomanometer was placed around the upper arm (20 patients:reactive hyperemia group) or around a one liter bag of saline solution (20 patients:control group), both hidden beneath the drapes. The investigator positioned the wrist and hand prior to leaving the room. The blood pressure cuff was inflated approximately 20 mmHg above systolic pressure around the arm or around the IV bag and left inflated for 10 minutes. Betadine was painted and the arm fully draped to prevent the investigator from witnessing the skin flush of reactive hyperemia. Upon release of the tourniquet, the pulse strength was graded. After 1 minute radial artery cannulation was attempted. Each forward movement of the cannula was marked as an attempt. Time to cannulation was noted when the catheter easily threaded up the arterial lumen. The need for a second, more proximal insertion site was also recorded. Results were analyzed using ANOVA, Kruskal-Wallis, and Chi-Square Tests. A p value ≤ 0.05 was considered statistically significant.

Results: Time to cannulation and number of insertion attempts were significantly lower in the reactive hyperemia group. Cannulation was successful with the first or second attempt in 80% of the reactive hyperemia group compared to 45% in the control group. Difficult cannulation requiring a more proximal percutaneous puncture occurred in 10% of the reactive hyperemia group compared to 25% of the control group. No difference between groups was found regarding average blood pressure, heart rate, pulse strength, or ASA status. No patient had recall of the tourniquet and no significant complications occurred from this technique.

Discussion: Reactive hyperemia produced superior anatomic and flow characteristics for inserting a radial artery cannula. Prior study utilizing real-time color doppler imaging revealed maximal arterial dilation one minute after tourniquet release with gradual return to baseline over three additional minutes. Maximal flow occurred immediately upon tourniquet release. This protocol may assist the clinician when cannulating a radial artery under difficult conditions such as low flow states or vasospasm.

	Control	Tourniquet
Time to Cannulation	154 Seconds*	48 Seconds*
Number of Attempts	3.4*	2.0*
% Requiring Second Cannulation Site	25%*	10%*
Baseline Pulse Strength	2.5	2.8

* $P \leq 0.05$ significant difference

References:
1. Joseph JI, Igidbasian VN, Needleman MD, Nack RVT, Lessin JB, Seltzer JL: Tourniquet induced reactive hyperemia may improve the technique of arterial cannula insertion. Anesthesiology 69:3A, A311, 1988.
2. Lewis T, Grant R: Observations upon reactive hyperemia in man. Heart 12:73, 1925.