

Hemodynamics

Blood Volume - Blood Replacement

Notes from E. Foster Conklin, M.D.

The measurement of blood volume in the intact normal human can be estimated within an error of about 5%. In the postoperative heart case, such measurements are complicated by, among other factors, vasoconstriction, A-V shunts, low cardiac output with visceral capillary bed stagnation; we believe the error to be much greater.

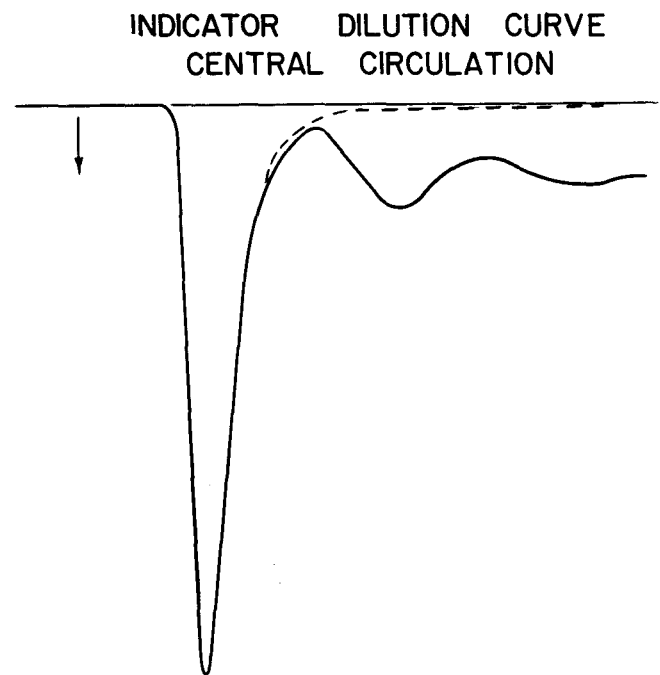
We currently rely on a continuous dynamic measurement of effective circulatory volume, the central venous pressure, rather than on static measurements of an imponderable space, the blood volume. We employ the central venous pressure as our guide to the adjustment of circulating volume as bypass is discontinued and, together with the measured blood loss, as a monitor of post-operative blood replacement.

Reviewing the charts of those patients studied with pre- and post-operative blood volumes, I cannot say that we were seriously misled by blood volume determination. We have abandoned it in the ordinary clinical situation for what we believe a simpler, cheaper and more reliable guide to effective circulatory blood volume, the central venous pressure.

Calculation of Blood Volume from Dye Dilution Curves

$$\text{FLOW RATE} = \frac{\text{AMOUNT INDICATOR INJECTED}}{\text{AREA UNDER CURVE}}$$

$$\text{VOLUME} = \text{FLOW RATE} \times \text{MEAN TRANSIT TIME}$$



Q and **A**

QUESTION: Do the flow requirements of the patient undergoing open-heart surgery differ with each of the various defects and lesions?

ANSWER: There are usually no variations in flow specified by a given defect or lesion. In some instances, when more than one vascular bed must be perfused, the percentage of flow to each area is governed by the tissue mass and vital organs contained in each area. Suggested reading is Galletti and Brecher, Heart-Lung Bypass Chapter XIII.