CURRENT COMMENT

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Estimation of Blood Loss in the Operating Room

In discussions with surgeons concerning the quantity of blood lost by patients during surgical intervention, Drs. Robert W. Virtue and Curtis Pearcy of the University of Colorado in Denver were stimulated to measure the circulating blood volume both before and after operation to find the degree of accuracy in the estimation of blood loss by their (resident) staff.

Their method, for the past few years, has been based on the assumption that a 4 × 4-inch sponge holds 5 cc. of blood, and that a laparotomy pad holds 30 cc. These values have been modified according to the personal estimate of the anesthesiologist as to whether or not the cloths were soaked. This has seemed more satisfactory than to weigh all sponges, because in the dry climate of Denver the weight of a bloody sponge is frequently less than that of the control damp sponge.

Blood volume was measured by using the radioactive iodinated serum albumin dilution technique. Control determination of circulating blood volume on nonoperated patients checked within 5 per cent at 24-hour intervals. The blood volume of 53 patients was measured preoperatively, and again two hours after operation in the recovery room. Adult patients were chosen who were scheduled for major surgery and who were available for determinations the day prior to operation. Blood was replaced as deemed necessary for patient welfare during operation.

The average blood loss was measured to be 734 cc. The average discrepancy between estimates and the measured blood loss was 299 cc. (standard deviation = 239). When the estimated loss was greater than measured, the average discrepancy was 224 cc. (31 cases). When it was lower than measured, the average difference was 400 cc. (22 cases). The greatest blood loss in the series was 3,560 cc. The greatest estimated discrepancy was 1,005 cc. lower than measured. The greatest “high” estimate was 470 cc., in a patient in whom 3,030 cc. loss was measured.

The results obtained certainly did not confirm that clinical estimation of blood loss gave close approximation to the actual loss. An average 40 per cent error emphasizes the necessity for closely assessing the clinical response of the patient during operation in deciding how much blood should be administered. The estimated loss should guide, but not necessarily determine, the amount of replacement.

It is realized that the 5 per cent error of the method would make an error of approximately 300 cc. (5 per cent of 6,000 cc. in average adult) which is nearly the same error as in our estimated method. However, these errors are just as likely to cancel each other. Determination of circulating blood volume by using tagged erythrocytes might be better than the RISA method. A more simplified and rapid method has been described by Albert (S. N. Albert, W. A. Spencer, J. Shibuya, C. S. Coakley, and J. R. Thistlethwaite: Observations on Fluctuations in Blood Volume as Determined with Radioactive Isotopes, Anesth. Analg. 36: 54, 1957).

Regardless of which method is used, it is necessary that someone other than the anesthesiologist caring for the patient be available for the determinations. This severely limits the clinical usefulness of the procedure.

The concept has been advanced that transfusion with one unit of blood should not be practiced, realizing that those who donate blood lose the unit with little change in well-being. Another argument in support of this is that deaths from transfusion are between 1/1,000 and 1/3,000. The references which produced these figures have been evaluated and it was found that they were obtained
prior to 1943. In examining data obtained more recently, Joseph found the mortality rate appears to be 1/250,000! (Joseph, J. H.: Mortality Due to Blood Transfusions, Letters to the Editor, Lancet 2: 709, 1960).

Blood should be given, optimally, to prevent morbidity from loss of blood. When signs of impending trouble from hemorrhage (pallor, hypotension, tachycardia, etc.) appear, blood should generally be administered. One unit may or may not suffice, and this may be more or less than the estimated loss.

**GADGETS**

**Syringe with Self-Retaining Plunger**

Dr. Benjamin I. Schneiderman of Beverly Hills, California, notes that when the ordinary syringes are connected to manifolds or similar devices without interposed valves, the plunger of the syringe is often pushed back by fluid under hydraulic pressure from the suspended bottle.

A number of devices are available to prevent this back flow. Retaining devices can be used to hold the plunger in place. More simply, a hemostat or clamp can be applied to the tube connecting the syringe with the intravenous set. A commercially prepared disposable set with an incorporated check valve is available, as are re-useable check valves. Each of these has certain disadvantages. They may be inconvenient, as when repeatedly applying and removing a clamp. They are not always reliable and even when they are reliable, they are an added expense.

A new, unbreakable, autoclavable polypropylene syringe retains its setting without the use of clamps, check valve, or other devices. In laboratory tests, the syringes were filled with water and suspended from an eight-foot length of tubing attached to an intravenous solution container. No motion of the plunger occurred, upon standing for twenty-four hours. A more severe test was to depress the plunger fully, then quickly withdraw it to the 5 cc. mark (in 5 cc. syringes), while under an eight-foot head of water. Again, the plunger remained stationary.

Ten syringes were filled with water and connected to an air pressure valve. An average pressure of 9.6 p.s.i. was required to cause the plunger to move, with a minimum of 5 p.s.i. (equivalent to a water head of 10.8 feet). When the pressure test was applied to disposable plastic syringes of 10 cc. and 20 cc. size, 25 per cent of the plungers failed to hold at 5 p.s.i. These syringes were therefore regarded as unsuitable for the purpose.

Although the plunger is self-retaining when used as described, it can easily be depressed to discharge the syringe contents, without excessive thumb pressure.

Clinically, the new polypropylene syringes have now been used in 200 operations, with complete satisfaction. The plungers held their settings at all times. Only the 5-cc. size is currently available, but it is contemplated that larger sizes will be developed in the future.

**Modified Endotracheal Catheter**

Drs. Bernard M. Carr, Perry F. Crawford, and Robert E. Lau, of the Lackland Air Force Base Hospital in Texas, believe that there is some advantage in facilitating the removal of secretions collecting above the cuff on the usual endotracheal catheter. They have modified an endotracheal catheter to permit the withdrawal of secretions.

The original suction tube (fig. 1) consisted of a one-quarter inch wide semicircular piece of clear plastic material, which engaged the entire circumference of the endotracheal tube above the inflatable cuff. Oval-shaped holes had been cut on the outer convex surface of the plastic collar. Connected to the plastic collar was a fifteen-inch piece of size 8 plastic