Symposium

Answers to earlier SYMPOSIUM questions are trickling in and will be printed as they arrive. In order to give everyone a chance to respond, we are repeating all of these questions this issue with the assurance that any contributions in answer to early questions will be utilized.

GIVEN: A patient with an aneurysm of the descending or thoracic aorta.

QUESTION: Describe and explain the pump-oxygenator circuitry your team prefers in dealing with this lesion.

At Memorial Hospital we use a Med-Science version of the DeBakey roller pump with a Kay-Cross disc oxygenator. A left-lateral chest incision is made to expose the lesion, the left atrium is cannulated with the blood returned by gravity through 1/2″ silastic tubing to a venous reservoir which feeds the returning blood to the oxygenator.

Blood is returned to the patient via an arterial roller pump with 1/2″ silastic tubing through a Brunswick torpedo tube type heat exchanger then through an arterial filter then to the patient via the left femoral artery. The arterial return and venous return lines are connected together and the priming solution is circulated to remove all air from the system. The priming solution is Lactated Ringer's solution or Lactated Ringer's solution and blood depending on the patient's pre-pump hemoglobin level. The patient is started on bypass and the lesion is repaired and the chest closed.

Submitted by . . .

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GIVEN: A patient is undergoing a cardiac-diagnostic workup.

QUESTION: Describe the technique and equipment your team prefers for determining cardiac output during diagnostic procedures.

EQUIPMENT:

Hewlett-packard (Sanborn) Multichannel Monitor System and Scope with a 350-2700 high gain preamp for dye dilution curves; Sanborn 130 Cardiac Output Computer; Sanborn 37 R-1 Disc Calculator for the Sanborn Computer; Gilford 105 S Constant Flow System; Gilford 103 IR Cuvette-Denistometer; Hamilton gastight No. 1710 special purpose syringe with a Hamilton PB 600 repeating dispenser; Hamilton gastight No. 1010 10cc syringe with a Chaney adaptor; four medicine glasses; Rochester needle, used to draw the calibration blood samples through the Cuvette; sterile venotubing, used to connect the Cuvette outlet to the Constant Flow System; 30cc syringe; 50cc syringe, for the Constant Flow System; remote foot switch marker; six B-D 2cc observation tubes/patient.

PROCEDURE:

Prior to the start of the case 1% detergicide solution (soln.) is dripped through the Cuvette-Denistometer for 20 min. and flushed with 60cc of saline. A Cournand needle is inserted into the left brachial or femoral artery. A 30cc sample of blood is taken for later calibration in a heparinized syringe. A cutdown is performed at the right antecubital fossa to expose the brachial or superficial vein for right heart catheterization and the brachial artery for left heart catheterization.

The right heart catheter is advanced to the main pulmonary artery where cardiac outputs (C. O.) are routinely performed. (When the dye curve starts rising, the computer integrates the dye curve automatically all the way up to the peak, and then down again to

the point identified as 60% of the peak in fig. 4-5.

Mathematically, with an exponential curve, the integral between two points having a known ratio of amplitudes is directly proportional to the integral from the first integral to infinity. The ratio between the 60% and 40% point is one-third the ratio between the 60% point and zero. Therefore, when the computer finds it has reached the 60% point on the curve, it automatically increased its gain by a factor of three, continues its integration to the 40% point, and then shuts itself off. This final integral now represents the integral of the entire dye curve, and avoids the effects of recirculation by integrating between 60% and 40% points at increased sensitivity, and then stopping integration.

A dye curve whose slope is sufficiently abnormal to cause a significant error in the indicated C. O. can usually be recognized from the dye curve recording. If the abnormality does not occur until after the 40% point shown in the fig. 4-5, the abnormality may be ignored—because integration will already be complete.

If the abnormality occurs before the 40% point, its presence will cause an error in the indicated C. O. A "bump" in the curve between the 60% and 40% points, for example, caused by a cardiac shunt, will give an indicated C. O. which is obviously low, and which can be discarded either from observation of the indicated value itself or from observation of the dye curve recording (1). Should a shunt be present in this 60% to 40% downslope integral, the C. O. injections are repeated in the ascending aorta.

A sterile soln. of Cardio-Green (Indiocyanine) is prepared with a concentration (conc.) of 50 mg/20cc for most patients. Also, a soln. with a conc. of 25mg/20cc is used for infants. From this soln. a 2cc sample is injected through the catheter from a 2cc B-D observation tube with a 20 cc syringe filled with 10-20cc of saline attached to give a good bolus of dye.

Before the dye is injected a Gilford Constant Flow System machine is activated to start withdrawal of blood from the Cournand needle at a rate of 28cc/min. through a Gilford Cuvette-Densitometer to establish a base line on

The Questions

1. *Given: X-rays depict a loss of calcium from the bone tissue of a chronic dialysis patient.*

   Question: Describe the techniques preferred by your team in the treatment and/or prevention of this complication.

2. *Given: A post-myocardial infarct patient requires the use of cardio-pulmonary support.*

   Question: Describe in detail the pump-oxygenator circuit and rationale your team would use in the event of a support bypass.

3 *Given: A patient is just diagnosed as having renal failure and is considered a candidate for chronic dialysis.*

   Question: Describe your dialysis program, the equipment you use and the techniques involved much as you would to the patient's personal physician.

4. *Given: A patient is undergoing a cardiac diagnostic work-up.*

   Question: Describe the technique and equipment your team prefers for determining cardiac output during diagnostic procedures.

Please reply by letter, include any illustrations you might desire, and send your reply to:

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the recorder and scope. Simultaneously with the dye injection the physician activates a remote foot switch marker to measure the appearance time of the curve, also a Sanborn Cardiac Output Computer connected to the Densitometer in an integrate mode is activated. The computer measures the area under the curve which is recorded from the digital readout. A minimum of two injections will be sufficient providing the readout values are within 10% of each other.

CALIBRATION:

From the 30cc blood sample taken at the beginning of the procedure, 5cc samples are put into each of four dry, clean medicine glasses measured from a Hamilton gastight 10cc syringe with a Chaney adaptor. Two of the samples are used as blanks to be drawn through the Cuvette-Densitometer with the Computer in the calibrate mode. When the blood comes through the Cuvette and a stable baseline is established the calibrate switch is activated. The readout data from these two samples are background references as to the optical density of the blood or calibration counts.

To the other two samples 0.05cc of dye is added to each from a Hamilton gastight special purpose syringe with a repeating dispenser. These samples are drawn through the Cuvette to give a readout value of the optical density of the blood with a known conc. of dye/ unit volume or calibration counts of blood and dye mixture. These values are plotted on a Sanborn 37 R-1 Disc Calculator to give a calibration factor "y".

This factor is used in the equation,

$$\text{C.O.} = \frac{1 \times 60 \times \dfrac{N_D - N_B}{D}}{A} = \frac{1 \times 60 \times y}{A}$$

found on the reverse side of the calculator to determine the C.O. in L/min.

1 = dye injected (mg.)
A = area counts
D = dye conc. (mg/L)
N_B = calibration count of blood
N_D = calibration count of blood and dye

Meetings . . .

September 1970

American Hospital Association — Houston, Texas, September 14-17. Information: 840 North Lake Shore Drive, Chicago, Illinois 60611

Canadian Society of Extracorporeal Circulation Technicians—Park Plaza Hotel, Toronto, Ontario, Canada, September 10-12. Information: Miss G. Elliott, 38 Glenbrae Avenue, Toronto 17, Ontario, Canada