



FIG. 1. Simplified diagram of an Ohio anesthetic machine.

rubber mushroom valve and is designed so as to prevent retrograde flow in the vaporizers and flowmeters.

Dislodgement of the mushroom valve from the outlet check valve resulted in the occlusion of the pipeline system and prevented gas flow to the patient. The flowmeters read 2 l/min nitrous oxide and 1 l/min oxygen, which should have been sufficient for ventilation of this patient had those been the actual amounts being delivered and had a tight mask fit been obtained. In actuality the reservoir bag could hardly be distended even though a tight mask fit had been obtained and the pop-off valve was entirely closed. The probable explanation for these findings is that very little gas flow was able to pass the occlusion caused by the mushroom valve. The level of the flowmeter column floats was lowered by retrograde pressure resulting from the obstruction of flow by the displaced valve. This phenomenon is apparent in variable-orifice flowmeters<sup>1</sup> such as those present in the Ohio Unitrol Model Heidbrink Gas Machine used in this case.<sup>2</sup>

The mushroom valve in the machine in question has since been replaced with a new mushroom valve

and has been in continuous use for more than four months with no subsequent problem.

The purpose of reporting this case is to stress the possibility of failure of anesthetic machines in spite of regular inspection and the necessity of having accessory ventilatory equipment such as Ambu bags and an extra anesthetic machine readily accessible.

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## Successful Central Venous Catheter Placement from Peripheral Subcutaneous Veins in Children

*To the Editor:*—Central venous catheter placement can be accomplished reliably by percutaneous cannulation of the large veins of the chest via the sub-

clavian and internal jugular veins. There are, however, risks associated with these approaches in patients with coagulopathies and in small children. In

TABLE 1. Successes and Failures in Entering the Chests of Young Patients in Two Age Groups Using Central Venous Catheters Placed from Different Entrance Sites

	Children of Ages		Total
	0-5 Years	>6 Years	
Entrance site right arm			
Success	22 (67 per cent)	30 (67 per cent)	52 (67 per cent)
Failure	11	15	26
Entrance site left arm			
Success	39 (49 per cent)	45 (68 per cent)	84 (58 per cent)
Failure	41	21	62
Entrance site right neck			
Success	19 (70 per cent)	18 (82 per cent)	37 (76 per cent)
Failure	8	4	12
Entrance site left neck			
Success	8 (57 per cent)	19 (95 per cent)	27 (79 per cent)
Failure	6	1	7
TOTAL	154	153	307

In addition, some physicians still find the small risk associated with these approaches unacceptable in any patient. Consequently, percutaneous catheterization of subcutaneous veins in the antecubital fossa and neck is preferable in many instances. This study (from the Cardiac Surgery Service, Children's Hospital Medical Center, Boston, Massachusetts) was undertaken to determine whether there is a specific peripheral site from which the catheterization of central veins is more successful in children.

Three hundred and seven central venous catheters were placed in 266 children and young adults just prior to cardiac surgical procedures. The subjects ranged in age from 1 day to 23 years; most were children. The entrance site was noted upon the patient's arrival in the intensive care unit after operation. The location of the catheter tip was noted on the postoperative chest roentgenogram.

In children less than 6 years old, the right neck and right arm are the best sites for catheterization of the central veins of the chest ( $P < 0.01$ ) (table 1). In patients more than 6 years old, the left neck and right neck are the best sites ( $P < 0.02$ ). When all patients are considered together, the left neck and right neck are significantly better ( $P < 0.05$ ) than sites in the arms.

The results of this study confirm what one might expect from a knowledge of anatomy. The right neck should always be a good site, as it has the straightest route to the right atrium. Similarly, if there is any difference in arm sites, the right arm veins lead most directly to the chest. A convenient way to remember the conclusions of this study is to recall that when one is about to place a central venous catheter in a patient less than 6 years old, the operator should stand at the patient's right side. When the patient is more than 6 years old, the operator should stand at the patient's head.

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## Another Method for Distinguishing Arterial from Venous Puncture

*To the Editor:*—In a recent letter, Scamman<sup>1</sup> described a method for determining whether blood aspirated percutaneously for arterial blood-gas analysis is actually arterial or venous. We have used a method

that we feel is superior in that it allows one to determine whether the sample is arterial before it is actually aspirated into the syringe.

The method involves the use of a 25-gauge butterfly