

cuff, yet resistance persists in some communities to using blood pressure cuffs on small children because of the alleged difficulty in interpreting the data. Although temperature probes are readily available, in many operating rooms they are used only during open heart procedures or for patients thought to be susceptible to malignant hyperthermia. In-line oxygen monitors, even when available, frequently are not plugged into the circuit or are left in the off position. Many of our colleagues routinely place a stethoscope over the precordium or in the esophagus to monitor heart tones and breath sounds. Others claim that, by monitoring electrical activity of the heart, auscultation is not necessary, although these two monitors supply different information. Finally, many think they can accurately monitor residual muscular blockade from neuromuscular blocking agents without a nerve stimulator.

Some argue that the patient undergoing a hernia repair with general anesthesia does not require the same monitoring as for gastric resection. There is no such thing as "minor" general anesthesia and, therefore, minimal standards should be established, although the most complex cases will require even more monitoring. Others claim they have not read well-controlled studies that scientifically prove that monitors improve anesthetic outcome. Yet who of us would volunteer for a "control" group undergoing general anesthesia without any monitors? Adequate monitors are not a substitute for the clinical vigilance of an anesthesiologist. The data obtained from monitors complement the anesthesiologist's experience and, thus, enhance proper anesthetic management.

Many have been reluctant to advocate standards for fear of litigation if these standards are not met; on the other hand, it is our obligation to be the patient's advocate. I believe the following should be set as standards for minimal monitoring during general anesthesia: precordial or esophageal auscultation or, if it is technically not possible to place such a monitor, another indirect indicator of blood flow, such as an oximeter or a pulse amplifier; blood

pressure, either manual, automatic, or invasive; respiration by auscultation; continuous body temperature; neuromuscular activity when the adequacy of muscle function is unclear; inspired oxygen concentration; expired carbon dioxide; and an electrocardiograph.

The equipment necessary to do this, possibly with the exception of that needed to monitor carbon dioxide, is available in virtually every hospital in which general anesthesia is performed. Thus, the added expense to conform to such a standard is small compared with the cost of one major respiratory accident per hospital every 10 yr. This point is apparent to the insurance industry, because some carriers have indicated a willingness to reduce premiums if these minimal standards are followed.\*

We recently have witnessed an explosive growth in the technology of equipment available to us for the care of our patients. This has come at a time when cost containment in medical care has become of paramount concern. Many would hide behind the premise of cost containment in justifying why equipment should not be obtained to properly monitor our patients. On the other hand, we must be the patient's advocate and not compromise safety.

It is time that monitoring became a higher priority. Surely, with the uniform application of monitoring all respiratory gases, cardiac function, and oxygen delivery with noninvasive methods and use of automated records, even the standards recommended today will be out of date in the next few years.

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\* Walker J, Florida Physicians Insurance Reciprocal. Personal communication, 1985.

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## Methylene Blue Aids Multiple-lumen Catheter Replacement

*To the Editor:*—Multiple-lumen central venous catheters are often inserted into chronically hospitalized patients because of poor venous access. When these patients need an operation, they also often need a pulmonary artery catheter or an additional infusion site. The catheter in place decreases the number of sites available and makes a second central venous catheter placement more difficult.

Inserting a guide wire into the existing catheter and

then replacing it with an introducer and pulmonary artery catheter theoretically exposes the patient to less risk than a new venipuncture. Unfortunately, commonly available guide wires are 40 cm long, and the length of the triple lumen catheters from distal tubing connector to distal tip is also 40 cm. Theoretically, one could clamp the catheter above the skin entrance, cut it sterilely, insert a guide wire into the distal lumen, and then replace the catheter.

Because the lumens are very similar on cross section, there is a good chance of inserting the guide wire into the improper channel, passing the guide wire through a lateral hole instead of the distal tip hole, and causing vessel trauma. The lateral exit of a guide wire requiring removal of both the central venous catheter and guide wire has been reported.<sup>1</sup>

We injected a small amount of methylene blue into the distal infusion connection before sterile clamping and cutting and easily distinguished the distal channel from the other channels. The multiple lumen catheter can then be confidently replaced with wire guide and introducer system.

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#### REFERENCE

1. Arancibia CU, Hawk WD: Unusual complication of a central venous catheter. *Anesth Analg* 64:92, 1985

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### Unexpected Arteriovenous Fistula in the Arm of an Intravenous Drug Abuser

*To the Editor:*—A 37-yr-old former iv drug abuser required emergency decompression laminectomy for a spinal cord tumor. A 16-g Cathelon® iv catheter was placed without difficulty in a normal-appearing dorsal hand vein. It seemed to be well positioned (there was backflow of bright red blood when the iv bottle was lowered), but the iv fluid would not flow to the patient. The catheter was removed before induction of anesthesia, revealing pulsatile flow of bright red blood from the puncture site. Apparently, the patient had an arteriovenous fistula in his arm due to his prior iv drug abuse.

Fortunately, no iv drugs were given before removal of the catheter. Sodium thiopental, for example, had it been rapidly injected, might have entered the arterial limb of the presumed fistula and caused a serious complication.

In order to avoid intraarterial injection, one needs to

be aware that iv drug abusers may have such fistulae. Useful warning signs include the presence of a surprisingly good vein in such a patient and the backflow of bright red blood without good forward flow. As an added precaution, the slow injection of iv drugs may help prevent their retrograde passage into the arterial circulation.

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### Potency versus Cost of Narcotics

*To the Editor:*—In reply to Aldrete's letter,<sup>1</sup> it is not my purpose to engage in a debate over cost-containment issues but to point out some important factors that must be taken into consideration when cost comparisons are made. Aldrete was comparing ampuls of drug on a volume basis. In this respect, it would be accurate to say that a 2-ml ampul of sufentanil injection CII (50 µg/ml) is more expensive than a 2-ml ampul of fentanyl (50 µg/ml). However, sufentanil should not be compared with fentanyl on an equal volume or an ampul-to-ampul basis because of

the potency difference. In clinical studies, sufentanil has been found to be five to ten times as potent as fentanyl. In a double-blind study comparing fentanyl, sufentanil, morphine, and meperidine in a balanced technique, the ratio between fentanyl and sufentanil was 1:6.3.<sup>2</sup> At the 1:6.3 ratio, 2 ml of sufentanil would be equivalent to 12.6 ml of fentanyl. A second study comparing sufentanil/O<sub>2</sub> versus fentanyl/O<sub>2</sub> found the potency ratio to be 1:5.<sup>3</sup> At this ratio, 2 ml of sufentanil would be equivalent to 10 ml of fentanyl. Other clinical reports have shown the po-