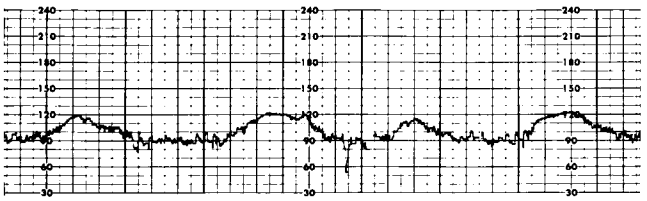

FIG. 1. Heart rate of laboring patient, as recorded with the use of direct ECG mode of fetal monitor. One min of time is represented between each pair of heavy vertical lines.

to 250 obstetric patients. They did not report how many of their patients were in active labor. They did state that "if the patient was in labor, the anesthesiologist waited until just after a contraction to inject the test dose . . . [to minimize] the likelihood of a painful stimulation causing an increase in heart rate coincident with injection of the test dose."[2] In eight patients with presumed intravenous placement of the epidural catheter, "mean maternal heart rate rose from 76 ± 2 to 109 ± 6 . . . beats/min."[2]

Both Moore and Batra[1] and Abraham *et al.*[2] monitored heart rate by radial artery palpation or by use of an electrocardioscope. We find neither method to be consistently satisfactory when giving a test dose to laboring patients. We report an alternate technique for the monitoring of maternal heart rate during injection of an epinephrine-containing test dose with the use of the direct ECG mode of a fetal monitor (Model 8040A, Hewlett-Packard, Palo Alto, CA). We have consistently obtained an excellent recording of maternal heart rate by placing one standard ECG lead at the upper left sternal border and a second lead just beneath the left breast in the anterior axillary line. The lead wires are inserted into the cable block, which is strapped to the patient's arm. The monitor electronically calculates each R–R interval and provides a graphic recording of maternal heart rate.

Figure 1 includes a representative segment of a tracing recorded during placement of an epidural catheter in a 21-yr-old nulliparous woman in active labor. Each heart rate acceleration corresponds temporally with the occurrence of a uterine contraction. These accelerations are similar in magnitude and duration to those reported by Moore and Batra[1] and Abraham *et al.*[2] after intravenous injection of 0.015 mg epinephrine. The tracing illustrates that an increase in maternal heart rate may not be specific for intravascular injection of an epinephrine-containing test dose.

We[3] and others[4] have previously expressed concern for the potential adverse effect of intravenously administered epinephrine on uteroplacental blood flow. With this correspondence, we neither endorse nor condemn administration of an epinephrine-containing test dose to laboring patients. Rather, for those practitioners who include epinephrine in the test dose, we suggest that there are two advantages of this method of maternal heart rate monitoring. First, the equipment is readily available on an obstetric suite. Second, it provides a visual image of the actual heart rate. Should a parturient have heart rate accelerations with uterine contractions, one may avoid injection of the test dose immediately before and during a uterine contraction. However, an electrocardioscope should be available in the unlikely event that the parturient experiences a persistent cardiac arrhythmia.[1]

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Minimal Requirements for Monitoring—1986

To the Editor:—The equipment available for monitoring patients during the conduct of an anesthetic was extremely crude a few decades ago. The watchful eye of the anesthesiologist looking for chest movement and noting the patient's color, as well as an occasional finger on the pulse, were thought to be adequate. Today, equipment is vastly improved, yet resistance to its routine use is still evident. Many recommend the routine use of a blood pressure

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.

* 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.