

A mechanical method in clinical use is the counterpulsating intra-aortic balloon technique. In addition to the sudden reduction of the afterload by deflation of the balloon, additional hydraulic energy is supplied by inflating the balloon during diastole.⁴ This method, at present, is limited to a few medical centers. It also requires that the patient be kept on anticoagulants, which may be disadvantageous to some patients following open-heart surgery.

A pharmacologic method to decrease the afterload is to use an agent which decreases systemic vascular resistance. When one negates sympathetic tone either chemically or surgically, there is still inherent tone in the vascular muscle. One can further decrease this tone and hence, systemic vascular resistance, by using an agent which acts directly on the muscle. Sodium nitroprusside is such an agent. It is particularly advantageous because it is very potent, has a short duration of action, does not appear to cause tachyphylaxis, and has no effect on myocardial contractility.^{5,6}

By reducing the systemic vascular resistance with this easily controlled drug, one can reduce the afterload to the appropriate extent which produces the maximum stroke volume for the left ventricular contractile force available.

In summary, a case of advanced mitral insufficiency in which the left ventricle was contracting at its maximum capability is pre-

sented. When the geometric dynamics were suddenly changed by replacing the incompetent valve, the left ventricular wall was unable to generate enough wall stress to eject an adequate stroke volume. As a result of decreasing systemic vascular resistance and thereby the afterload with sodium nitroprusside, the ventricular wall stress capability was sufficient to eject an adequate output. During the subsequent 30 hours, the ventricle adjusted to the newly imposed geometric dynamics. The patient survived and is back to full activity six weeks after operation.

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A Simple Method for Monitoring Twitch Height

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We have developed an inexpensive way to monitor twitch height.

MATERIALS AND METHODS

The materials required are a peripheral-nerve stimulator (Wellcome Peripheral Nerve Stimulator), a 20-inch length of 2-0 silk, a large curved endotracheal tube adapter, a metal stylet, a 3-inch plastic needle, a paper measuring tape, and an intravenous pole.

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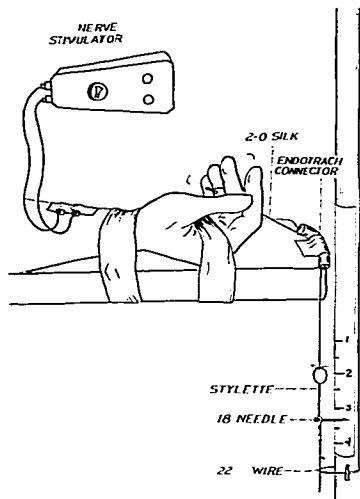


FIG. 1. Items necessary for the quantitative measurement of peripheral neuromuscular blockade.

The arm and hand are fixed to an arm board. The 2-0 silk is taped to the third or fourth fingers, run past the end of the arm board through a curved endotracheal tube adapter, and then attached to the stylet. The plastic needle is taped perpendicular to the stylet approximately two inches from the distal end. The paper tape is fixed to the intravenous pole. As the ulnar nerve is stimulated with the nerve stimulator, the flexion of the fingers elevates the stylet. The degree of excursion can be quantitated in inches by observing the excursion of the plastic needle up the tape (fig. 1).

We tested the reproducibility of this device in five adult patients, ASA class I, who were premedicated with opiate, tranquilizer, and anticholinergic drugs. Anesthesia was induced with Innovar, 1 ml/10 kg body weight, and a nerve stimulator was attached by

25-gauge needles near each ulnar nerve at the wrist. Each hand was fixed to an arm board. A Grass FT-10 force-displacement transducer, connected to a Grass recording polygraph, was attached to one arm. The other arm was attached to our neuromuscular blockade display unit. After control twitch height was obtained for each hand, neuromuscular blockade was induced with pancuronium, approximately 0.04 mg/kg. The twitch height, monitored on the Grass polygraph, was kept at 5–10 per cent of control by repeated administration of pancuronium, 0.25–0.5 mg. When the end of the operation was near, the neuromuscular blockade was reversed by intravenous administration of atropine, 1.0 mg, and pyridostigmine, 10 mg. Without observing the Grass polygraph, the senior author indicated when he felt twitch height had returned to 50 per cent of control, 90 per cent of control, and control height. These estimates were compared with the twitch heights observed on the direct-writing Grass polygraph. In all cases observation of the neuromuscular blockade display unit agreed to within 10 per cent of the polygraph recording.

DISCUSSION

We have demonstrated that the neuromuscular blockade display unit correlates well with the accepted standard of the force-displacement transducer. Others have developed similar display monitors using readily available materials.¹ The advantages of our monitor are that it creates a continuously observable monitoring pattern; it can be easily and inexpensively constructed and rapidly adapted to a patient; and if it is not operating satisfactorily the reasons become obvious because of the simplicity of construction.

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