Automated Blood Pressure Monitoring During Surgical Anesthesia

BENJAMIN L. STEINBERG, M.D.,* AND SEYMOUR B. LONDON, M.D.†

Direct blood pressure monitoring is not yet feasible for everyday use and clinical methods of repeated sequential indirect blood pressure measurement are often burdensome or omitted in the face of more urgent tasks. This report presents our initial experience with a new digital computer type of instrument* which automatically measures indirect systolic and diastolic blood pressures.

METHODS

The principle of the pressurometer, figures 1 and 2, is to accomplish electronically the same complicated activities as performed by the physician in determining blood pressure by the indirect auscultatory method. By employing analogue and digital computer techniques the apparatus† performs (1) rapid inflation and slow deflation of a compression cuff, (2) detection of blood pressure sounds (Korotkow) by a contact microphone at the brachial artery, and (3) registration on an illuminated panel, of cuff pressure at which the sounds are heard. The pressures are presented in the form of a simple read-out, achieved by the use of complex circuitry through which blood pressure sounds electronically activate separate circuits at 5 mm. of mercury decrements of cuff pressure. These separate digital circuits distinguish this instrument from earlier automated devices.† Each circuit activated responds by illuminating only the corresponding numerical value of the cuff pressure at which the sound is heard. The entire pulse pressure is illuminated and remains so until the next measuring cycle. The first illuminated value represents systolic pressure and the last value diastolic pressure.‡ The instrument automatically recycles at preset intervals of 15 seconds to 5 minutes. A recycle button allows a new measurement cycle to be initiated manually without delay.


‡ Monitor Instruments, 605 Lincoln Road, Miami Beach, Florida.

* Department of Anesthesiology, Mt. Sinai Hospital of Greater Miami, Miami Beach, Florida.
† Department of Medicine, Mt. Sinai Hospital of Greater Miami, Miami Beach, Florida and University of Miami Medical School, Miami, Florida.

FIG. 1. Pressurometer: automatic self-contained instrument for indirect auscultatory blood pressure measurement. The illuminated digital read-out indicates the pulse pressure. The first illuminated value is systolic pressure and the last is diastolic pressure. (See text.)
Fig. 2. The cuff is placed on the arm in the usual position; the contact microphone is suspended in a special pocket over the brachial artery. The amplifier compressor pump and the mercury manometer are illustrative of the basic components contained within the case. The digital circuitry is omitted.

if desired. The range of monitoring is 250 to 30 mm. of mercury. A narrower range of monitoring, however, can be preset for the individual case to avoid unnecessary compression of the arm. An alarm system is incorporated into the circulatory to give visual and auditory indication above or below preset blood pressure levels. Since no pressure transducer is used the calibration does not change and no readjustment or warm-up is needed.

One hundred adult patients were monitored continuously during a wide variety of surgical procedures and anesthetic techniques. Since earlier validation studies with this apparatus showed close correlation with direct arterial pressure readings and with simultaneous double blind indirect measurements on the same arm, our studies in this group of patients were primarily concentrated on the evaluation of the clinical reliability of the instrument. Initially, the pressures obtained with the Pressurometer cuff on one arm were compared with the conventional manual compression cuff on the other. Most measurements coincided when done simultaneously while alternate measurements yielded only occasional variations; ± 10 mm. of mercury. The first 20 cases gave a good correlation between the two methods and subsequently manual readings were done less frequently.

RESULTS

The instrument, based on this initial experience, functioned well and clearly relieved the anesthesiologist from a repetitive and demanding task, particularly when he was faced with other more pressing immediate responsibilities. The latter situations in which the blood pressure readings would not have been made developed in this series with surprising frequency; during intrathecal injection of local anesthetic drugs, respiratory obstruction immediately following thiopental induction, laryngospasms and/or apnea, starting transfusion or adjusting intravenous needles, etc. The alarm system was activated several times in the recovery room when nursing personnel were not in direct attendance. Unexpectedly, we found that the arm cuff could be applied to arm being used for intravenous therapy. Since compression to the cuff was intermittent and not prolonged appreciable changes in the rate of intravenous flow did not occur.

Limitations of the instrument were found owing to obvious extraneous causes or interfer-
REFERENCES


Thermometer for K-Pad

J. H. Sprouse, Jr., M.D., and P. P. Bosomworth, M.D.*

Excessive heat loss with a resulting fall in body temperature frequently occurs during surgery in infants and young children. This has prompted us routinely to place a K-pad warming blanket beneath these patients and monitor body temperature with an esophageal or rectal thermometer. Despite usual precautions minor burns occurred in two patients over skin areas which had been in contact with the warming blanket. Measurements of