

### Expedient for Leaking Cuff

Dr. Robert E. Ploss of Berkeley, California, reports also that emergency inflation of a leaking endotracheal tube cuff can be accomplished by use of an air displacement rig made from two 1,000 cc. bottles and used intravenous tubings. The same problem can be solved by a balanced escape "Y" line from

a room air pressure source. Either system can be practical when replacement of the tube or packing of the pharynx is impossible or impractical.

Manufacturers of the equipment described in this column may be obtained from ANESTHESIOLOGY, J. B. Lippincott Co., East Washington Square, Philadelphia 5, Pa.

## CORRESPONDENCE

### Monitoring During Anesthesia

*To the Editor.*—Since the condition and hence the requirements of the anesthetized patient tend to change from moment to moment in response to changes in depth of anesthesia, pulmonary ventilation, blood volume, cardiovascular tone, body temperature, position and many other factors, it is essential that the anesthesiologist constantly reevaluate the physiological status of his patient. To do this the anesthesiologist has traditionally relied upon three of his senses: touch, sight and hearing, and a few primitive accessory instruments, including a watch, a sphygmomanometer, and stethoscope. Anesthesia modifies and often masks vital signs, and in particular normal responses to stress. Traditional methods of observation frequently detect trouble late or after the patient is already in jeopardy. Additional sources of information are required to provide earlier warning of incipient danger.

Many new devices intended to monitor physiological functions have become available to the clinical anesthetist in recent years. Some of these have been outgrowths of development in the physiological research laboratory, others owe their origin to the new science of astronautics, and still others represent the frantic inventions of harried clinicians, seeking to ease the burdens of their responsibility. Almost all of these inventions have received reasonable clinical trials. Only a few have gained acceptance of any significant magnitude. It seems worthwhile to consider some of the reasons for these failures and to contemplate solutions to problems of design of clinical monitors based on the demands imposed by patient care in the operating room.

The usefulness of the information transmitted to the anesthesiologist by a physiological monitor is determined by several factors: how representative of the parent function is the parameter being detected, e.g., digital pulse volume versus cardiac output; the success with which the transducer or detection device samples the behavior of the patient, and nothing else; the fidelity and effectiveness with which the display system projects the function toward the anesthesiologist; the intelligence of the physician in translating the signals of the monitor; and finally the willingness of the physician to make use of the instrument and rely upon its output. A study of the natural history of representative monitors in the operating room revealed commonly recurring causes for failure determined by all of these factors. The last two deserve special consideration. It is relatively easy for the physician to reject an instrument with the explanation that it is not trustworthy, that it presents useless information or that it is inconvenient to use. Engineers are competent to design equipment to perform according to clearly stated specifications. They are not competent to define the specifications appropriate to the monitoring of physiological functions of anesthetized patients being cared for in an operating room in a form convenient and intelligible to an anesthetist because they have had no experience with these things. The physician must learn how to make his needs known to the engineer.

Few anesthesiologists possess the skills necessary to define their needs. In order to improve their ability to assist in the design

of improved instruments for their own use, physicians should do the following things. They should work more consistently with currently available monitors. They should develop a more sympathetic understanding of the limitations of physical systems to discriminate pertinent from extraneous information. They should distinguish those parameters of circulation, respiration and reflex irritability which provide the most useful information. They should learn to recognize those modes of data presentation

which communicate to them maximum intelligence with minimum distraction. They should determine the type of instrument package which will provide maximum availability with minimum cost of time and energy to initiate its function. Finally, they should invite design engineers to work with them and to observe at first hand the nature of their problems.

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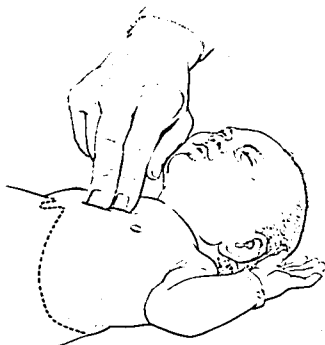
### Closed Chest Cardiac Massage in the Newborn

To the Editor.—Though isolated cases of successful treatment of cardiac arrest in the newborn by thoracotomy and cardiac massage have been reported, an analysis of the experience of the Sloane Hospital for Women showed one survivor out of 10 cases of attempted cardiac resuscitation. This one survivor after 12 months has definite neurologic damage. Particular disadvantages of the open technique for the newborn lie in the additional burden of a thoracotomy superimposed upon the severe asphyxia of birth, as well as delays caused by doubt as to diagnosis, unpreparedness, or an understandable reluctance to initiate such an operation.

Cardiac massage without thoracotomy has been recently reintroduced by Kowenhoven, Jude, and Knickerbocker (*J. A. M. A.* 173: 1064, 1960), who, after experimental work with dogs, showed this to be a safe and effective method for patients. Clinical application of this technique by these workers on 20 patients aged from two months to 80 years has resulted in an over-all survival rate of 70 per cent. Although closed chest cardiac massage would appear to be especially advantageous for use in the newborn, there has been no previously reported experience with this technique in this age group.

Cardiac resuscitation through an intact chest has been used and studied at Sloane Hospital for Women in 4 babies during the first three days of life. Three of the infants developed cardiac arrest during or after birth; the fourth had received an overdose of digitalis on the third day of life. After the

babies' lungs had been properly ventilated via an endotracheal tube, sternal compression was usually provided by the use of two fingers.



Location of fingers for sternal compression in cardiac massage in the newborn.

However, the effectiveness of thumb pressure in maintaining adequate blood pressure was also evaluated and compared to the two finger technique.

Closed chest cardiac massage was maintained for periods ranging from 10 minutes to two and one-half hours. An effective spontaneous heart beat returned in the one infant who received sternal compression within 60 seconds of the diagnosis of cardiac arrest by auscultation. This newborn left the delivery suite in good condition and at three months