Intravenous Procaine During Thoracic Surgery

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With increasing boldness and skill surgeons are probing into hitherto inaccessible areas, altering and remodeling tissues of some of our most vital organs and effecting surgical cures for conditions which a decade ago were accepted as unfortunate but incurable maladies. Among the most recent beneficiaries of such surgical intrepidity are those successfully undergoing surgery of the heart and great vessels. As a result of such surgery many children, once in hopeless invalidism because of some congenital cardiovascular defect, now lead normal lives, with a greatly extended life expectancy.

Surgery on the heart and paracardial structures or traction on the hilus of the lung may initiate serious arrhythmias which can result in death if not promptly controlled. Procedures involving the pericardium are particularly apt to be followed by severe derangements of rhythm. Thus anesthesiology is faced with another challenge.

Various investigators, Mautz (1936), Shen and Simon (1938), and Burstein and Marangoni (1940), have shown that irritability of the myocardium and conduction system of the heart may be reduced by topical application or intravascular injection of procaine, thus preventing fibrillations which would ordinarily occur under the conditions of the experiment. In many instances procaine re-established a normal rhythm even after fibrillation had been induced.

The recent war produced a large number of cases in which operative procedures were carried out on the heart. These provided an excellent clinical test of the above mentioned principles. Burstein reports 14 cases in which dysrhythmias were corrected during surgery by intravenous injection of 1 per cent procaine. These occurred in a series of 121 operations in which shell fragments or other foreign bodies were removed from the pericardium, myocardium, or from within or in close relation to the great vessels.

Disturbances of rhythm and shifting of the pacemaker may result either from direct stimulation of cardiac muscle or reflexly through the well-known vago-vagal mechanism. In the laboratory, cardiac arrhythmias can be produced almost at will in animals under cyclopropane anesthesia by injections of epinephrine in doses which are no more than double the amount which may be expected to be secreted during an average emotional strain. Vago-vagal reflexes may be initiated by stimulation of the pericardium or by traction on the hilus. These impulses which
are received by afferent fibers of the vagus nerve and reconveyed to the heart over efferent pathways of the same nerve, produce dysrhythmias of varying severity. Likewise, stimulation of vagal afferent end organs in the respiratory tract by passage of an endotracheal tube or bronchial aspiration during light anesthesia may result in alarming cardiac disturbances. One such instance is known by the writer to have produced a cardiac standstill which terminated fatally. Procaine was not used in that instance.

The conditions which pertain in intrathoracic surgery are, therefore, particularly conducive to the occurrence of cardiac arrhythmias, namely: (1) The presence in the circulation of more than normal quantities of epinephrine secreted in physiological response to emotional stresses. (2) The direct and reflex stimulation occasioned by traction and manipulation of cardiac, paracardiac, and pericardiac tissues as well as hilar structures. (3) The desirability of endotracheal intubation and the frequent need for intermittent bronchial aspiration.

The use of procaine intravenously to quench undesirable reactions from these stimuli has now become a widespread custom. The mechanism is that of reducing the irritability of the cardiac conduction system. Whereas Burstein achieved this result by intermittent injections of 4 to 7 cubic centimeters of 1.0 per cent procaine after the appearance of the arrhythmias, it is now more common practice to administer a weaker (0.1 per cent) solution continuously throughout surgery as a prophylactic measure in any case where cardiac disturbances might reasonably be expected to develop.

There are some by-products of this procedure, other than control of dysrhythmias, which are of interest. There appears to be a synergistic action between procaine and other anesthetic agents, particularly pentothal, which decreases the required dosage of the latter. Bittrich and Powers feel that it greatly lessens coughing and bronchospasm, even in light planes of anesthesia. It was also their impression that patients receiving intravenous procaine seemed to tolerate surgery better, show less shock, and make more rapid recoveries.

Pentothal, through its cortical depression, effectively counteracts the convulsant properties of procaine. By way of caution it should be noted that ether and cyclopropane do not; therefore, when procaine is used with the latter agents one must be constantly on the alert for toxic symptoms. Pentothal should either be administered concomitantly or be available for instantaneous injection.

It is now evident that the intravenous administration of procaine has become a valuable addition to the armamentarium of the anesthesiologist in his endeavor to preserve the integrity of the thread of life while the surgeon carries out his heroic assignment without restrictions.

BIBLIOGRAPHY


