

FATAL AND NEAR-FATAL ACCIDENTS ASSOCIATED WITH  
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Modern techniques of endotracheal anaesthesia were crystallized as a result of the work of Rowbotham and Magill.<sup>1,2</sup> The method was widely adopted because it produced a quiet field for upper abdominal operations and permitted safe anaesthesia for operations about the head and neck.

*Techniques Employed*

The first essential for endotracheal anaesthesia is the ability of the anaesthetist to perform atraumatic laryngoscopy. This requires either a conscious and cooperative patient whose pharynx and larynx have been rendered analgesic by adequate topical analgesia, or an unconscious patient whose pharyngeal and laryngeal reflexes have been deadened by general or topical anaesthesia. To avoid the reflex cardiac disturbances induced by the strong local stimulus to the larynx which instrumentation produces,<sup>3</sup> and the associated hypoxic disturbances induced by breath-holding and coughing efforts,<sup>4</sup> adequate anaesthesia of the pharynx and larynx is a *sine qua non* of endotracheal intubation. To facilitate instrumentation the mouth must be opened as widely as possible. This can be achieved either by having the patient consciously cooperating or by utilizing the deeper planes of inhalational anaesthesia, which are ordinarily accompanied by a considerable degree of muscular relaxation. Not all the agents commonly used to induce anaesthesia are suitable for use in endotracheal intubation. Thiopentone, for example, while permitting very good initial relaxation of the jaw muscles, has very poor anaesthetic properties, so that the stimuli arising from the instrumentation produce reflex closure of the mouth and the glottis itself, rendering intubation difficult or impossible.

The second and third planes of the third stage of ether anaesthesia<sup>5</sup> provide the ideal field for successful atraumatic endotracheal intubation, but in the opinion of many anaesthetists and surgeons the chief disadvantage of the use of this technique is the time taken to reach this degree of anaesthesia. In order to save themselves time and trouble a very large number of anaesthetists resort to methods which rapidly provide unconscious and completely relaxed patients. In one of these techniques the patient is given a dose of a barbiturate (usually thiopentone) by the intravenous route, followed rapidly by a dose of a muscle relaxant by the same route. The apnoeic patient is then inflated for a few breaths with pure oxygen, the endotracheal tube is introduced into the trachea and life is maintained by artificial respiration. Anaesthesia or analgesia is maintained in the lightest levels by the use of nitrous oxide and oxygen, supplemented by a variety of anaesthetic or analgesic agents.

While such methods are highly convenient for the ultra-

practical anaesthetist, they make little or no allowance for unsuspected drug sensitivities, for anatomical difficulties, or for failure of equipment. Nor do they pay much heed to the physiological disturbances which may ensue. The purpose of this article is to report very briefly on 6 patients who were in good health physically and considered to be normal anaesthetic risks, and who died or were seriously maimed following the use of such techniques. Since not one of these patients presented any medical or surgical explanation for their death or disablement, it must be presumed that the anaesthetic was in some way responsible. Five of these patients were anaesthetized by specialist anaesthetists. Four of the 6 patients unexpectedly developed cardiac arrest 20-50 minutes after the start of the anaesthetic. It is perhaps significant that the use of cardiac massage (artificial circulation) as a method of resuscitation has achieved prominence only in recent times.

## CASE REPORTS

Five of these 6 patients were seen by me in consultation after the mishap. The remaining case was reported to me in detail by the surgeon who had operated on the patient. I wish here to emphasize that it is the 'fashionable' method which I am criticizing and not individual anaesthetists. However, I do not wish to make identification of the cases easy, and for this reason only the barest details are reported here. One patient was anaesthetized by a trainee attached to my department and this patient's story is reported in more detail.

*Case A*

Some months after sustaining a depressed fracture of the skull, a healthy young adult male, between 20 and 30 years of age, was scheduled for plating of the bony defect in the skull. Anaesthesia was induced with thiopentone and a relaxant was used to facilitate intubation. About 20 minutes later, before the operation was well begun, sudden cardiovascular collapse occurred. The anaesthetist had not recorded any difficulty with the conduct of the anaesthetic up to this time. Cardiac massage was immediately instituted and the arrested heart was re-started. The operation was abandoned and the patient was returned to his bed. He remained comatose and died within 48 hours of the start of the anaesthetic. No cause for the cardiac arrest was evident at autopsy.

*Case B*

Signs of mental retardation in a physically healthy child brought the parents and the child for a medical opinion. To exclude any physical cause for the mental defect, air studies of the ventricular system were advised. The child was anaesthetized with thiopentone and a relaxant was used to facilitate intubation. While preparing for the diagnostic procedure, the surgeon commented on the colour of the patient's skin. It was then found that the pulse and heart sounds were absent. Cardiac massage failed to restart the heart. An autopsy report is not available.

*Case C*

A healthy male adult, between 40 and 50 years of age, complained of weakness of the legs. A lesion in the lumbar region of the spine, compressing the spinal cord, was diagnosed, and laminectomy was advised. Anaesthesia was induced with thiopentone and a relaxant was used to facilitate intubation. The patient was prepared for operation and the incision was made. At this point cardiac arrest occurred. Cardiac massage was immediately instituted and the heart action resumed. The patient remained comatose and apnoeic so that artificial respiration was necessary. The patient died within 48 hours of the start of the anaesthetic. No autopsy report is available.

*Case D*

This healthy adult male, between 20 and 30 years of age, is still alive. He developed acute appendicitis and immediate surgery was advised. Anaesthesia was induced with thiopentone and a relaxant was used to facilitate intubation. However, efforts to pass an endotracheal tube into the trachea under direct vision, using a laryngoscope, failed. The endotracheal tube was then inserted *via* one nostril by the 'blind' technique and anaesthesia was continued. The patient showed some cyanosis for a considerable period of the operation. On regaining consciousness he was confused and developed athetosis which waxed and waned in degree, but was at times gross. This eventually abated and partial recovery ensued. The mental state of this patient has since deteriorated again. He has personality defects and is now subject to major epileptic seizures. He is not able to hold down a steady job.

*Case E*

A healthy male, aged 38 years, complained of pain and weakness of the left arm and left leg. Clinical and radiological evidence suggested a lesion in the cervical part of the spinal canal which was compressing the cord. The apprehensive patient was premedicated with 0.65 mg. atropine only. The anaesthetist administered 700 mg. of thiopentone in a 2.5% solution, and 80 mg. of gallamine triethiodide ('flaxedil'), both by the intravenous route, and nitrous oxide, oxygen and trichloroethylene by inhalation. An endotracheal tube was inserted into the trachea and the nitrous oxide, oxygen and trichloroethylene mixture was continued. Hyperpnoea developed. About 40 minutes after the start of the anaesthetic, the anaesthetist noted that the pulse was absent and the heart sounds could not be heard. Noradrenaline was administered by intravenous infusion and when, after 4 or 5 minutes, there was no response to this therapy, cardiac massage (artificial circulation) was instituted. The heart was restarted and the operation was completed. This patient is still alive but is demented.

*Case F*

A physically normal adult male, between 40 and 50 years of age, was troubled by headaches. No physical cause could be found for these, but neurological investigations suggested that there might be a lesion in the vicinity of the 4th ventricle. It was decided to explore the posterior fossa of the skull. Thiopentone was used to induce anaesthesia and a relaxant was used to facilitate intubation. Endotracheal anaesthesia was apparently uneventful and the operation, which did not disclose any lesion, was successfully completed. However, the patient did not regain consciousness and 6 weeks after the anaesthetic was still unconscious. Eventually, there was some improvement, but personality changes were evident. The patient would make no effort on his own behalf and slipped gradually downhill. Death finally released him from a physical and mental crippledom.

## COMMENTS

Each one of these 6 patients received thiopentone, a muscle relaxant (either suxamethonium or gallamine triethiodide) and nitrous oxide and oxygen *via* an endotracheal tube. By calculations from the recorded gas-flow rates, all delivered gas mixtures contained at least 20% oxygen. All 6 patients were considered to be normal anaesthetic risks. Not one of the 6 patients was subjected to excessive

surgical trauma and no surgical accidents or complications were recorded. In only 1 patient (case D) was muscular relaxation required for the surgery which was contemplated or performed. It is thus extremely difficult to resist the conclusion that death or disablement was caused, either by the anaesthetic agents used, or the anaesthetic techniques, or both.

Deaths can and do occur with the use of the older and more conservative methods of anaesthesia. Thiopentone can cause death by respiratory depression or by cardiovascular disturbances, but in only 2 patients (cases D and E) did the total dose of thiopentone exceed 500 mg. Endotracheal intubation can also, of itself, lead to death, but this is rare. In more than half-a-million anaesthetics Beecher and Todd<sup>6</sup> found only 2 deaths attributable directly to endotracheal intubation. These authors did find, however, that the anaesthetic techniques employing muscle relaxants were more hazardous to the patients than the older and more conservative techniques. Michael Johnstone<sup>7</sup> pointed out that the muscle relaxants in common use do often cause changes in the normal electrocardiogram.

These cases reinforce the contention that the need for endotracheal intubation does *not* constitute an indication for the use of muscle-relaxing drugs. The inherent risks of suffocation (anoxia and hypercarbia) far outweigh the few minutes of time and the impression of dexterity which the anaesthetist gains. It would appear that the earlier dictum that relaxants should not be used *until* an endotracheal tube is properly in place, could well be revived.

It is contended by many that the anaesthetist, using controlled respiration in a completely paralysed patient, is better able to maintain oxygenation and remove carbon dioxide than is the patient himself, when anaesthetized in an old-fashioned way. Since the anaesthetist has no means of judging the partial pressures of either of these gases in the patient's alveolar air, or their tensions in the patient's arterial blood, I find it difficult to accept this rationalization of an inherently dangerous technique. It seems odd that Man should consider himself better able than Nature (or God) to sustain natural functions in his fellow men. While accepting the fact that Man is an odd animal, it is perhaps time to draw wider attention to the paraphrased advice of a distinguished American surgeon—'The bold anaesthetist should remember that it is the patient who runs all the risks!'

## SUMMARY

Brief case reports are presented of 6 patients who suffered death or disablement following the use of currently fashionable methods of endotracheal anaesthesia. The circumstances strongly suggest that the technique is at fault.

## REFERENCES

1. Rowbotham, E. S. and Magill, I. (1921): *Proc. Roy. Soc. Med. (Sect. of Anes.)*, **14**, 17.
2. Magill, I. (1928): *Ibid.*, **22**, 83.
3. Burstein, C. L., lo Pinto, F. J. and Newman, W. (1950): *Anesthesiology*, **11**, 224.
4. King, B. D., Harris, L. C., Greifstein, F. E., Elder, J. D. and Dripps, R. D. (1951): *Ibid.*, **12**, 556.
5. Guedel, A. E. (1952): *Inhalation Anaesthesia*, 2nd ed. New York: Mac-Millan.
6. Beecher, H. K. and Todd, D. P. (1954): *Ann. Surg.*, **140**, 34.
7. Johnstone, M. (1955): *Anaesthesia*, **10**, 122.