QUESTION AND ANSWER*

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QUESTION

Describe the induction of anaesthesia with ultra-short-acting barbiturates. Discuss the complications and the types of patient with whom especial caution is needed. How far can their needs be met by modifying the technique of administration of these drugs?

ANSWER

INDUCTION OF ANAESTHESIA

Induction of anaesthesia with ultra-short-acting barbiturates should be by slow intravenous injection of a dilute solution of the chosen agent. The initial dose must be estimated as that just necessary to produce unconsciousness, and the reaction of the patient can be the better assessed if he is asked to count during the administration. Loss of consciousness is usually preceded by a sulphurous taste in the mouth when sodium thiopentone is used, and occurs within 20-45 seconds, depending upon the circulation time of the patient. It is accompanied by muscular relaxation and some obstruction to respiration may occur if the tongue is allowed to fall on the posterior pharyngeal wall. At this stage there is often a deep breath, followed by a period of respiratory depression or even of arrest, depending upon the actual dose given, and then the re-establishment of normal breathing. This is the moment for injection of a further dose—based on the effectiveness of the first—which completes the induction of anaesthesia.

COMPLICATIONS

A. Local.

Extravenous injection of these agents may cause a painful area of inflammation and possibly eventual tissue necrosis if any quantity of solution escapes. Healing is with fibrosis and in the antecubital fossa may lead to adhesions with limitation of movement. Attempted injection of the basilic vein on the median side of the antecubital fossa may lead to some solution reaching the median nerve, and only a very small quantity is needed to cause injury.

Intravenous injection of inadequately diluted solutions of these barbiturates will lead to thrombosis and occasionally thrombophlebitis of a short length of the vein and its immediate tributaries. Even
a successful injection may cause a localized haematoma due to seepage at the puncture. Inadvertent intra-arterial injection will be followed by arterial spasm and eventually thrombosis if any quantity of solution is administered and treatment not rapidly carried out. Gangrene may result.

B. General.

Medullary depression is a feature of induction, so that respiratory depression and hypotension are likely to occur in some degree. Depression of the myocardium is marked. In a proportion of cases coughing, sneezing and laryngeal spasm may be precipitated, due perhaps to the parasympathetic effects of the barbiturates or to slight stimuli under the very light level of anaesthesia. Tremors occur in others—either localized to the arm used for injection or sometimes spreading over the whole body, but subsiding as the dose of drug is increased.

Resistance to anaesthesia may be shown by some patients due to too slow an injection or too small an initial dose, though occasionally an adequate dose by normal standards may be insufficient. It is in the latter type of case, particularly in those of muscular build and with short necks, that induction of anaesthesia may be associated with respiratory obstruction.

**TYPES OF PATIENT IN WHOM CAUTION IS NEEDED**

Local complications with intravenous injection occur more frequently in patients who have difficult veins due to fat or spasm of the vessel, as in shock, fright, or cold atmospheres. In some patients superficial veins are difficult to find, while in others a history can be obtained of susceptibility to venous thrombosis or phlebitis following injections. Intra-arterial injection is likely when puncture of a deep vein is attempted in the antecubital fossa or in that 10 per cent of people who have an abnormal ulnar artery, arising from a high division of the brachial artery above the elbow joint and running superficially in the forearm. The chances of making an accidental extravascular or intra-arterial injection are greatly increased in struggling, frightened children.

The medullary and direct myocardial depressant effects of these drugs are markedly potentiated in aged and ill patients. Pre-existing circulatory and cardiac disease, including peripheral circulatory failure and respiratory obstruction or any form of respiratory depression, are all diseases in which even a small dose may rapidly lead to decompensation. Laryngeal irritability and like phenomena are more apt to occur in fit and resistant patients, and in those with chronic coughs caused by heavy smoking or by disease leading to the presence of mucus or pus in the sensitive region of the glottis. These reflexes may also be initiated by slight reflux of acid stomach contents, and the use of this form of induction to anaesthesia for cases with a full stomach is fraught with danger. Tremors are more likely to occur in nervous patients or when cold solutions are injected.

**MODIFICATIONS OF THE TECHNIQUE OF ADMINISTRATION**

A venepuncture which is likely to prove difficult due to the local condition of the vein can frequently be made simple
if vasodilation is produced by heat and friction in the presence of the venous tourniquet. It is wise to use a concentration of solution which will not irritate the vein wall, particularly for those patients giving a history of thrombosis or phlebitis. Comparative series have shown a slighter incidence of such sequelae after the use of 2% per cent solutions of thiopentone than after the standard 5 per cent solution.

Intra-arterial injection is avoided by careful palpation of the chosen area before a tourniquet is applied. Only by this method can an aberrant superficial ulnar artery be excluded prior to puncture when it is essential to inject into a vein in the area of the antecubital fossa. It is wiser when practicable to choose a vein along the volar aspect of the forearm, and never to inject more than 1 ml. of solution until satisfied that no pain follows.

The myocardial and central medullary depressant effects are primarily due to the concentration of the drug used and the amount injected at one time and allowed to reach the heart and brain, though there is a little evidence that some barbiturates are more depressant than others. These agents may be preferable for sick patients, but whichever is chosen, a dilute solution (2½ per cent in the case of thiopentone) should always be used, and the initial dose be given very slowly. The injection should be preceded by, or at least combined with, the inhalation of oxygen by the patient, and some writers recommend the addition of methylamphetamine (Methedrine) to the barbiturate in the syringe to offset the hypotensive effect. There are occasions when it is wise not to use these drugs for induction at all.

Paradoxically, a large initial dose may be needed to achieve a satisfactory induction in a robust patient, and the speed of injection must be quick or unconsciousness will be very much delayed. Difficulty with the airway and laryngeal irritability, like other signs of reflex stimulation, can be avoided if the barbiturate is rapidly followed by a small dose of a muscle relaxant or perhaps, and when possible, combined with one.