A REPORT ON THE USE OF SUCCINYLCHOLINE CHLORIDE IN A THORACIC UNIT

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FOLLOWING the demonstration by Bovet et al (1949) and, independently in this country, by Buttle and Zaimis (1949), of the powerful muscular blocking activity of succinylcholine, there has been much discussion in the literature regarding the merits and demerits of this drug in anaesthetic practice.

The chemistry and pharmacology of this compound have been adequately reviewed by Glick (1941), Castillo and de Beer (1950), Bourne and Somers (1951) and Mayrhofer (1952).

It is our purpose to present our experiences using succinylcholine chloride in a series of bronchoscopic and oesophagoscopic examinations.

In performing these examinations, succinylcholine has been administered without complications to a consecutive series of 1,000 patients ranging in age from 21 months to 83 years.

TECHNIQUE

The solution of succinylcholine we have used is that supplied by Allen & Hanbury's, a clear, colourless, 5 per cent solution ("Scoline") provided in 2 ml. ampoules.

Premedication. In adults, an injection of 1/6 gr. (10 mg.) of morphine and 1/100 gr. (0.65 mg.) of atropine is given 1 hour before the examination. In children, atropine alone is used.
**Induction.** A serum needle attached to a Blease-Halton 2-way tap is inserted into a suitable vein and then connected to a saline drip.

A sleeping dose of sodium thiopentone is injected and followed by a dose of succinylcholine. The doses employed depend on the age, weight and general condition of the patient; for sodium thiopentone 250–400 mg., for succinylcholine, 20–50 mg.—a dosage much less than that recommended by the manufacturers (50–100 mg.). A usual dose for an adult is 350 mg. of thiopentone followed by 35 mg. of succinylcholine.

A variant of this technique is to sandwich the injection of succinylcholine between two injections of thiopentone. The advantage of this method is that the optimal effects of each drug more nearly coincide and it is thereby possible to use minimal doses of each drug.

The lungs are then inflated with oxygen and the bronchoscope passed. During these examinations a flow of oxygen of 2 litres/min. is administered, in bronchoscopy through the side tube of the bronchoscope and in oesophagoscopy through a gum elastic catheter inserted into the trachea for this purpose.

A careful watch is kept on the patient’s colour and pulse and further increments of succinylcholine and/or thiopentone given as required.

To ensure adequate oxygenation of the patient during examinations lasting more than the customary 3–5 min., there are two manoeuvres which will help to improve the oxygen content of the residual air in the less well ventilated parts of the lungs.

These manoeuvres are:

1. Intermittent blockage of the bronchoscope opening with a finger with the oxygen by-pass open, so inflating the lung.
2. Manual massage of the upper abdomen with resultant elevation of the diaphragm and compression of the lower lobes of the lungs particularly, thereby dispersing a percentage of the residual air present.

OBSERVATIONS

Within 5–30 sec. following the injection of succinylcholine, muscle fibrillations are observed in all cases. The muscle twitches vary in duration, distribution and degree. Complete muscular relaxation follows in 5–10 sec. The intensity of these effects appears to be unrelated to the dose of succinylcholine given or to the muscularity of the individual patient.

The duration of respiratory paralysis is approximately 2–4 min., occasionally 6 min. When spontaneous respiration reappears it is completely adequate within one minute of complete apnoea.

No unexpected or significant changes in the patient’s pulse rate, rhythm or force have been noted, and no evidence of increased salivation observed.

ADVANTAGES

Duration of Relaxation. “The use of succinylcholine in bronchoscopy proved difficult, since the patient passed too rapidly between the extremes of paralysis and strength. Here gallamine with thiopentone was preferred. But, provided the lungs were well inflated beforehand with oxygen, the use of succinylcholine in bronchoscopy was satisfactory when the examination was brief or the surgeon permitted interruptions for reinflation.”

This statement, in a recent paper by Bourne, Collier and Somers (1952) based on 4 bronchoscopies, 20 oesophagoscopies, is in direct contrast with our experience. The duration of anaesthesia and relaxation has been adequate
in all cases, ensuring a thorough examination and a satisfied surgeon.

Some cases, however, require successive doses of succinylcholine of the order of 25 mg. to prolong the period of relaxation, permitting a more than brief examination. This is well illustrated in the following case report.

An obese female patient, aged twenty-five years, required an oesophagoscopy for the removal of a safety pin lodged at the cardio-oesophageal junction. In this case the surgical manipulations occupied one hour. For this prolonged period, relaxation and anaesthesia were maintained with an initial dose of 350 mg. thiopentone plus 35 mg. succinylcholine followed by successive increments to a total dosage of 500 mg. of succinylcholine and $1\frac{1}{2}$ g. of thiopentone. The 2-litre flow of oxygen maintained satisfactory oxygenation throughout, no cyanosis being observed. At the completion of the operation, respirations were normal and the patient conscious.

Though this case is a little extreme, there is no difficulty or danger in obtaining satisfactory relaxation for periods of 15–20 mins. without modification of the technique described.

Where incremental doses of succinylcholine have been given further muscular twitchings were not observed, nor was prolonged apnoea a feature. There were no additive effects seen and this ensures the anaesthetist maintaining full control of the duration of relaxation when successive doses of succinylcholine are used.

Degree of Relaxation. The excellent relaxation of the vocal cords obtained so quickly with succinylcholine facilitates easy passage of the bronchoscope with minimal trauma to the larynx. Moreover the apnoea accompanying the relaxation and terminating with it favour the necessary surgical manipulations during the examinations.

Though techniques using other relaxant drugs such as d-tubocurarine chloride or gallamine triethiodide with
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thiopentone have been used extensively by us in the past, for the above reasons surgical and anaesthetic opinion in the Thoracic Unit is now unanimously in favour of succinylcholine.

**Rapidity of Action.** The rapid action of succinylcholine favours the early introduction of the bronchoscope without that reaction from the patient which is seen not uncommonly with the longer-acting relaxants. The rapidity of obtaining relaxation and of recovery is an important factor in a busy Thoracic Surgical Unit.

**Laryngeal Spasm.** This has been a not uncommon feature after bronchoscopy when other relaxant drug techniques have been used. In our series using succinylcholine, the incidence of this complication has been markedly reduced. In the few cases in which it did occur, the spasm was mild in degree and of short duration.

Two possible explanations may account for this observation:

(a) The completeness of relaxation facilitates the atraumatic passing of the bronchoscope.

(b) The degree of histamine liberation in comparison with that of d-tubocurarine chloride is small (Bourne, Collier and Somers, 1952). However, though histamine may play a part in the causation of bronchial spasm, what relation it might have to the occurrence of laryngospasm is problematical.

**DISADVANTAGES**

**Prolonged Respiratory Paralysis.** There have been several reports in the recent literature of cases of prolonged respiratory paralysis following succinylcholine (Gould, 1952; Harper, 1952; Langton Hewer, 1952; Hurley and Monro, 1952; Love, 1952; Sherman, 1952). In only one
case in this series of 1,000 did apnoea persist for more than six minutes following the single initial dose of succinylcholine.

Case Report. A middle-aged male patient suffering from pulmonary tuberculosis received a dose of 500 mg. of thiopentone and 50 mg. of succinylcholine for bronchoscopy. Apnoea persisted at the conclusion of the bronchoscopy and inflation of the lungs with oxygen was carried out during this period. Twenty minutes after the injection of succinylcholine spontaneous respirations began to return and were normal within a further minute.

The explanation of the prolonged apnoea in this case remains obscure.

Several theories have been suggested to explain such occurrences.

1. Excessive dosage (Foldes, 1952).

In the case described, the first theory would not seem to apply, as the dose used was much less than that advocated by many authors. The second possibility could account for the occurrence but is unlikely, as many other patients have had the same degree of ventilation. The third theory, recently supported by the work of Evans et al. (1952), is the most probable in the light of our present knowledge.

CONCLUSION

The anaesthetic technique described, using succinylcholine for bronchoscopic and oesophagoscopy examinations, has now completely supplanted in the Liverpool Thoracic Surgical Unit other relaxant techniques, viz. — thiopentone with d-tubocurarine chloride or gallamine triethiodide.
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We believe for the reasons given that the advantages of this drug far outweigh any possible disadvantages.

We should like to thank Messrs. Allen & Hanbury's for their generous supplies of succinylcholine in the early stages of this series.

REFERENCES