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CORRESPONDENCE

RAPID TRACHEAL INTUBATION WITH NON-DEPOLARIZING NEUROMUSCULAR BLOCKING DRUGS: THE PRIMING PRINCIPLE

Sir,—Tracheal intubation can be performed within 1 min after the injection of suxamethonium chloride i.v. Suxamethonium, however, has unwanted side-effects and may cause serious complications. With reasonable doses of non-depolarizing neuromuscular blocking drugs, suitable conditions for tracheal intubation cannot be achieved in less than 2–3 min. Furthermore, with the exception of vecuronium, intubating doses of these drugs may have unwanted side-effects.

In exploring various possibilities to facilitate rapid tracheal intubation, it was envisaged that this may be accomplished by the administration of a non-depolarizing neuromuscular blocker in divided doses. The first, a "priming" dose, administered to awake patients should be large enough to cause moderate inhibition of neuromuscular transmission, indicating greater than 75% occupancy of the endplate receptors (Paton and Waud, 1967), but small enough not to cause any unpleasant symptoms. The second, larger, "intubating" dose administered after the induction of anaesthesia would then rapidly increase receptor occupancy to 90%, necessary for profound neuromuscular blockade (Paton and Waud, 1967).

Subsequently it was established with vecuronium that the "priming" dose should be 15–20% and the "intubating" dose 50–60% of the customary dose (100 $\mu g\,kg^{-1}$) used to facilitate tracheal intubation and that the optimal time interval between the two doses should be 6–8 min. Using a 15-$\mu g\,kg^{-1}$ "priming" and a 50-$\mu g\,kg^{-1}$ "intubating" dose of vecuronium, excellent conditions developed for tracheal intubation in 19 patients in 65 ± 13 s (SD).

The priming principle for the facilitation of rapid tracheal intubation was also found applicable to other non-depolarizing drugs. The recommended doses of these agents are given in table I.

TABLE I. *Recommended doses of non-depolarising drugs*

Compound	"Priming" dose ($\mu g\,kg^{-1}$)	"Intubating" dose ($\mu g\,kg^{-1}$)
Vecuronium	15–20	50–60
Atracurium	75–100	250–300
Pancuronium	15–20	50–60
Alcuronium	45–60	150–180
Tubocurarine	75–100	250–300
Dimethyl tubocurarine	40–50	125–150

In addition to enabling rapid tracheal intubation, by virtue of the reduction of the total initial dose of neuromuscular blocker by 20–35%, the described technique also has other advantages: it decreases the clinical duration of the initial dose, for example with vecuronium, from about 35 to 25 min; it decreases the frequency and severity of dose-related side-effects (e.g. tachycardia with pancuronium, histamine release with tubocurarine or atracurium (Basta et al., 1982)); and the response to the priming dose would reveal any unusual sensitivity to non-depolarizing relaxants.

A similar method was recommended by Gergis and colleagues (1983) for rapid tracheal intubation with atracurium. The priming dose was similar to that recommended in this communication. However, they only allowed 3 min to elapse between the injection of the priming and intubating doses. Probably because of this, in spite of the larger (420-$\mu g\,kg^{-1}$) intubating dose, suitable conditions for tracheal intubation only developed in 90–120 s.

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PHOSPHORUS-31 NUCLEAR MAGNETIC RESONANCE STUDIES OF MUSCLE METABOLISM IN MALIGNANT HYPERPYREXIA

Sir,—The technique of phosphorus-31 nuclear magnetic resonance (^{31}P NMR) can be used to determine relative concentrations of ATP, phosphocreatine (PCr) and inorganic phosphorus (Pi) in skeletal muscle, and can thus be used to study metabolism in healthy and diseased muscle. We wish to report here the use of ^{31}P NMR to study muscle metabolism in swine which are susceptible to malignant hyperpyrexia (MH).

Susceptibility to MH was assessed in muscle biopsy samples by pharmacological methods (Okumura, Crocker and Denborough, 1979). Two MH susceptible (MHS) and two control pigs were used. Gracilis muscle samples for NMR studies were obtained using thiopentone–nitrous oxide anaesthesia. Each sample was dissected into 30-mm strips of 1 mm diameter, four or five of which were attached to a platinum wire holder and the whole assembly placed into a standard 10-mm NMR tube. A recirculating perfusion system was used to keep the muscle oxygenated. Approximately 200 ml of a muscle buffer was bubbled with carbogen at 37 °C. Halothane was added to the buffer by passing the carbogen through a calibrated Dragewick vaporizer before bubbling through the reservior of buffer, and caffeine was added, as a powder, direct to the reservoir.

^{31}P NMR spectra were recorded at 80.9 MHz on a Bruker CXP-200 spectrometer. Spectra were obtained in 32 min, using 2000 pulses at a repetition rate of 1 s. Chemical shifts were measured from a secondary reference of methylene diphosphonic acid 1 mol $litre^{-1}$ (pH 9.0) contained in a 1-mm capillary tube. The chemical shifts were reported relative to the primary reference, 85% phosphoric acid.

Spectra were obtained from control and MHS porcine muscle in the absence and presence of 3% halothane or caffeine 2 mmol $litre^{-1}$. The resonances were assigned to the various metabolites according to Hoult and colleagues (1974). No difference was detected between the spectrum of control muscle and