Do you regularly intubate without muscle relaxants?

Neuromuscular blocking drugs were first using in clinical practice to aid intubation in 1940s.[1,2] Prior to this intubation of the trachea was first described in 1880 using no pharmacological agents and fingers as a makeshift laryngoscope[3]. In the early 20th century intubation was carried out under deep ether anaesthesia using forceps to guide the wide bore catheters into the trachea.[1]

The introduction of muscle relaxation allowed good operating conditions with safe concentrations of 'balanced anaesthesia' and development of new surgical techniques such as minimally invasive surgery[2].

Since the early 20th century intubation under deep anaesthesia using halothane and now sevoflurane has been practiced, especially in paediatric practice and as an option when wishing to avoid neuromuscular blocking agents. Now with new shorter acting anaesthetic agents and opioids available a combination of propofol with a short acting opioid intubation without paralysis is often successful.[1]

There are several reasons why you may wish to avoid neuromuscular blocking agents including allergy to neuromuscular blocking agents or avoidance of the side effects of depolarising muscle relaxants.

Certain neuromuscular conditions affect clinical pharmacology of neuromuscular blocking agents and may affect choice of agent and reversal used. Avoiding these drugs all together may be beneficial for example in myasthenia gravis patients requiring thymectomy.

Procedures where neuromuscular monitoring is used for example thyroid surgery, ENT or neurosurgery where the neuromuscular junction must be functional for this to work. The options for this situation include either giving a short acting agent and allowing it to wear off or avoiding neuromuscular blocking agents at all.

Short procedures performed by a skilled surgeon may be significantly quicker than the duration of action of the neuromuscular blocker, although with the introduction of sugammadex both rocuronium and vecuronium can be reversed much earlier than with traditional reversal agents. Although this technique may have financial implications if this became routine practice.

If you wish to avoid muscular blockade all together there are different techniques described to perform intubation without neuromuscular blocking agents. However within the studies there is variation regarding the assessment of optimum intubating conditions. The vast majority of studies used sevoflurane with varying approaches and adjuncts to add smooth intubation.

In children, researchers in Japan found that a MAC_{EI} (minimum alveolar concentration for endotracheal intubation) was 2.7% for sevoflurane, which is 30% above the MAC level. This equates to previous studies using halothane and enflurane. The MAC to prevent movement in 50% of patients in laryngeal mask insertion was also 2.8%. The addition of nitrous oxide of 33% and 66% has shown to decrease MAC_{EI} by 18% and 40% to 2.2% and 1.6% respectively[1].

Researchers also looked to see if sevoflurane alone could provide as rapid intubating conditions and propofol and suxamethonium. Using 8% sevoflurane in 66% nitrous oxide compared with propofol and suxamethonium all patients were intubated at 150 seconds. All intubations were successful but excellent conditions were only reported in 55% of sevoflurane cases compared with 82% using propofol and suxamethonium.[1]

Sevoflurane 8% in nitrous xide 60% was compared with propofol/suxamethonium and propofol/alfentanil in 120 children aged 3 to 12 years. Patients in the sevoflurane group were intubated after 3 minutes; the others were intubated after 60 seconds. Satisfactory intubating conditions were found in 97.5, 87.5 and 52.5%. The authors felt that therefore sevoflurane was an alternative to using propofol and suxamethonium.[4]

In one study propofol given alone for tracheal intubation in a dose 2.5mg/kg allowed intubation in 19/20 of patients and provided ideal intubation conditions in 14/20 patients. These patients were premedicated and another study with the same dose of propofol showed unsatisfactory conditions in 56% of patients. Although these two studies used different methods and end points to describe a successful intubation.[1]

Three opioids have been studied in relation to their use in intubation. These are fentanyl, alfentanil and remifentanil.

Fentanyl has been shown to blunt the pressor response to laryngoscopy 5 minutes after administration.[1] A double blinded, randomised controlled trial comparing intubating conditions after giving thiopentone/fentanyl/suxamethonium to propofol/fentanyl found no difference in intubating conditions between two groups to 25 patients.[1]

A study of 60 ASA 1 & 2 children found fentanyl 3mcg/kg given 5 minutes prior to 3mcg/kg propofol was the ideal dosing regime resulting in 75% having satisfactory intubating conditions.[5]

Many studies have looked at using alfentanil to facilitate intubation without neuromuscular blocking agents. The dose given during the studies has been variable ranging from 10ug kg^{-1} to 50ug kg^{-1}. In studies with similar methods and criteria for intubating conditions one found doses of 10ug kg^{-1} of alfentanil provided good or excellent intubating conditions in 86% of patients with 5 needing suxamethonuim for intubation. The second study found ideal intubation conditions in only 20% at this dose and increased the dose to 20ug kg^{-1} with a 73% having ideal intubating conditions after induction with propofol 2.5mg kg^{-1}.

This difference may highlight some of the subjectivity in assessing coughing and vocal cord movement.[1]

In children, a higher incidence of acceptable intubating conditions was found for the same dose of alfentanil, but usually this was given with a higher dose of propofol between 3 to 4mg kg^{-1}. This may highlight the important part propofol plays in this technique.[1]

Remifentanil also blunts the pressor response to intubation and in studies using remifentanil in comparable doses to alfentanil as a bolus dose the degree of attenuation of the pressor response is similar. The optimal target for remifentanil using a target controlled infusion of propofol and remifentanil has been studied. Using a propofol target of 6.5ug ml^{-1}, reducing to 3ug kg^{-1} after a min to induce anaesthesia, three target levels of remifentanil were used. There were 19, 15, 11ng ml^{-1} reducing to 10, 8 and 6ng ml^{-1} after a minute. Intubation was attempted at 4 minutes; it was satisfactory in 75, 75 and 35% in the three groups.[1]

In most of these studies using short acting opiates, propofol was used as the induction agent. thiopentone or etomidate cannot provide the conditions needed for intubation without neuromuscular blockers.[1]

Lignocaine has been studied as both an intravenous agent and topical adjunct to aid tracheal intubation. Using lignocaine alone has shown no significant difference compared with saline at facilitating intubation after inducing anaesthesia with propofol. However in doses of 1mg kg^{-1} intravenous lignocaine halved the dose of alfentanil or remifentanil needed to produce similar conditions for intubation. Lignocaine also does not affect the pressor response to intubation. Topically applied lignocaine is more successful in aiding intubation. After induction with propofol 2.5mg kg^{-1} and alfentanil 30ug kg^{-1} the vocal cords were then sprayed with lignocaine 90 seconds before intubation. All 27 patients had satisfactory conditions for intubation compared with 73% in the saline group. 1/10 Although lignocaine admistered this was has no effect on the pressor response associated with laryngoscopy and intubation.[1]

There is evidence that tracheal intubation without neuromuscular blockers carries a higher risk of a difficult tracheal intubation. A Danish database of over 100000 patients showed avoidance of neuromuscular blocking agents was an independent risk factor for a difficult or failed intubation with an odds ratio of 1.5.[6] A double-blinded study looking at post intubation symptoms in 300 patients randomly allocated to receive rocuronium or saline after induction with propofol and alfentanil. Intubation was attempted after 90 seconds. Those who received saline were more likely to have pharynolaryngeal symptoms 24 hours after intubation as well as increased rates of difficult intubation and adverse haemodynamic changes (hypotension and bradycardia).[7]

All these studies show that it is possible to intubate without neuromuscular blockers when these drugs are contraindicated or it is desirable to avoid their use. There are various techniques, which could be utilised depending on the

clinical situation and experience of the anaesthetist. However there is evidence this may increase the occurrence of side effects of intubation and the risk of a difficult intubation.

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Dr Claire Ansley-Watson, Anaesthetic Registrar, Oxford

Dr Sumit Das, Consultant Paediatric Anaesthetist, Oxford