Anesthesiology
70:1030, 1989

Modified Rapid Sequence Induction. II.

To the Editor:—Cicala and Westbrook[1] conducted a large trial comparing a vecuronium priming sequence with succinylcholine for rapid sequence intubation. Unfortunately, interpretation of their results is difficult due to several methodologic shortcomings.

Patients in this trial received intravenous fentanyl; however, the dosage was not controlled, varying from 0–3 μg/kg. Helbo-Hansen *et al.*[2] have shown that intravenous opioids significantly improve intubating conditions following a priming sequence. Intravenous opioids may also be important in limiting subjective side effects of the priming dose in the conscious patient. Therefore, intravenous opioids should be viewed as an integral part of the priming sequence and their dosage and timing should be controlled in a clinical trial. This should also be taken into account before applying the results of clinical trials, since in the patient with a full stomach at risk for aspiration (especially the pregnant patient), many clinicians avoid the administration of opioids or other sedatives prior to induction.

Cicala and Westbrook also allowed the thiopental dosage to vary from 3 to 5 mg/kg. This affected the study in two ways. First, the contribution of anesthetic depth to intubating conditions varied. Second, Cicala and Westbrook often used the loss of lash reflex in determining the timing of the intubation attempt. Therefore, the amount of time in which the relaxant was allowed to act may have been related to the dosage of thiopental. This was not, however, the only variable that determined the timing of the intubation, since "intubation was attempted 30 s after the loss of lash reflex or sooner if mandibular relaxation was adequate for laryngoscopy." Intubating conditions were determined not only by the muscle relaxant, but also by the clinical acumen of the anesthetist in timing the intubation. The relatively high incidence of inadequate intubating conditions reported in this trial was probably due to anesthetists who occasionally rushed the intubation when using succinylcholine.

We recently reported the results of a double-blind trial assessing the intubating conditions produced by succinylcholine and various priming sequences.[3] The timing of the intubation attempt was held constant, 60 s after the administration of thiopental (4 mg/kg). Since the trial was double-blind, the muscle relaxant was administered immediately before the thiopental. In our study, succinylcholine produced uniformly excellent intubating conditions.

Like Cicala and Westbrook, we included a control group which received no relaxant, since some colleagues would state that one could intubate with just deep anesthesia and no relaxant. Our no-relaxant control group had dismal intubating conditions and, just as Cicala and Westbrook, we had to terminate it early. Hopefully, other investigators will never again feel the need to include such controls.

The results of our double-blind study differed considerably from previous unblinded studies. Priming sequences that were reported equal to succinylcholine in unblinded trials[4] were not equivalent in our blinded study. We were able to demonstrate that priming significantly improves intubating conditions over an equivalent single dose of relaxant. This result has been confirmed by Mirakhur *et al.*[5] in a double-blind study. In our study, d-tubocurarine was administered before succinylcholine and fasciculations did not appear to compromise the double-blind design. A double-blind design is still probably the most reliable way to limit investigator bias.

In our study, one of the priming sequences performed very well, producing excellent conditions in 14/15 patients. The difference did not reach statistical significance from the succinylcholine controls. This highlights the need for clinical trials with larger numbers of patients (50–75 per group). Cicala and Westbrook have attempted to provide such a study. Unfortunately, inadequate control of important clinical variables, combined with an unblinded design, limits the usefulness of their results.

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(Accepted for publication March 13, 1989.)

The opinions and assertions herein are the private views of the author and are not to be construed as reflecting the views of the U. S. Army or the Department of Defense.

Anesthesiology
70:1030–1031, 1989

Modified Rapid Sequence Induction. III.

To the Editor:—In a report comparing a pretreatment technique using vecuronium (VEC) 0.01 mg/kg + 0.14 mg/kg given to awake patients with a technique employing succinylcholine 1.5 mg/kg administered after induction for rapid sequence induction,[1] Cicala and Westbrook report only one patient out of 50 who had untoward signs or symptoms attributable to the paralysis provided by VEC. This is a

surprisingly low incidence of such problems, since 0.010 mg/kg VEC alone represents the ED_{10}[2] of this relaxant and is therefore expected to exceed the margin of safety of the neuromuscular junction.

Studying the effects of small doses of VEC given to awake healthy volunteers, Engbaek *et al.*[3] noted a patient receiving only 0.005 mg/kg VEC who was unable to swallow and whose twitch height had decreased to 25% of control. VEC 0.010 mg/kg caused heavy eyelids, blurred vision, and general discomfort in many patients.[3] We have noted similar results with VEC 0.012 mg/kg.[4] Aside from discomfort, the use of a pretreating or "priming" dose of only 0.015 mg/kg VEC has been reported to have caused a case of aspiration pneumonia[5] even when no anesthetics had been administered.

Cicala and Westbrook[1] conclude that "priming with vecuronium and the administration of the intubating dose before induction yields the shortest period of obtundation yet described for a rapid-sequence induction using non-depolarizing agents." [1] The authors acceptance of suboptimal conditions for the tracheal intubations and the lack of a direct comparison to other techniques involving nondepolarizing muscle relaxants or even a suitable control group places this claim in doubt. The authors seem to imply that "obtundation" occurs only with anesthetic agents such as thiopental rather than muscle relaxants. The case of aspiration after a priming dose of VEC mentioned above[5] demonstrates that administration of muscle relaxants to a patient at risk for aspiration can be dangerous, since airway reflexes may be impaired even if consciousness is not. It suggests that the application of cricoid pressure and constant closed observation of such patients after the administration of priming doses should be considered.

The authors assessed intubating conditions only 30 s after the administration of succinylcholine, well before its maximal effect is expected. Their conclusion that "intubating conditions were comparable after both succinylcholine and vecuronium" is troubling. Endotracheal intubating conditions in patients who are incompletely paralyzed may be suboptimal and they may strain on laryngoscopy leading to the aspiration of gastric contents. Furthermore, the times to complete loss of twitch of 69 and 174 s for succinylcholine and VEC 0.01 + 0.14 mg/kg, respectively, noted by the authors[1] imply that a well-oxygenated normal adult receiving cricoid pressure should be completely paralyzed at the time of laryngoscopy before significant hypoxia ensues when using succinylcholine but probably not with this dose of VEC, thus indicating the superiority of succinylcholine over the priming technique advocated.

The authors state that a "control" group treated without muscle relaxants had poor intubating conditions and they seem to imply that muscle relaxants are necessary for endotracheal intubation. However, any discussion of rapid intubation of patients at risk for the aspiration of gastric contents should include awake intubation as an alternative to the use of muscle relaxants.

The priming technique espoused by Cicala and Westbrook is likely to make patients extremely uncomfortable and may put them at risk for aspiration without necessarily improving intubating conditions compared to a single bolus technique.[4] If a patient is one of those rare individuals who has a condition that contraindicates the use of succinylcholine, a large single dose of VEC administered after the induction of anesthesia is likely to offer the fastest onset of paralysis. Lennon *et al.*[6] have shown that good intubating conditions and a 95% reduction of twitch height can be obtained 64 s after VEC 0.25 mg/kg. If there is any question about the ability to intubate the trachea, awake tracheal intubation should be performed.

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(Accepted for publication March 13, 1989.)

Anesthesiology
70:1031–1032, 1989

Modified Rapid Sequence Induction. IV.

To the Editor:—In their recent article, Cicala and Westbrook[1] reported an alternative method of paralysis for rapid sequence induction. The alternative method lies in the administration of the complete dosage of vecuronium prior to the administration of the induction agent (thiopental). The authors stated that all studies comparing vecuronium and succinylcholine have demonstrated an increased time between induction and tracheal intubation for vecuronium.

This statement could only be made because the authors did not mention the first description[2] of this new method. In this study, three induction regimens for the induction technique were compared. Sixty patients were randomly assigned to three groups. All patients received 0.1 mg fentanyl 120 s prior to the scheduled induction. At the same time two groups (A, B) received a priming dose of 0.02 mg/kg vecuronium, the third group (C) received a placebo priming. Preoxygenation was maintained until the patients reported heavy eyelids or weariness or the time reached 120 s. The patients then received 5 mg/kg thiopental followed by 1.5 mg/kg succinylcholine (group B) or 0.08 mg/kg vecuronium (group A) resp. 0.1 mg/kg vecuronium (group C) directly before the thiopental. Rapid intubation and scoring of the intubation conditions was performed by an anesthetist who was unaware of the grouping. The tracheas of all patients in group A (0.02 + 0.08 mg/kg vecuronium) and B (succinylcholine) could be intubated within 60 s (mean time 40 ± 9 s and 37 ± 6 s) after the end of the injection of the drugs in contrast to only 15 patients ($P < 0.05$ *vs.* A, B) in group