tant that the patient should feel no discomfort before induction of anesthesia, a smaller priming dose should be employed. In this case, however, to be able to intubate rapidly, the size of the intubating dose must be increased substantially. Thus, for example, the onset of muscular relaxation (2.1 ± 0.2 [SEM] min [n = 21]) and the clinical duration of the intubating dose (29.1 ± 1.6 min) were longer after the administration of a 0.01 mg/kg priming and 0.07 mg/kg intubating dose of vecuronium than when the priming and intubating doses of vecuronium were 0.015 and 0.05 mg/kg (onset time 1.6 ± 0.2 min [n = 11]; clinical duration 19.0 ± 1.4 min). Studies in progress indicate that with a 0.01 mg/kg priming dose of vecuronium an intubating dose of 0.1 mg/kg is necessary to be able to intubate within 60–90 s.

Our present practice is to use, in most patients, 0.015 mg/kg priming and 0.06 mg/kg intubating doses of vecuronium, administered 6 min apart. This priming dose seldom causes unpleasant symptoms. The priming dose is decreased to 0.01 mg/kg when it is essential to avoid the possibility of unpleasant sensations. With the 0.01 mg/kg priming dose the intubating dose is increased to 0.07–0.10 mg/kg. The lower intubating dose is used when prolongation of the intubation time by 20–30 s is not an important consideration, and muscular relaxation is required for a relatively short period. For long surgical procedures, where the duration of action of the initial dose is unimportant, the larger intubating dose may be used. For "crash intubation," 0.015 mg/kg priming and 0.10–0.12 mg/kg intubating doses are employed. In ambulatory patients, where rapid recovery of NM function is desirable, 0.015 mg/kg priming and 0.05 mg/kg intubating doses of vecuronium are recommended.

In our experience, increasing the priming dose of vecuronium to 0.02 mg/kg does not offer enough advantages to compensate for the increased incidence and severity of discomfort experienced by conscious patients.

The priming principle is also applicable to atracurium and other nondepolarizing MR. These agents, however, are less suitable than vecuronium for facilitation of "crash intubation." The reason for this is that the doses of these compounds required for this purpose could cause histamine release and circulatory side effects. Furthermore, with the exception of atracurium, the duration of action of the necessary doses of other nondepolarizing MR would exceed the requirements of most surgical procedures.

In closing, I would like to emphasize that no set rules can be formulated for the facilitation of rapid tracheal intubation with the administration of nondepolarizing MR in divided doses. The application of this technique will require clinical judgment and the priming and intubating doses of the MR used have to be selected to satisfy the requirements of each case.

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REFERENCES


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The Priming Principle and the Open Eye–Full Stomach

To the Editor—Schwarz et al. imply that priming offers the solution to the long-standing problem of the open eye–full stomach. Although Dr. Miller's editorial stressed caution in the clinical application of priming, we feel further warning is justified, since our experience with priming sequences of nondepolarizing relaxants differs significantly from that of Schwarz et al.

We recently reported a randomized double-blind comparison of priming sequences of atracurium and vecuronium with succinylcholine. Succinylcholine produced uniformly excellent intubating conditions in 60 s with no bucking. All patients were intubated successfully with the

The opinions and assertions contained herein are the private views of the authors and are not to be construed as reflecting the views of the Department of the Army or the Department of Defense.
priming sequences; however, slight to moderate bucking occurred in some patients (20–40%). There are two possible explanations for these differences in results. Schwarz et al. used an artificially small dose of succinylcholine (0.6 mg/kg), while we employed 1.5 mg/kg preceded by precurarization. Secondly, our study is double-blind. Schwarz et al. did not use a double-blind design; therefore, their results are subject to irreparable bias.

Dr. Miller notes that studies of intubating conditions are notoriously difficult to interpret. While cultural differences in muscle relaxant responses offer a possible explanation,4 we feel the absence of the double-blind design is the most likely reason for these difficulties in interpretation. Future studies should employ a randomized, double-blind design.

Coughing or bucking after laryngoscopy can produce disastrous increases in intraocular pressure for a patient with an open eye. It may be possible to devise a combination of intravenous anesthetics and nondepolarizing relaxants that totally prevents coughing after rapid intubation. Until this combination is devised and confirmed in a large, controlled, double-blind series, clinicians should not apply the priming principle to the open eye–full stomach patient. Use of a blockade monitor to predict intubating conditions may be unreliable, since muscle groups vary in their response to nondepolarizing relaxants.5 At this time, succinylcholine with precurarization probably remains the most tenable compromise in the open eye–full stomach challenge.6,7

As predicted by Dr. Miller, unpleasant symptoms of weakness after priming can be a problem in awake or lightly premedicated patients. Schwarz et al. could not observe this, since their patients were anesthetized. Initially, we used Dr. Foldes’ recommendation8 for priming doses of 0.1 mg/kg and 0.02 mg/kg for atracurium and vecuronium, respectively, and found an unacceptable incidence of weakness (three of six patients). Halving the priming doses lowered the incidence and perhaps the severity of the weakness symptoms. These symptoms may be more common and of greater severity with atracurium primes than with other priming agents such as vecuronium or curare. Small doses of fentanyl9 administered early in the priming sequence may be important in limiting the weakness symptoms. Administration of any sedative drug before induction of the patient at high risk for aspiration is controversial. The importance of fentanyl sedation in the priming sequence must be elucidated before priming can be used in obstetrics. While it is very helpful to reassure the patient that symptoms such as double vision and chest heaviness are expected, some patients still will have an exaggerated response to the priming dose and require an accelerated induction sequence. Maintaining contact with the patient and experience in the assessment of patient responses to small doses of nondepolarizers is important for the safe use of the priming principle in the emergency setting. The clinician should gain experience with priming in elective situations before using it in the patients at high risk for aspiration.

The priming principle is a very sensible application of pharmacokinetics and has a promising future. We agree with Dr. Miller that further studies are required before the priming principle is introduced into general clinical practice.

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