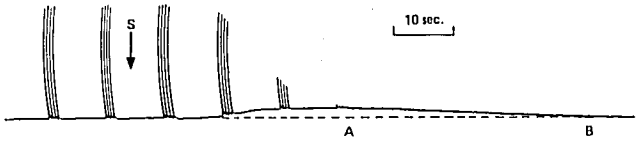

FIG. 1. Train-of-four tension recording obtained from the adductor pollicis muscle of the thumb of an infant, during administration of 2 mg/kg of succinylcholine. The broken line indicates control muscle tension. Injection of succinylcholine (S) was followed by an increase in muscle tone, indicated by elevation of the baseline, which persisted after abolition of the train-of-four response (*A*) for 30–40 s (*B*).

administration. It will be seen that following succinylcholine 2 mg/kg there was an increase in muscle tone, indicated by elevation of the baseline, which persisted for 30–40 s after the abolition of the train-of-four response. This transient increase in muscle tension is presumably due to the agonal effects of succinylcholine.

If the purpose of Van der Spek *et al.* was to explain the unduly high rate of diagnosis of masseter spasm in children,[3] it is arguable that their most important finding was that 1.5 mg/kg of succinylcholine failed to achieve 100% suppression of twitch in three children. These observations are in agreement with the results of our study,[2] which suggests that children require at least 2 mg/kg and infants 3–4 mg/kg of succinylcholine to produce clinical effects comparable to those obtained in adults. Since these doses are approximately double those currently used in pediatric patients,[4] it seems likely that many of the difficulties experienced while intubating children with succinylcholine are the result of inadequate neuromuscular blockade.

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In Reply:—Masseter spasm or masseter muscle rigidity has been suggested to be the result of inadequate dosage of succinylcholine.[1] An adequate dose of succinylcholine for intubation means the interruption of neuromuscular transmission as evidenced by cessation of neurally evoked muscle twitches. Thus, one criterion advanced for the diagnosis of masseter spasm is the inability to open the mouth or difficulty intubating the trachea, although the neurally evoked muscle twitch is completely ablated.[1] In our study, however, an increased resistance to mouth opening occurred in all patients in whom the twitch was ablated.[2] In three patients, the twitch was greatly diminished yet not fully ablated after 1.5 mg/kg of intravenous (iv) succinylcholine. Resistance to mouth opening in these patients was also increased, but in only one of these three patients was intubation hindered by the reduced mouth opening. The tracheas of an additional two patients were difficult to intubate, despite complete abolition of the twitch response. These patients were "adequately dosed," fulfilling one criterion for "masseter spasm."[1]

In their abstract, Meakin et al. determined the ED_{95} for the suppression of the adductor pollicis force developed upon supramaximal ulnar nerve stimulation to be 0.423 mg/kg (no standard deviation given) of iv succinylcholine in children, age 1–5 yr.[3] Thus, our dose of 1.5 mg/kg, administered iv in the two 2-yr-old children and one 16-yr-old child who did not fully lose their muscle twitch, was at least three times the ED_{95} for twitch suppression,[2] and should have been sufficient to abolish the indirectly evoked adductor pollicis twitch, even by Dr. Meakin's (and others') standards. Indeed, we think that *neuromuscular transmission* in our study was completely inhibited in all patients, even in those in whom the twitch was greatly diminished but not completely lost. The twitching of the fingers observed was most likely due to improper stimulation technique rather than an inadequate dose of succinylcholine. The resulting direct muscle stimulation was probably responsible for the minimal twitch. In subsequent study, care was taken to avoid direct muscle stimulation, and the adductor pollicis twitch was fully ablated after 1.5 mg/kg iv succinylcholine in all patients (age 2–13 yr).[4] This was also the case in two subjects whose tracheas were difficult to intubate due to an increased resistance to mouth opening.

Quite unlike the 30–40 s of baseline tension increase observed by Dr. Meakin, our subsequent study showed an increased resistance to mouth opening in six of our patients for as long as 10 min.[4] It should be pointed out, however, that the isometric tension measurement provided by Dr. Meakin does not equate with measurements of joint stiffness. Such measurements in the hand (during anesthesia) have yet to be carried out, although clinically an increase in joint stiffness has not usually been apparent beyond the period of twitch ablation and fasciculation. The elucidation of the mechanism(s) responsible for these observations may help to establish the true significance of "masseter spasm." We hope that continued debate on the merit of these studies promotes and encourages further research to establish the mechanism(s) involved. We thank Dr. Meakin for his interest.

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Patient-controlled Analgesia (PCA)

To the Editor:—To date, there are no reports of severe respiratory depression with catastrophic outcome following PCA. Two cases of respiratory depression following PCA with morphine were mentioned in a recent correspondence.[1] The safety record of PCA machines has been excellent. There is also one report of two mishaps both due to human error.[2]

My concern regarding safety is the current introduction of a choice of modes increasingly offered by manufacturers. Three modes are available: 1) PCA; 2) continuous; or 3) continuous plus PCA. Whenever the continuous or continuous plus PCA mode is used, a danger of overdose is present.

With the PCA mode, patients are given a pre-assessed individualized loading dose to create analgesia. They are taught to titrate potent opioids by pressing a button on a hand-held pendant. The physician sets the PCA machine to deliver a small dose of opioid. When the button is pushed and released, the small dose is delivered intravenously. A preset, lockout interval also limits the maximum dose the patient may receive. With experience with more than 18,000 postsurgical patients, we have utilized a low dose of morphine (1 mg) or meperidine (10 mg) for the patient dose followed by a lockout period of 6 min. The maximum hourly patient-controlled dose is 10 mg of morphine or 100 mg of meperidine. Some patients push the button frequently, while others require only occasional bolus doses. If excessive sedation or somnolence occurs, the patient does not push the button. At Magee-Womens Hospital, severe respiratory depression has not occurred using either morphine or meperidine.

We foresee problems with the continuous mode plus PCA. The manufacturer's recommended continuous dose is 1–3 $mg \cdot h^{-1}$ morphine, which may be dangerously high for some patients. At Magee-Womens Hospital following abdominal hysterectomy patients receiving 0.5 $mg \cdot h^{-1}$ morphine have slept well during the night *without having to activate the machine*, in other words, no additional boluses are required. When a continuous plus PCA mode is prescribed, the safe and effective setting of the continuous dose is an estimate by the prescribing physician. *If the patient does not use PCA with continuous, the continuous dose is too high. If the patient needs frequent PCA boluses, the continuous dose is too low.*

In many hospitals, the prescribing physician is not in-house during the night. The nursing staff is responsible for monitoring prescribed patient care by following doctor's orders and nursing protocols. Assessment of the hourly level of consciousness is advocated in some institutions and used as a monitoring tool.[3] Somnolence should precede respiratory depression for patients using PCA and the patient does not push the button. However, if the continuous plus PCA mode is being used, the continuous dose must be less than the patient requires. In our opinion, some patient use of PCA is essential to prevent overdose from the prescribed continuous dose.

We suggest that when the patient is utilizing the continuous plus PCA mode, nursing staff must confirm that the patient is using some PCA. Nursing orders for the above mode could be made to preempt the state of somnolence. For example, "If no patient activation during the last hour, reduce continuous dose by 0.2 $mg \cdot h^{-1}$. If patient activation exceeds 4 per hour, increase continuous dose by 0.2 mg/h." Individual variation may require more than 0.2 mg reduction/increase of the continuous dose for morphine for some patients and would be prescribed by the physician.

In conclusion, the danger of opioid overdose is ever present when the continuous mode is used. When continuous plus PCA mode is used, patient use of PCA must be monitored to maintain the excellent safety record pure PCA machines have established.

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An Illuminating Suggestion

To the Editor:—In a recent letter, Kubota *et al.*[1] describe the illumination of the vocal cords by holding a pencil torch at the mouth, in the event of laryngoscope light failure. We would like to make the following suggestions. First, there should always be two laryngoscopes available. Second, the technique they describe may be refined in the following manner. The larynx should be transilluminated anteriorly