flurane administration with a resultant total MAC hours of 113.

Both patients' clinical status improved with the administration of isoflurane. This was manifested as a reduction in airway pressures and improvement in gas exchange. Indices of renal function were monitored in both patients during the period of isoflurane inhalation and there was no deterioration. For the second patient serum fluoride concentrations were monitored during the isoflurane inhalation. The highest serum fluoride concentration was 10.5 $\mu mol \cdot L^{-1}$ which occurred at 112 MAC hr. At no time did the fluoride level approach the nephrotoxic level of 50 $\mu mol \cdot L^{-1}$ [6]

Our second patient received 113 MAC hr isoflurane. This is a larger total dose of isoflurane than has been previously reported. Despite this, fluoride concentrations did not reach nephrotoxic levels. A previous report[4] has shown higher levels of fluoride after a smaller total isoflurane dose (36.8 $\mu mol \cdot L^{-1}$ after 107 MAC hr). There are three reasons that may explain the difference in results. Firstly, it is possible that the metabolic pathways involved in the biotransformation of isoflurane may be immature at two years than in adults. Alternatively, an individual variation in metabolism of isoflurane or in excretion of fluoride may account for the variation in fluoride levels. Thirdly, the effects of concurrently administered drugs may affect the rate of metabolism of isoflurane and therefore cause differences in serum fluoride concentrations.

We believe that we have demonstrated the safety of prolonged use of isoflurane. We would advise, however, that inorganic flouride concentrations should be monitored during and immediately[5] after the administration of isoflurane. This would ensure that nephrotoxic levels are not reached in some patients due to individual variability in drug biotransformation.

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Post-succinylcholine muscle pain and smoking

To the Editor:

Diffuse muscle pain is a well-known adverse effect of succinylcholine. Myalgia involves the muscles of the trunk and the extremities and is observed most frequently on the first postoperative day in young women who are ambulatory soon after surgery. The frequency varies widely.

We suspected that smoking might be a factor that has not been controlled by the experimental design. The nicotine receptors in smokers might respond less vigorously when challenged by succinylcholine, a nicotinic agonist, than the same, "naive" receptors in nonsmokers. We tested in a small cohort of patients with the working hypothesis that the incidence of myalgia is less frequent in smokers.

The study was approved by the Institutional Review Board of the University Hospital, Groningen. Forty-two adult patients of whom 19 were women, gave their verbal consent and were studied. Smokers (16/42) constituted a smaller group. Of the smokers, only four patients were women, whereas 15 of the 26 non-smoking patients were female. Age and the duration of the surgical intervention did not differ between sexes or between smoking habits (overall mean ± SD: age = 29.5 ± 8 yr, duration = 75 ± 38 min). After induction with thiopentone (4–5 $mg \cdot kg^{-1}$), anaesthesia was maintained with isoflurane (0.5% to 1.0% inhaled) and nitrous oxide (65%). Succinylcholine (1 $mg \cdot kg^{-1}$) was administered as a bolus *iv*, and intubation was performed after adequate relaxation as judged by clinical criteria. The extent of fasciculations (none, mild, or marked) was estimated by an anaesthetist-observer, blinded as to the smoking habits of the patients. Another anaesthetist, also blinded, interviewed the patients 24 hr postoperatively. Postoperative myalgia not related to surgical intervention was graded on a four-point scale (none, mild, moderate, and marked). No patient required analgesics to alleviate muscle pains.

Overall, myalgia was reported by 19 of the 42 patients. Since only five patients reported moderate muscle pain

(all non-smokers) and none a more extensive pain, muscle pain was considered only as present or not. Myalgia was independent of the preceding fasciculations: it was reported by 18 out of 40 patients in whom fasciculations were seen, and by one of two patients in whom fasciculations were not observed. Of the 19 patients who reported postoperative muscle pain, four were smokers. Such a marked difference in the incidence of myalgia on the first postoperative day (smokers 4/16, non-smokers 15/26) is not likely to have arisen by chance (Fisher's exact one-tailed test, $P = 0.0390$). Disregarding the smoking habit, postoperative pain was observed in nine male and ten female patients ($P = 0.382$). Among the 26 non-smoking patients, myalgia was reported by 7 of 11 male patients, and by 8 of 15 female patients ($P = 0.599$). It appears that smoking did not influence the incidence of myalgia in female patients: of the four smoking patients, two did and two did not report muscle pains, whereas of the 15 non-smoking patients, eight reported having experienced muscle pains. A similar incidence of myalgia was observed in non-smoking males (7/11 patients reported having experienced myalgia). However, the incidence was markedly lower in smoking male patients: of the 12 smoking male patients only two reported muscle pains.

These results support the notion that the incidence of muscle pains after administration of succinylcholine may be lower in smokers; the effect was noticeable among the male smoking patients. The number of smoking female patients was too small to make a decision. We believe that future studies on the influence of various treatment modalities on the post-succinylcholine muscle pains should take into account the smoking habit of the patients.

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