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Suboptimal Protocol?

To the Editor:

Park *et al.*[1] compared surgical pleth index (SPI)-guided analgesia with conventional analgesia during adenotonsillectomy in 45 pediatric patients. The authors confirmed their primary outcome that intraoperative fentanyl requirements are lower in SPI-guided patients. However, they failed to confirm any secondary outcomes, instead showing that intraoperative sevoflurane consumption, emergence agitation, pain, and analgesic requirements were all aggravated in SPI-guided patients. The authors concluded that SPI may not be valid in children.

I congratulate the authors for carefully blinding study personnel, which surely promoted accurate results. However, I am concerned by the authors' analgesic protocol. Adenotonsillectomy is a short and painful procedure, in this case, averaging only 25 to 30 min of anesthesia and just 15 to 18 min of surgery.

Given the authors' protocol for analgesic administration, it seems likely that patients in both groups were undertreated. No analgesics were given before incision; moreover, the protocol mandated analgesic administration only after SPI increased to at least 50 or an increase in blood pressure or heart rate to at least 120% for a minimum period of *3 min* for the initial event and *5 min* for subsequent events. This seems a remarkably long cycle time for such a short operation. Many clinicians would argue that participating patients should have been preemptively treated and that a shorter cycle period would be appropriate.

Patients in the SPI-guided group were, on average, given just a single 0.5-μg/kg bolus of fentanyl (average total dose only 0.4 μg/kg). Patients in the control group were given approximately three boluses (average total fentanyl dose of 1.7 μg/kg). A more typical preincision loading dose would be 1 to 3 μg/kg fentanyl for adenotonsillectomy if fentanyl is used as single agent for analgesic treatment both intraoperatively and postoperatively.[2–4] A consequence of avoiding preemptive analgesia and a protocol-mandated long cycle time is that at least some patients may never have reached analgesic equilibrium—thus not truly testing the efficacy of SPI guidance. The high incidence of tachycardia events in both study groups (67%, no difference between groups) is consistent with this theory. Given what appears to be inadequate analgesic administration, it is perhaps unsurprising that patients in both groups were suffering and agitated in the postanesthesia care unit.

The results reported by Park *et al.* are presented as a failure to validate SPI in children but instead appears to be a predictable consequence of their protocol. Thus, whether SPI is helpful in children remains unanswered.

Competing Interests

The author is a consultant at Medasense Ltd. (Ramat Yishai, Israel), a company currently developing a nociception monitor based on the Nociception Level index. The author receives a consultant fee and has company option shares.

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In Reply:

The efficacy of surgical pleth index (SPI) to guide the nociception–antinociception balance has been proven in study settings during general anesthesia rather than before anesthesia induction or during emergence from anesthesia. Considering that SPI only works well in anesthetized patients[1] and that operation time of adenotonsillectomy is usually short, the authors have designed the analgesic protocol of this study without preemptive analgesia so as to adequately verify the efficacy of SPI in children undergoing the surgery under general anesthesia. Preemptive analgesia given in a short procedure may provide over the necessary amount of

analgesics according to the degree of surgery-induced nociception, the main factor in eliciting a stress response during general anesthesia,[1] thus giving rise to the possibility of masking the difference of two different methods of analgesia.

Also, the authors do not agree that the analgesic protocol of this study is a long time cycle, considering that although the onset of effects of fentanyl is rapid (2 to 3 min after iv injection), the peak effect lags behind peak plasma concentration by up to 5 min.[2,3] A shorter cycle period for fentanyl administration can carry the risk of causing problems related to opioid overdose. Especially, obstructive sleep apnea syndrome is common in children with adenotonsillar hypertrophy. These children may have a diminished ventilatory response to carbon dioxide compared with normal children, and chronic hypoxemia may render them more susceptible to the respiratory depressant effects of opioids.[4] Therefore, opioids must be used judiciously in these patients as they may be more sensitive to their effects. In addition, excessive analgesia given before and during the surgery may cause delayed emergence and residual sedation.[5] The fact that there were few of these adverse events in this study supports that our analgesic protocol did not result in opioid overdose.

However, the fact that the emergence times were not too short (average time 11 to 16 min) in the conventional analgesia group and that they were comparable or longer than those of other studies may support that our protocol did not provide inadequate analgesia.[6] Especially, in the conventional analgesia group, the intraoperative fentanyl dose was comparable with that of other studies in children undergoing adenotonsillectomy[6] and the fact that the median postoperative pain score was 3 in the group, which is a low score, show that adequate analgesia was provided during the procedure. Taken together, we suggest that these results prove the efficacy and safety of the analgesic protocol used in this study.

Heart rates in children undergoing adenotonsillectomy can still remain quite high despite of considerable amount of fentanyl administration, especially during the first 30 min of the procedure.[6] Also, in the conventional analgesia group, the postoperative pain score was low and the incidence of emergence agitation (25%) was comparable or lower than that of other studies[6] and thus it is wrong to assume that patients in both groups were suffering and agitated due to inadequate analgesia in the recovery room.

In conclusion, the authors do not agree that the analgesic protocol of this study was suboptimal due to avoiding preemptive analgesia and a protocol-mandated long cycle time, thus affecting the results of this study. Low postoperative pain scores and less rescue analgesic requirement in the conventional analgesia group make this point clear. Most of all, this study aimed to compare two methods of analgesia. It is clear that SPI-guided analgesia group showed many statistically significant outcomes that are unfavorable compared with the conventional analgesia group. Thus, the authors had concluded that SPI does not appear to be valid in children in this study.

Competing Interests

The authors declare no competing interests.

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