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Comparison of efficiency, recovery profile and perioperative costs of regional anaesthesia vs. general anaesthesia for outpatient upper extremity surgery

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EDITOR:
There is little data to support the favourable recovery and cost profiles of peripheral nerve block (PNB) over general anaesthesia (GA). Studies have demonstrated that the recovery profile following hand, wrist or shoulder surgery has improved after regional anaesthesia (RA), resulting in a higher degree of patient satisfaction [1–5]. The purpose of this study was to evaluate the efficacy, recovery profile and perioperative costs of RA compared with those of GA in patients undergoing upper extremity surgery in our day-surgery centre.

Our Institutional Review Board approved this study. All upper extremity surgical procedures performed in our day-surgery centre from September 1999 through August 2000 were reviewed. We generated two study groups: patients who received brachial plexus block and those who received GA. Anaesthetic choice was made collaboratively by anaesthesiologists and patients according to the routine practice at our institution.

In both groups, residents supervised by staff anaesthesiologists provided anaesthesia care. Routine non-invasive monitors were used for all patients. Blocks were placed by the same care team scheduled to provide anaesthesia during surgery. No additional personnel were assigned to facilitate PNB. During block placement, light sedation was provided with midazolam (1–2 mg) and fentanyl (25–250 mcg). The brachial plexus block was administered using a single injection technique with a 22-G, 50 mm, short-beveled tip, insulated needle (Stimuplex®; B. Braun AG, Melsungen, Germany) and a nerve stimulator (Stimuplex®; B. Braun AG, Melsungen, Germany). Mepivacaine 1.5% with sodium bicarbonate 10% v/v was used. In selected PNB patients, sedation was provided during surgery using a propofol infusion at a rate of 10–50 $mcg\,kg^{-1}\,min^{-1}$. Failed nerve blocks were converted to general anaesthesia. General anaesthesia was administered using either a laryngeal mask (in 80 of 121 patients) or an endotracheal tube (in 41 of 121 patients). Propofol was the induction agent along with a short-acting inhalation agent (sevoflurane or desflurane), fentanyl or sufentanil in titrated doses and cisatracurium, as needed for muscle relaxation. Patients were discharged from the phase-1 recovery using the Modified Aldrete Recovery Scoring System [6].

The two groups were analysed and compared based on the following data: (1) anaesthesia preparation time, i.e., the time elapsed from the start of continuous anaesthesia care until the patient was ready for surgery; (2) length of stay in the post-anaesthesia care unit (PACU) from admission to discharge; (3) number of patients who bypassed phase-1 recovery based on a modified Aldrete score of 9 or above [6]; (4) number of unplanned admissions; (5) frequency of critical postoperative complications, i.e., persistent pain management issues, intractable nausea and vomiting, postoperative airway obstruction requiring airway manipulation, aspiration and emergence delirium; and (6) all perioperative costs including admission, operating room, PACU, phase-2 recovery and pharmacy and anaesthesia supplies. Charges for surgical supplies and physician fees were excluded.

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Table 1. Patient data presented as mean ± SD or numbers of patients.

	GA group ($n = 121$)	PNB group ($n = 92$)
Age (yr)	39 ± 43	45 ± 25
Weight (kg)	82.0 ± 22.6	79.1 ± 26.3
Gender (M/F)	73/48*	45/47*
ASA I/II/III/IV	52/52/17/0	34/41/15/2
Painful surgery		
Bone	32	29
Joint	6	6
Amputation	3	4
Less painful surgery		
Soft tissue	65	42
Vascular	15	11

*$P < 0.05$.

Data are expressed as a mean ± standard deviation and were analysed using a *t*-test with Bonferroni's test or ANOVA when appropriate. Non-parametric data were analysed by χ^2-test. Significance is indicated at $P < 0.05$.

We identified 92 PNB and 121 GA patients ($n = 213$) who underwent upper extremity day-surgery. The two groups are demographically similar (Table 1), with the exception of a preponderance of male and younger patients in the GA group ($P < 0.05$) and two ASA IV patients in the PNB group. Painful surgery types were bone, joint and amputation (Table 1), whereas less painful surgery types were vascular and soft tissue, with no difference in case distribution between the groups.

Eighty-five axillary (91.3%), six interscalene (6.5%) and two supraclavicular (2.2%) blocks were performed. Eight failed blocks (8.7%) were converted to GA (four male and four female), but were retained in the PNB group for data analysis. There was no significant difference in anaesthesia preparation time between the two groups (19 ± 13 min for PNB vs. 15 ± 13 min for GA, $P = 0.685$). However, average PACU time was 15 ± 36 min in the PNB group vs. 49 ± 32 min in the GA group ($P < 0.0001$). Seventy patients in the PNB group (76.1%) were fast-tracked to phase-2 recovery vs. two patients (1.7%) from the GA group ($P < 0.05$).

The frequency of postoperative complications was significantly lower in the PNB group (three patients (3.3%) vs. 14 (11.7%) in the GA group, $P < 0.05$). Severe or persistent emesis did not occur in the PNB group, but was a problem in four patients (3.3%) in the GA group. One patient (0.8%) in the GA group experienced an airway obstruction that required airway manipulation. No other complication was recorded in either of the two groups. There was a total of eight (6.7%) unplanned admissions, all from the GA group, four (3.3%) owing to intractable nausea and vomiting and four (3.3%) owing to persistent pain management issues. Perioperative costs in the PNB group were \$3656 ± 1904 per patient vs. \$4780 ± 2721 per patient in the GA group ($P < 0.05$).

Discussion

This retrospective study has compared objective measurements such as time efficiency, complications, unplanned admissions and perioperative costs of RA vs. GA for upper extremity day-surgery. Investigator bias is reduced as the anaesthesiologist managed the cases according to the standard procedure in our institution in a real-life situation, with no pressure to facilitate one or the other group or to modify a management plan according to his/her preconception. Therefore, it represents a valuable method for evaluating and reporting these types of data, and is similar to the Williams and colleagues study on the economics of nerve blocks [4].

Inadequate pain control and persistent nausea and vomiting are the two major reasons for unplanned hospital admission after ambulatory surgery [7]. PNB addresses these problems. Although longer anaesthesia preparation time is a potential disadvantage of PNB, only a small, non-significant increase in preparation time for PNB was noted in this study. This finding may be the result of the frequent use of these techniques at our institution, with a resultant inherent efficiency. Furthermore, in the PNB group, a significant decrease in PACU time was noted with more frequent bypass of phase-1 recovery and fewer postoperative complications and associated unplanned admissions, resulting in a significant decrease in perioperative costs. Other studies of RA for upper extremity surgery have also demonstrated shorter recovery times and less complications compared to GA [2,3,5,6]. In conclusion, these data support the use of PNB in upper extremity day-surgery and can translate into significant healthcare cost savings.

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Ephedrine, phenylephrine and BIS during propofol anaesthesia

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EDITOR:
We congratulate Takizawa and colleagues [1] on their interesting study examining the effect of commonly used vasopressors on bispectral index scores (BIS) during propofol anaesthesia supplemented with high-dose fentanyl. This has complemented the earlier work of Ishiyama and colleagues [2] who performed a similar study with sevoflurane. Both these studies have demonstrated a statistically significant increase in BIS following ephedrine administration for intraoperative hypotension, which is an everyday occurrence, particularly following induction of anaesthesia. Therefore, the question posed by Takizawa is important. What is not clear, however, is whether this apparent 'lightening' of anaesthesia with ephedrine is clinically significant or not. Clearly, with a reported incidence of awareness of 0.07–0.18% [3], a much larger cohort of patients would be required to demonstrate clinically significant changes in the incidence of awareness. However, we have some concerns regarding the methodology of the reported study.

The effect of opioids on BIS is less well characterized compared with volatile and intravenous anaesthetic agents. Barr and colleagues [4] found that patients given fentanyl 10 $\mu g\,kg^{-1}$ supplemented with 0.5 $mg\,kg^{-1}$ propofol at induction, lost consciousness at a much higher BIS (median 91; range 78–98), compared with patients given fentanyl alone (median 80; range 45–94). The 'deeper' plane of anaesthesia was maintained for 10 min after induction. In the current study, clinicians were free to give fentanyl 10–20 $\mu g\,kg^{-1}$ at induction. Although this is a routine practice for cardiac patients, data on fentanyl dosage between groups would have perhaps added weight to the finding that BIS scores were higher in the ephedrine group. In this way, any pharmacological interaction between propofol and fentanyl could be accounted for.

Eight patients (40%) in the ephedrine group had BIS scores greater than 60, 10 min after the ephedrine was given. The inference is that these patients were at risk of awareness. There is no report by the authors of postoperative interviews with these patients to check for any recall, either implicit or explicit. Therefore, although the authors' conclusions are just and BIS has been shown to reduce the incidence of awareness in high-risk patients [5] (e.g. off-pump coronary artery bypass), the clinical ramifications of this study remain unclear. Indeed, it would seem counterintuitive to administer ephedrine for hypotension and then to have to deepen the anaesthetic for fear that the patient became aware.

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