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Research Article

Continuous sedation using propofol and remifentanil versus an ultrasound-guided supraclavicular brachial plexus block for distal radius plate removal

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Abstract: The purpose of this study was to determine whether continuous sedation using propofol and remifentanil could provide acceptable anesthesia and be suitable as an ambulatory anesthetic alternative to ultrasound-guided supraclavicular brachial plexus block for distal radius plate removal. We anesthetized 60 patients undergoing distal radius volar plate removal using continuous sedation with propofol and remifentanil (group S) or an ultrasound-guided supraclavicular brachial plexus block (group B).In group S, the pain levels following the application of local anesthesia ($P < 0.001$) were significantly lower than those in group B. Intraoperative pain, including tourniquet pain, did not significantly differ between the groups ($P = 0.561$). Furthermore, the postoperative pain scores when the patients left the postanesthesia care unit were not significantly different between the groups ($P = 0.291$). In terms of adverse events, three (10%) patients complained of nausea in group S. In contrast, five patients (17%) experienced Horner syndrome, three patients (10%) complained of postoperative mild dyspnea, and four (13%) felt paresthesia in group B. Based on our results, continuous sedation using propofol and remifentanil provided acceptable anesthesia and comprises a suitable alternative for ambulatory anesthesia during distal radius plate removal to an ultrasound-guided supraclavicular brachial plexus block.
Keywords: ambulatory surgery, propofol, radius, regional anesthersia, remifentanil, ultrasonography.

INTRODUCTION

Generally, most extremity procedures can be performed using regional anesthesia with light sedation [1]. A supraclavicular brachial plexus block provides consistently effective anesthesia to the upper extremities [2]. However, traditional nerve localization techniques are associated with a high risk of complications, including vascular puncture, recurrent laryngeal nerve blockade, phrenic nerve blockade, Horner syndrome, and pneumothorax [3, 4]. Although brachial plexus injury following this block is rare, it can occur [5]. Perlas et al. [6] reported that an ultrasound-guided supraclavicular block (SCB) was associated with a high rate of successful surgical anesthesia and a low rate of complications. However, complications following an ultrasound-guided SCB have been reported [7, 8], including nerve injury [9]. Furthermore, a long motor block effect of regional anesthesia is not ideal for outpatient surgery, although the procedure itself is a simple hardware removal.

The purpose of this study was to determine if continuous sedation using propofol and remifentanil could provide acceptable anesthesia and whether it is a suitable alternative for ambulatory anesthesia to ultrasound-guided supraclavicular brachial plexus localization for distal radius plate removal.

MATERIAL AND METHODS

After obtaining both approval from our institutional ethics committee (IRB No. 2012-56) and written informed consent, 60 adult patients (ASA I or II) undergoing plate removal who had previously undergone T-shaped volar plate fixation for distal radius fractures were included in this prospective study. Patients were allocated randomly to one of two groups: those who received propofol and remifentanil for sedation (group S) and those who received an ultrasound-guided supraclavicular brachial plexus nerve block (group B). Neither the participants nor the investigators were blinded to the interventions. The exclusion criteria included an inability to consent to participate in the study, < 20 or > 65 years of age, weight > 100 kg, a Mallampati class IV oral opening, history of chronic sedative use, history of alcohol or drug abuse, preexisting neuropathy, coagulopathy, hepatic or renal failure, and allergies to local anesthetic agents.

Sedation

After arrival in the operating room, each patient's noninvasive arterial pressure (NIBP), heart rate (HR), pulse oximetry (SpO_2), and electrocardiogram (ECG) were monitored. All patients were given O_2 at a rate of 5 L min^{-1} using a face mask. After the initial monitoring of group S, the patients received a remifentanil injection at a loading dose of 0.5 μg kg^{-1} and a continuous dose of 0.07 μg kg^{-1} min^{-1}. At 5 min after the remifentanil injection, propofol was infused using a target controlled infusion pump set to a target of 2 μg mL^{-1}. After administering the loading and continuous doses of the study drugs, an operator draped the operation site, injected 2 mL of lidocaine along the site of the incision, and performed the plate removal. The operation was performed using a tourniquet.

Ultrasound-guided supraclavicular brachial plexus block

After arriving in the operating room, each patient's NIBP, HR, SpO_2, and ECG were monitored. All patients were given O_2 at a rate of 5 L min^{-1} using a face mask. Our approach to ultrasound guidance is similar to that described by Perlas et al. [6]. After the initial monitoring of group B, the patients were laid in the supine position with their head rotated slightly to the contralateral side and their arm by the side of their body. All blocks were performed by staff or fellows. For SCB, a 6-13 MHz prove (SLA; SonoSite, Bothell, WA, USA) for ultrasound (Micromaxx®; SonoSite) was applied in a sterile fashion in the supraclavicular fossa to obtain a short-axis view of the neurovascular structures. The trunks of the brachial plexus were identified as a cluster of hypoechoic nodules superficial and lateral to the subclavian artery. After 1 mL of lodocaine (1%) was injected at the puncture site, a 2-inch, 22-gauge insulated needle (Stimuplex; B. Braun Medical, Bethlehem, PA, USA) was introduced lateral to the ultrasound prove, in parallel with the long axis of the prove. The needle was advanced in-plane with the ultrasound beam until the brachial plexus sheath was penetrated. At this point, electrical nerve stimulation was used to confirm the motor response of the radial nerve. Next, 15 mL of 2% lidocaine and 15 mL of 0.5% bupivacaine with 1:200,000 epinephrines were injected after aspiration to prevent intra-arterial injection, pausing to reaspirate the syringe after every 10 mL. The spread of local anesthetic was monitored by ultrasound based on the hypoechoic signal dispersed around and within the brachial plexus. Intraoperative anxiolysis was achieved using intravenous midazolam (2-3 mg).

Outcome measurement

The patients were questioned by anesthesiologists in the postanesthesia care unit (PACU). Pain during the application of the local anesthetic or SCB, intraoperative pain (including tourniquet pain), and postoperative pain when the patients left the PACU were assessed using a visual analog scale (VAS): 0 = no pain to 10 = severe pain. In group S, adverse events, including postoperative headache and nausea, were evaluated. In contrast, in group B, adverse events, including Horner syndrome, dyspnea, paresthesia, and vascular puncture, were examined.

STATISTICAL ANALYSIS

An *a priori* power analysis was performed. Sample size estimates were based on VAS induction scores and on intraoperative and postoperative pain. A minimum of 28 patients in each treatment group was anticipated to provide approximately 80% power to detect a clinically meaningful difference of 1 VAS score (within-groups SD, 1.5 of the VAS score) at $\alpha = 0.05$. All analyses were performed using SPSS software (ver. 12; SPSS, Chicago, IL, USA), and statistical significance was set at $P < 0.05$. Continuous variables were analyzed using Student's *t*-test or the Mann-Whitney test; categorical variables were analyzed using Pearson's chi-squared test or Fisher's exact test.

RESULTS AND DISCUSSION

Patient demographics

The two groups were similar with respect to age, sex, height, weight, and duration of anesthesia and surgery (Table-1).

Pain during anesthesia

In group S, six patients (20%) felt pain at the injection site, and their mean pain VAS score was 2.3/10; thus, the overall group S score was 0.47/10. However, in group B all patients felt pain (100%) during needling and injection for the supraclavicular brachial plexus block, and their mean pain VAS score was 3.27/10; thus, the overall group S score was 3.27/10. The mean injection pain scores for group S were significantly lower than those for group B ($P < 0.001$) (Table-2).

Pain during the operation, including tourniquet pain

In group S, two patients experienced surgical pain (VAS = 2, 3); however, no patient experienced tourniquet pain. In group B, no patient complained of surgical pain and three patients felt tourniquet pain (VAS = 3, 5, 5). The mean operation pain scores were not significantly different between the two groups ($P = 0.561$) (Table-2).

Postoperative pain

In group B, three patients (10%) felt postoperative pain when they left the PACU, and their mean pain VAS score was 2.3/10; thus, the overall group B score was 0.23/10. In group S, 6 patients (20%) felt pain and their mean pain VAS score was 2.5; thus, the overall group S score was 0.5/10. The mean postoperative pain scores when the patients left the PACU were not significantly different between the two groups ($P = 0.291$) (Table-2).

Satisfaction with the sedation and SCB

The average VAS satisfaction scores for groups S and B were 8.15/10 and 7.42/10, respectively. The satisfaction scores for group S were significantly higher than those for group B ($P = 0.031$) (Table-2).

Adverse events

In group S, four (13%) patients had a headache and three (10%) of the four patients complained of nausea. In group B, five patients (17%) experienced Horner syndrome, three (10%) patients complained of postoperative dyspnea that did not cause desaturation, and four (13%) felt paresthesia. No patient suffered from vascular puncture.

Table-1: Patient demographics and clinical profiles

	Group S	Group B	*P*-value
Number of patients	30	30	
Age	41.7 ± 8.5	40.5 ± 8.2	0.601
Sex (male)	14 (46.7%)	17 (56.7%)	0.438
Weight	64.6 ± 10.9	66.3 ± 11.0	0.566
Height	164.0 ± 8.6	166.4 ± 8.6	0.286
Duration of anesthesia and surgery	58.8 ± 5.7	60.9 ± 6.0	0.159

The data are shown as mean ± SD. No significant differences were observed between the two groups.

Table-2: Pain scores and satisfaction scores

	Group S	Group B	*P*-value
Number of patients	30	30	
Injection pain	0.3 ± 0.7	3.3 ± 1.1	< 0.001*
Operation pain (including tourniquet pain)	0.2 ± 0.7	0.4 ± 1.4	0.561
Postoperative pain	0.5 ± 1.0	0.23 ± 0.73	0.291
Satisfaction score	8.1 ± 0.9	7.4 ± 1.3	0.031*
Repeat same technique‡	27 (90.0%)	23 (76.7%)	0.299

The data are shown as means ± SD. * Significant difference.
‡Whether the patient would select the same method of anesthesia for his/her consecutive surgery. Categorical data are presented as the percent of patients (%).

DISCUSSION

This prospective study compared continuous sedation with regional anesthesia for ambulatory distal radius plate removal. Rapid recovery, adequate analgesia, avoidance of nausea and vomiting, and timely discharge after surgery are essential for a successful ambulatory anesthesia practice [10, 11]. The sedative propofol has a pharmacokinetic profile that is well-suited for continuous infusion because it has a rapid onset of action, short duration of effect, and minimal postanesthetic side effects [12]. In addition, the high clearance and favorable recovery profile of propofol offer advantages over other intravenous sedatives for ambulatory surgery. Furthermore, its use for the induction and maintenance of anesthesia has been associated with a lower incidence of postoperative nausea and vomiting [13, 14]. Also, the rapid onset and metabolism of remifentanil makes it ideal for outpatient surgery, and should permit more precise control of its analgesic effects [15]. Our previous study indicated that continuous sedation using an optimal dose of propofol and remifentanil can be used as a safe, efficacious ambulatory anesthesia [16]. There are several studies comparing regional anesthesia against general anesthesia for outpatient hand and wrist surgery [17, 18]; however, few studies have compared sedation against regional anesthesia for this type of surgery.

Despite advances in anesthesia, postoperative nausea and vomiting remain common problems that result in distress to patients and frequently delay discharge after ambulatory surgery [19-21]. Klein et al. [22] reported that peripheral nerve blocks are an excellent anesthetic option for ambulatory upper limb surgery, resulting in a lower incidence of nausea, vomiting, and sore throats than general anesthesia. Another study reported that postoperative nausea and vomiting (8%) and sore throats (4%) occurred less frequently in patients undergoing an infraclavicular nerve block compared with general anesthesia (32 and 36%, respectively) [18]. Thus, our technique could be used as an alternative outpatient anesthesia for wrist surgery because three patients (10%) developed nausea with no vomiting or sore throat. Interestingly, two patients had high satisfaction despite nausea.

In group S, pain during anesthesia was significantly reduced, as expected. During the operation, two patient (6.7%) experienced surgical pain (VAS = 2, 3) in groups S but no patient in group B. On

the other hand, three patients (10%) in group B felt tourniquet pain (VAS =3, 5, 5), however, no patient in group S. Tourniquet pain is an important factor to consider in patients undergoing anesthesia. Koscielniak-Nielsen et al. [23] reported that six patients (10%) undergoing a supraclavicular block and five patients (8.3%) undergoing an infraclavicular block complained of tourniquet pain with mean VAS scores of 49/100 and 51/100, respectively.

When the patients left the PACU, three group B patients (10%) felt postoperative pain (VAS = 2, 2, 3), and 6 patients (20%) experienced postoperative pain (VAS = 2, 2, 2, 3, 3, 3) in group S. McCartney et al. [17] reported that regional anesthesia when compared with general anesthesia did provide improved early pain control, but did not result in better pain control at home up to 14 days. In our study, there was no significant difference between the two groups VAS scores after operation, thus our sedation technique compared favorably with regional anesthesia for early postoperative pain. However, we did not evaluate the long term pain scores, so further study is needed. The satisfaction score for group S (mean score, 8.1) was higher than that for group B (mean score, 7.4). In addition, 27 patients (90%) in group S would choose the same technique for a similar operation compared with 23 patients (77%) in group B.

CONCLUSION

Continuous sedation using propofol and remifentanil can be used as an ambulatory anesthesia for distal radius plate removal due to providing rapid recovery, adequate analgesia, and low incidence of adverse events with a higher degree of patient satisfaction, compared to an ultrasound-guided supraclavicular brachial plexus block.

REFERENCES

1. Sharrock NE, Beckman JD, Inda EC, Savarese JJ; Anesthesia for Orthopedic Surgery. In: Miller RD, Fleisher LA, Johns RA , Savarese JJ, Wiener-Kronish JP, Young WL, editors; Miller's Anesthesia. 6th edition, Elsevier Publishers, Philadelphia, 2005: 2409-2434.
2. Arcand G, Williams S, Chouinard P, Boudreault D, Harris P, Ruel M, et al.; Ultrasound-guided infraclavicular versus supraclavicular block. Anesth Analg, 2005; 101(3): 886-890.
3. Neal JM, Hebl JR, Gerancher JC, Hogan QH; Brachial plexus anesthesia: essentials of our current understanding. Reg Anesth Pain Med, 2002; 27(4): 402-428.
4. Brown DL, Cahill DR, Bridenbaugh LD; Supraclavicular nerve block: anatomic analysis of a method to prevent pneumothorax. Anesth Analg, 1993; 76(3): 530-534.
5. Lim EK, Pereira R, Brachial plexus injury following brachial plexus block. Anaesthesia, 1984; 39(7): 691-694.
6. Perlas A, Lobo G, Lo N, Brull R, Chan VW, Karkhanis R; Ultrasound-guided supraclavicular block: outcome of 510 consecutive cases. Reg Anesth Pain Med, 2009; 34(2): 171-176.
7. Bhatia A, Lai J, Chan VW, Brull R; Case report: pneumothorax as a complication of the ultrasound-guided supraclavicular approach for brachial plexus block. Anesth Analg, 2010; 111(3): 817-819.
8. Erickson JM, Louis DS, Naughton NN; Symptomatic phrenic nerve palsy after supraclavicular block in an obese man. Orthopedics, 2009; 32(5): 368.
9. Reiss W, Kurapati S, Shariat A, Hadzic A; Nerve injury complicating ultrasound/electrostimulation-guided supraclavicular brachial plexus block. Reg Anesth Pain Med, 2010; 35(4): 400-401.
10. Junger A, Klasen J, Benson M, Sciuk G, Harlmann B, Sticker J,et al.; Factors determining length of stay of surgical day-case patients. Eur J Anesthesiol, 2001; 18(5): 314-321.
11. Pavlin JD, Rapp SE, Polissar NL, Malmgren JA, Koerschgen M, Keyes H; Factors affecting discharge time in adult outpatients. Anesth Analg, 1998; 87(4): 816-826.
12. Sebel PS, Lowdon JD; Propofol: a new intravenous anesthetic. Anesthesiology, 1989; 71(2): 260-277.
13. Vasileiou I, Xanthos T, Koudouna E, Perrea D, Klonaris C, Katsargyris A, et al.; Propofol: a review of its non-anaesthetic effects. Eur J Pharmacol, 2009; 605(1-3): 1-8.
14. McCollum JS, Milligan KR, Dundee JW; The antiemetic action of propofol. Anaesthesia, 1988; 43(3): 239-240.
15. Rosow C; Remifentanil: a unique opioid analgesic. Anesthesiology, 1993; 79(5): 875-876.
16. Lee JJ, Hwang SM, Jang JS, Lim SY, Heo DH, Cho YJ; Remifentanil-propofol sedation as an ambulatory anesthesia for carpal tunnel release. J Korean Neurosurg Soc, 2010; 48(5): 429-433.
17. McCartney CJ, Brull R, Chan VW, Katz J, Abbas S, Graham B, et al.; Early but no long-term benefit of regional compared with general anesthesia for ambulatory hand surgery. Anesthesiology, 2004; 101(4): 461-467.
18. Hadzic A, Arliss J, Kerimoglu B, Karaca PE, Yufa M, Claudio RE, et al.; A comparison of infraclavicular nerve block versus general anesthesia for hand and wrist day-case surgeries. Anesthesiology, 2004; 101(1): 127-132.
19. Jenkins K, Grady D, Wong J, Correar R, Armanious S, Chung F; Postoperative

recovery: day surgery patients preferences. Br J Anesth, 2001; 86(2): 272-274.
20. Macario A, Weinger M, Carney S, Kim A; Which clinical anesthesia outcomes are important to avoid? The perspective of patients. Anesth Analg, 1999; 89(3): 652-658.
21. Gan T, Sloan F, Dear Gde L, El-Moalem HE, Lubarsky DA; How much are patients willing to pay to avoid postoperative nausea and vomiting? Anesth Analg, 2001; 92(2): 393-400.
22. Klein SM, Evans H, Nielsen K, Tucker M, Warner D, Steele S; Peripheral nerve block techniques for ambulatory surgery. Anesth Analg, 2005; 101(6): 1663-1676.
23. Koscielniak-Nielsen ZJ, Frederiksen BS, Rasmusse H, Hesselbjerg L; A comparison of ultrasound-guided supraclavicular and infraclavicular blocks for upper extremity surgery. Acta Anaesthesiol Scand, 2009; 53(5): 620-626.