CLINICAL REPORT

Dexmedetomidine was safely used for sedation during spinal anesthesia in a very elderly patient

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Abstract We safely administered dexmedetomidine (DEX) for sedation during spinal anesthesia in a very elderly patient. The patient was a 98-year-old woman who had hypertension, renal failure, and first-grade atrioventricular block. She was scheduled to undergo internal fixation for fracture of the femoral neck. Initially, DEX (6.0 μg/kg/h) was administered over 10 min, followed by continuous infusion at a dose of 0.7 μg/kg/h. Consequently, her Ramsay sedation score (RSS) increased to 5, and the patient did not grimace in pain while being turned to the lateral position. Epidural catheterization and spinal anesthesia were performed under sedation without any problem. The DEX dose was adjusted to maintain the RSS within 3–4. The surgical operation was performed smoothly without any problem. Since the hemodynamic condition was stable, administration of ephedrine (5 mg) was required only once during surgery. Percutaneous oxygen saturation was maintained at 98% or more; respiratory rate was within 15–21 tpm, and no ventilatory assistance was required. The maximum predicted plasma concentration (pCp) of DEX was 1.56 ng/mL, and the mean pCp of DEX during surgery was approximately 0.45 ng/mL. We found that DEX can be safely used for sedation during spinal anesthesia in a very elderly patient.

Keywords Dexmedetomidine · Very elderly patient · Spinal anesthesia

Introduction

Dexmedetomidine (DEX) is a selective alpha2-adrenoreceptor agonist and is useful for the sedation of patients undergoing invasive procedures as well as for those admitted to intensive care units (ICU) [1, 2]. Although DEX exerts sedative and analgesic effects, it rarely affects the respiratory system, even at high doses [3, 4]. We experienced that DEX can be safely administered for sedation during spinal anesthesia in a very elderly patient.

Case description

The use of DEX for sedation during surgery was approved and monitored by the Research Ethics Committee of Asahikawa Medical College, and informed consent was obtained from the patient and her son.

The patient was a 98-year-old woman (height 151 cm and weight 50 kg) who received 4 mg of benidipine hydrochloride and 30 g of calcium polystyrene sulfonate daily for hypertension and chronic renal failure. She was alert, had good verbal response, and did not seem to have any psychological problem. Her blood pressure (BP) was controlled within 130–150 over 60–75 mmHg. The patient had elevated blood urea nitrogen and plasma creatinine levels of 41 and 1.8 mg/dL, respectively, and a reduced creatinine clearance of 24 mL/min; however, the urine

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volume was 2700 mL/day. Electrocardiography revealed first-degree atrioventricular block, but she was followed up without treatment because there were no symptoms. The patient had a fall at home and hurt her hip. Subsequently, she was diagnosed with extracapsular fracture of the femoral neck and was scheduled to undergo internal fixation with an intramedullary nail. A combination of epidural and spinal anesthesia was mainly planned as perioperative anesthetic management for surgery. However, systemic administration of an anesthetic drug was also planned for sedation and analgesia for the following reasons: (1) the patient was really anxious about surgery and wanted to be sedated; (2) since she experienced severe pain while moving, we were afraid that it would be difficult to turn her to the lateral position to place the epidural catheter and perform spinal anesthesia. We selected DEX as the sedative because we expected DEX to exert both analgesic and sedative effects and to have little effect on the respiratory system of a very elderly patient.

The patient was intravenously administered 20 mg of famotidine dissolved in saline 30 min before entry into the operation room (OR). In addition to monitoring the standard clinical parameters, we monitored her arterial pressure. Since her Ramsay sedation score (RSS) increased to 5 after the administration of 1 µg/kg of DEX over 10 min (initial dose), she was turned to the lateral position (Fig. 1). Since she did not grimace, which indicated that she was not in pain, an epidural catheter was placed in the epidural space via the intervertebral space of L3/L4, and spinal anesthesia was smoothly performed with 12.5 mg of 0.5% isobaric bupivacaine via the intervertebral space of L4/L5. Following anesthesia, DEX was adjusted to keep the RSS within 3–4 during surgery, and was administered at a dose of 0.2–0.7 µg/kg/h. The initial dose of DEX led to decreases in her BP and HR from 142/78 to 104/54 mmHg and from 76 to 68 bpm, respectively. However, the administration of cardiovascular drugs was not required at this time because the decreases in BP and HR were not critical. BP decreased to 90/48 mmHg 65 min after the administration of DEX, but was easily controlled by the administration of 5 mg of ephedrine, which was the only cardiovascular drug that was administered during surgery. The peripheral oxygen saturation (SpO_2) level was maintained above 98%, and the respiratory rate (RR) was stable within the range 15–21 tpm. Blood gas analysis showed no major abnormality (Table 1). The surgical operation was performed smoothly without any problem. Fifteen minutes after stopping DEX administration the RSS recovered to 2, and no side effects (including psychological conditions) were observed during and after the surgery. Following her operation, the patient was shifted to the orthopedic ward and administered 6 mL/h of 0.2% ropivacaine into the epidural space for postoperative pain management.
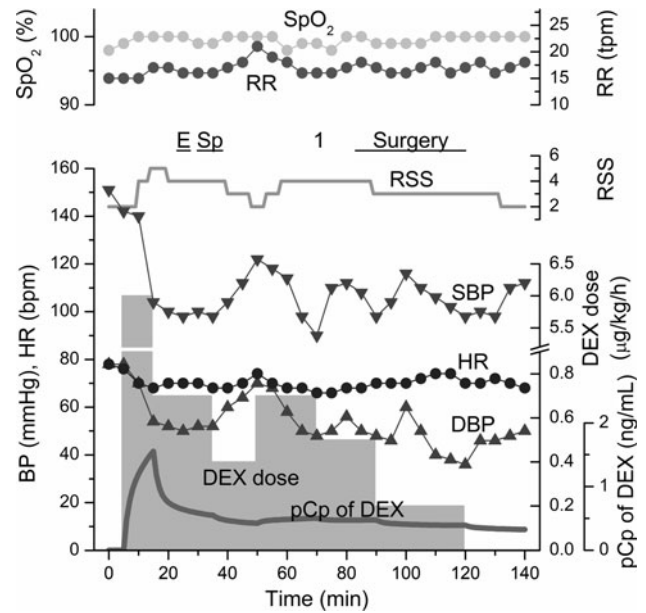
Fig. 1 Vital signs, dexmedetomidine (DEX) dose, and predicted plasma concentration of DEX. Dexmedetomidine (DEX) was continuously administered after the administration of its initial dose. The Ramsay sedation score (RSS) changed according to the DEX dose. Although blood pressure (BP) and heart rate (HR) decreased after the administration of the initial dose, they did not drop to critical levels. Five milligrams of ephedrine were administered at 70 min because BP decreased to 90/48 mmHg. However, the administration of other cardiovascular drugs was not required because the patient's hemodynamic condition was stable. Percutaneous oxygen saturation was maintained at 98% or more, and the respiratory rate (RR) during surgery was 15–21 tpm. The predicted plasma concentration (pCp) of DEX calculated by pharmacokinetic simulation increased after the administration of the initial dose of DEX and fluctuated around 0.45 ng/mL. SpO_2 percutaneous oxygen saturation, *BP* blood pressure, *HR* heart rate, *bpm* beats per minute, *DEX* dexmedetomidine, *DEX dose* dexmedetomidine dose, *pCp* predicted plasma concentration, *RSS* Ramsay sedation score, *RR* respiratory rate, *tpm* times per minute, *E* epidural tubing, *Sp* spinal anesthesia, *1* injection of 5 mg of ephedrine, *SBP* systolic blood pressure, *DBP* diastolic blood pressure

Table 1 Blood gas analysis data

Condition	Face mask, O_2 flow (L/min)		
	5[a]	5[b]	5[c]
DEX dose (µg/kg/h)	0	0.7	0.2
pH	7.457	7.415	7.430
P_{CO_2} (mmHg)	31.9	34.1	34.5
P_{O_2} (mmHg)	102.6	190.6	121.2
HCO_3^- (mmol/L)	23.2	24.4	24.0
Base excess (mmol/L)	−1.5	−0.1	−0.3

FiO_2 inspiratory oxygen fraction, P_{CO_2} carbon dioxide partial pressure, P_{O_2} oxyecoia partial pressure, HCO_3^- bicarbonate ion

[a] Before administration of DEX

[b] 5 min after administration of the initial dose of DEX

[c] 90 min after starting DEX administration

The predicted plasma concentration (pCp) of DEX was calculated after surgery via TIVAtrainer™ (http://www.eurosiva.org/; accessed 1 May 2010) using Dyck's parameter [5]. The maximum predicted plasma concentration (pCp) was 1.56 ng/mL, and the mean pCp during surgery was approximately 0.45 ng/mL.

Discussion

The usefulness of DEX as the sole sedative for invasive procedures has been reported since Ramsay first reported the use of DEX as an intravenous anesthetic agent [2, 4, 6]. Administration of DEX as the sole sedative to patients aged 50–84 years has not been reported to cause adverse effects in the respiratory system, even at high doses [2, 4, 6–8]. Our patient was administered normal doses of DEX; however, given the advanced age of the patient (98 years), we were worried about the effect of DEX administration on her respiratory system. However, her respiratory condition was stable, and ventilatory assistance was not required. Therefore, DEX is considered safe over a wide range of doses.

The maximum pCp of DEX (1.56 ng/mL) when the patient was turned to the lateral position was similar to that during an invasive procedure in a previous study [7], and the mean pCp of DEX (0.45 ng/mL) was less than the DEX concentration required for sedation in ICU patients [9]. Considering the scale of invasiveness, these values were thought to be reasonable. However, since we had to use the pharmacokinetic parameters reported by a previous study in healthy volunteers [5] to calculate the pCp (because no study has reported pharmacokinetic parameters in geriatric patients, while there have been several in children [10, 11]), the calculated pCp value may not be close to the actual value. Further studies are required to consider pharmacokinetics and pharmacokinetics in geriatric patients in depth.

No remarkable hemodynamic changes due to DEX administration have been reported in any case, and the administration of cardiovascular drugs was not required [2, 6]. In our patient, BP and HR decreased after the administration of the initial dose of DEX, and the administration of cardiovascular drugs was required only once during anesthetic management. However, since the use of DEX for sedation can cause hypotension and bradycardia, strict monitoring and preparation for treatment of these conditions is always required.

Elcicek et al. [12] reported that systemic DEX administration prolonged the duration of spinal anesthesia and provided adequate sedation with few side effects. In the present case, we were unable to determine the duration of the effect of spinal anesthesia. However, DEX was effective, and we did not have to administer an additional sedative drug, which can cause respiratory depression; this indicates the usefulness of DEX as, in the study reported by Elcicek et al. [12].

The analgesic effect exerted by DEX during the lateral positioning of the patient is considered to be one of the merits of this method, because management by other analgesic drugs such as alfentanil can lead to decreased blood pressure, which may require treatment [13]. In our case, the RSS remained at 5 during lateral positioning, and the administration of cardiovascular drugs was not required during that time.

The procedure for administering regional anesthesia under deep sedation or general anesthesia is still controversial [14]. Patients under DEX sedation can remain cooperative and can be easily aroused by stimuli; therefore, it is thought that these patients can recognize pain or other sensations that are prodromes of nerve injury. However, there is no evidence for this hypothesis. Since interventions performed under deep sedation are generally considered to have the potential to cause nerve injury or local anesthetic toxicity, the indication for DEX sedation should be carefully considered on the basis of the patient's age, block site, and risk-to-benefit ratio.

Sieber et al. [15] reported that the prevalence of postoperative delirium was significantly lower in the light sedation group than in the deep sedation group. Perioperative infusion of DEX has been reported to decrease the incidence and frequency of emergence agitation or delirium after sevoflurane-based general anesthesia in children without prolonging the time to extubation or discharge [16]. However, no study has reported the effect of DEX during spinal anesthesia on the psychological status of geriatric patients. Since we did not perform a detailed assessment of the psychological status of this patient using tools such as Hasegawa's dementia rating scale, we could not confirm the effect of DEX sedation on the patient's psychological status. However, since the patient showed no signs of delirium after surgery, and since there was no clinical change in the psychological status, it was assumed that DEX had no obvious adverse effects on the psychological status of this patient. Further studies should be performed to evaluate the effect of DEX on the psychological status of geriatric patients.

Sedation was induced by administering DEX during spinal anesthesia in a very elderly patient. Administration of DEX facilitated the turning of the patient into a lateral position and afforded comfortable sedation without causing any side effects. Although further studies are required to confirm the usefulness and safety of DEX for sedation during spinal anesthesia in elderly patients, we can conclude that DEX may be useful for sedation during spinal anesthesia in elderly patients.

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