Respiratory Depression After Intraoperative Opioid-Containing Periarticular Multimodal Drug Injection

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BACKGROUND

Recently, opioid-containing periarticular multimodal drug injection (PMDI) has become a common practice for pain management after artificial joint replacement surgery [1,2]. The aim of this retrospective study was to investigate the incidence of postoperative respiratory depression (RD) by examining respiratory rate (RR) and arterial oxygen saturation (SpO₂) in the patients who received opioid-containing PMDI.

Reference

- Gibbs DM et al. J Bone Joint Surg Br 2012;94:1154-9.
- Jin J et al. J Arthroplasty 2013;28:1882-7.

METHODS

This retrospective study was approved by the Ethics Committee of Fukushima Medical University (No.2818). We examined the digital records of patients who met all of the following conditions:

- underwent total knee or hip arthroplasty at our institution
- received a PMDI (containing morphine 5–10 mg) during surgery
- had their postoperative RR and SpO₂ continuously recorded using the Nellcor™ Bedside Respiratory Patient Monitoring System, PM1000N (Medtronic, Boulder, CO, USA)
- received no opioid either for spinal/epidural anesthesia during surgery or for postoperative analgesia continuously intra and postoperatively

The patient information was collected from medical and anesthesia records. The incidence of **RD, defined as RR <10 breaths/min for 5-minute or longer and/or SpO₂ < 90% for 1 minute**, between the end of surgery and the morning of the first postoperative day was examined.

Nellcor™ PM1000N

RESULTS

We analyzed the data obtained from 23 patients. They underwent surgery under one of the following: 1) general anesthesia; 2) general anesthesia combined with epidural anesthesia; or 3) spinal anesthesia with sedation by propofol.

RESULTS (cont.)

Postoperative RD, RR < 10/min without the decrease of SpO₂, occurred in five of the 23 patients (22%), 23 times in total (median 3, range 1–10) after surgery. The median time from PMDI to RD occurrence was 180 minutes (range 70–505), and the median RD event duration was 400 seconds (range 309–1449).

DISCUSSION

- At the time of RD occurrence, these five patients had received no respiratory-affecting medications intra- or postoperatively, other than the morphine that was included in the PMDI. This suggests an adverse effect of morphine on respiratory condition.
- Three patients developed RD even 4 hours after PMDI. Morphine-6-glucuronide, a metabolite of morphine, might be involved in prolongation of main and side effects of morphine.
- Limitations: This study is a retrospective study, which lacks a control group. Additionally, the number of cases in this study is too small to discuss which factors (such as surgical procedure, age, body weight, BMI, gender, ASA status, etc.) affect RD.

CONCLUSION

PMDI containing opioids can cause postoperative RD. Careful postoperative monitoring is essential to detect such conditions.

Table 1. Patient Characteristics (n = 23).

Gender (male/female)	1/22
Age (yr)	65.1 ± 9.7
Height (cm)	150.7 ± 4.9
Weight (kg)	55.3 ± 10.5
Body Mass Index (kg/m ²)	24.3 ± 4.0
Surgical Procedure	
THA	19
TKA	4
Anesthesia Method	
General	4
General + Epidural	4
Spinal + Propofol Sedation	15

The values are mean±SD. THA = total hip arthroplasty, TKA = total knee arthroplasty.

Table 2. Details of five cases of respiratory depression (RD) occurrence.

Case	Age	Sex	Height [cm]	Weight [kg]	BMI [kg/m ²]	Surgical Procedure	RD times	RD duration time [sec]	Time from PMDI to RD [min]	Least RR [/min]	SpO ₂ during RD [%]	O ₂ administration time from PMDI [min]	Analgesic drugs used during surgery	Analgesic drugs used after surgery
1	46	F	154	58	24.3	THA	10	319-812	107-505	4	92-100	—	Ace, Flu	Flu, Pen
2	83	F	141	46	23.0	THA	1	344	70	6	98-100	—	Flu, Fen	—
3	75	F	150	39	17.1	THA	7	369-1449	81-244	4	100-100	304	Flu, Ace	Flu
4	66	F	154	54	22.6	THA	2	309-315	92-118	4	99-100	741	Flu	Ace
5	60	F	156	47	19.3	THA	3	319-682	250-277	4	100-100	286	Flu, Ace	Ace

In these all 5 case, the contents of the PMDI were morphine (5 mg), ropivacaine, and epinephrine. In Case 1, intramuscular injection of pentazocine (15 mg) was performed twice, but at 3 hours or more after RD. In Case 2, intravenous injection of fentanyl (25 µg) was performed at the end of the surgery. THA = total hip arthroplasty, Ace = Acetaminophen, Flu = Flurbiprofen Axetil, Pen = Pentazocine, Fen = Fentanyl.

Fig. 1. The RR and SpO₂ trend in a representative case of postoperative RD.

A 75-year-old woman (Height: 150 cm, Weight: 39 kg) received THA under spinal anesthesia (isobaric bupivacaine 12.5 mg) with propofol sedation. PMDI (morphine 5mg, ropivacaine 150 mg and epinephrine 0.15 mg) was administered during surgery. She left the operating room 52 minutes after PMDI, at which point she was awake and her RR was 15 breaths/min.

RD occurred 7 times, 81 to 244 minutes after PMDI. (The red arrows in the figure indicate the RD phases.) There was a phase in which the RR was 4-6 breaths/min lasting for 364 seconds, while SpO₂ remained at 100%. The only other drugs used for postoperative analgesia were flurbiprofen axetil and acetaminophen.