

## Utilization of PCIA (Patient-Controlled Intravenous Analgesia) for Postoperative Analgesia of Spine Fusion

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We examined the effect of patient-controlled intravenous analgesia (PCIA) using metoclopramide hydrochloride and morphine hydrochloride in 30 patients (15 males, 15 females) who underwent spine fusion surgery under general anesthesia.

The intravenous administration of 2 mg morphine hydrochloride was done prior to the completion of surgery. Subsequently, morphine hydrochloride was administered via venous injection at a dose of 1 ml/hr. Additionally, a 1 ml bolus dosage was administered at a 60-minute lockout interval employing a pump which contained 36 mg of morphine hydrochloride, 30 mg of metoclopramide hydrochloride in 62 ml of physiologic saline. At approximately 72 hours, we observed the resting VAS (visual analog scale) and the side effects of morphine hydrochloride and thereafter the button pressing frequency (1 button have 0.5 mg morphine hydrochloride) was investigated. The resting VAS was stable through 72 hours in 13 males and 15 females of the 30 cases exhibiting from 2 to 3. The frequency of button pressing was investigated regarding time and gender. One male and two female patients exhibited metastatic tumors of the spine but demonstrated no button manipulation. For the remaining 27 subjects the button pressing frequency increased in most instances furthermore, from 24-48 hours after surgery, the frequency for male patients clearly increased. From 48 hours after surgery, no gender differences were evident regarding the button frequency. However, differences were observed regarding the disease, gender and postoperative time course of analgesia. As a result, no alteration in the background dose appeared to provide the best result, as did a short duration lockout interval.

**Key words :** Patient-controlled intravenous analgesia (PCIA), Spine fusion, Morphine, Metoclopramide

### INTRODUCTION

It is typically necessary to prescribe bed rest following spine fusion. However, in some cases, the patients are unable to remain in bed as a consequence of pain, nausea and vomiting. Moreover, it is difficult to obtain stable analgesia with intermittent suppositories and injectable drugs. Therefore, we investigated the effectiveness of patient-controlled intravenous analgesia (PCIA), employing metoclopramide hydrochloride and morphine hydrochloride, in order to prevent nausea and vomiting while also obtaining a sufficient level of postoperative analgesia.

### MATERIALS AND METHODS

The subjects consisted of 30 cases (15 males and 15 females) who had all undergone spine fusion (thoracic and lumbar spine). All patients included in this study were less than 70 years of age, exhibited a BMI (body mass index) of less than 30 and an ASA (American Society of Anesthesiologists, Physical Status) of 1-2, displayed no liver or kidney dysfunction, were capable of understanding the utilization method of the PCA pump, demonstrated no allergies to the medications and presented with no history of drug abuse [9].

In addition, it was an experiment to keep declaration of HELSINKI. The Sabratek 6060 PCA pump used in this study was made by the JMS company (Kandakonyacho14 Chiyodaku Tokyo JAPAN).

Premedication went anesthesia introduction 30 minutes ago and consisting of 0.25-0.5 mg atropine sulfate, 3-4 mg midazolam and 20 mg famotidine, was administered via intramuscular injection. Anesthesia induction was performed in all cases with 2 mg/kg propofol. Moreover, endotracheal intubation was performed with 0.1 mg/kg vecuronium. Anesthesia was maintained with 3L/min N<sub>2</sub>O, 3L/min O<sub>2</sub>, 0.3-0.4 mg fentanyl and either low-dose sevoflurane (0.5 %) or propofol (3-5 mg/kg/hr). Following general anesthesia, a central venous catheter was inserted into the jugular vein to serve as the pathway of medication. Immediately prior to the operation, 2 mg morphine hydrochloride were administered intravenously. The delivery of morphine hydrochloride was then initiated via a central venous 1-ml/hr background injection. In addition, a 1-ml bolus dose was administered with a 60-minute lockout interval setting via a pump which contained 36 mg of morphine hydrochloride, 30 mg of metoclopramide hydrochloride in 62 ml of physiologic saline [8]. Upon regaining consciousness after anesthesia, electrocardiograms, blood pressure and oxygen saturation were all monitored continuously. Postoperative pain was evaluated with a 10-cm visual analog scale (VAS, 0 cm: no pain, 10 cm: very painful) during bed rest. A diclofenac suppository (50 mg) was used as an analgesic support for patients displaying a VAS reading in excess of 5 when examined post-operatively. The

adverse effects of morphine hydrochloride included VAS, nausea, vomiting, respiratory depression, constipation and pruritus during bed rest and such side effects started to occur at approximately 72 hours after surgery. Following the removal of the PCA pumps, the duration of button frequency was investigated. Significant differences were examined with the non-paired student's t test. The results were considered significant when the values were less than 0.05 % ( $P < 0.05$ ).

## RESULTS

The average patient age at operation was 53.1 years. In addition, the average anesthesia time was 4 hours and 48 minutes. No significant no differences were observed between males and females. The VAS at bed rest in 13 males and 15 females ranged from 2 to 3 while up to 72 hours after surgery. The VAS of the remaining males exceeded 5 approximately three hours following surgery. Consequently, 50 mg diclofenac suppositories were utilized. Following suppository administration, the pain decreased to a greater degree than under of self-control. As a result, the patients were able to rest sufficiently in bed. From that juncture, the VAS never exceeded a reading of 5.

The frequency of button pressing was investigated at three time points: less than 24 hours, from 24-48 hours and over 48 hours following surgery. Differences due to gender were also evaluated. One male and two females did not press the button at all. These three patients underwent spine fusion and the removal of a metastatic spine tumor. The frequency of button pressing in the remaining 27 patients was the greatest at less than 24 hours following surgery.

**Table 1.** The frequency of button pressing

	less than 24 hours after operation	from 24-48 hours after operation	more than 48 hours after operation
Total (n:27)	21.1 ± 22.8	16.4 ± 28.9	1.7 ± 3.8
Males (n:14)	26.9 ± 25.3 ※※	23.5 ± 35.5 ※	1.6 ± 2.4
Females(n:13)	12.3 ± 15.9	5.6 ± 8.2	1.9 ± 5.3

Data values are expressed as means ± SD

※※  $P < 0.01$  VS to females groups

※  $P < 0.05$  VS to females groups

Regarding gender, no significant differences were observed at less than 24 hours; however, the frequency of button pressing for males was much higher than those for females. During the 24-48 hour postoperative period, greater button pressing was clearly evident in male patients; moreover, significant differences emerged. After 48 hours postoperatively, no differences were observed regarding gender and the degree of button pressing clearly decreased from 48 hours (Table 1).

Symptoms of ischuria as an adverse effect of morphine hydrochloride was unclear due to the use of an indwelling urethral catheter. Nausea and vomiting were absent in all cases, which thus demonstrated the effectiveness of metoclopramide hydrochloride. No reduction of percutaneous oxygen saturation was evident in any case. In addition electrocardiograms and blood pressure didn't have change. However, 28 of 30 patients complained of constipation, which subsequently improved after treatment with both 50 % glycerin enemas (30 ml) and sodium picosulfate (5-7.5 mg). In addition, one subject exhibited pruritus.

## DISCUSSION

In order to obtain stable postoperative analgesia, the administration of morphine hydrochloride has been reported to be highly effective, however, the appropriate amount of PCIA morphine hydrochloride has yet to be clearly elucidated in the Japanese literature for the field of orthopedics. Several reports regarding the total amount of PCA via morphine hydrochloride intravenous injection have appeared in the international literature. The data pertaining to this subject have been documented by Sechzer *et al.* (average 32 mg/ 24 hr) [7], Lehmann *et al.* (50.4 mg/24 hr) [6], Wheatley *et al.* (51 mg/24 hr) [10] and Joshi *et al.* (182.4 mg/48 hr) [3]. The amount of morphine hydrochloride administered in this study averaged 24.5 mg/24 hr, whereas the largest dosage was 36 mg/24 hr. Therefore, the morphine hydrochloride dosage in our study was less than that reported in other investigations. This distinction is believed to account for differences in physique, sense of pain and the method of administration. If the levels of morphine hydrochloride cited in the previous studies had been employed, then a

reduction in oxycoia saturation, respiratory depression and excess analgesia would have been expected in our patients due to an excessive administration.

We considered establishing an optional PCIA amount based on previous reports. We attempted to obtain longer lockout intervals of PCIA by administering background dosage. Three patients presented with metastatic bone tumors of the spine. Consequently, no button pressing was observed for 72 hours following the operation in these 3 cases. Moreover, the amount of morphine hydrochloride in the background administration regarding pain control was found to be sufficient. Morphine hydrochloride and NSAID were prescribed for these patients. Furthermore, we believe that a decreasing requirement of postoperative analgesia exists regarding the use of pre-emptive analgesia.

Differences regarding the button pressing frequency were evident in the remaining 27 patients. Based on the average age, female patients had both experienced menstruation and given birth prior to this procedure. In contrast, some male patients receiving the operation experienced great pain for the first time. Therefore, the inference indicated a difference regarding the button pressing frequency for relief of pain. No differences were observed after 48 hours postoperatively between males and females. Moreover, as the frequency of button pressing decreased, the morphine hydrochloride background administration level was believed to be sufficient. Furthermore, we also found differences related to the required morphine hydrochloride dosage regarding the disease, gender and length of time after operation.

No nausea or vomiting were observed as adverse effects of morphine hydrochloride due to the continuous administration of 10 mg/24 hr metoclopramide hydrochloride. The amount of metoclopramide hydrochloride utilized at the appearance of emesis in a report by Ono *et al.* [5] under morphine subcutaneous injection was  $7.9 \pm 11.0$  mg/48hr. As a result the continuous administration employed in the present study was considered to be adequate. In addition, extrapyramidal effects and galactorrhea was not recognized.

Constipation appeared in 28 of 30 patients. The high ratio of constipation was hypothesized to be attributable to the phar-

macodynamic action of morphine hydrochloride and the difficulty of obtaining sufficient abdominal pressure associated with bed rest.

### CONCLUSION

We performed PCIA using metoclopramide hydrochloride and morphine hydrochloride, following spine fusion. Good results were obtained regarding the inhibition of nausea and vomiting. Differences were also seen regarding disease, gender and the time course of postoperative analgesia. Consequently, effective control was achieved with a background dosage of 1 ml/hr and a lockout interval of less than 60 minutes.

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