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Original Article

Sex Differences in Elderly Patients Using Patient Controlled Analgesia in the Postoperative Period: A Retrospective Database Analysis☆

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SUMMARY

Background: Sex differences in pain perception exist in humans. This study aimed to search whether sex differences also existed in patient controlled analgesia (PCA) among elderly populations.
Methods: Patients' information was retrieved from a quality-insurance database from a period of 2 years. Demographic characters, types of PCA mode, consumptions of PCA drugs on postoperative Day 1, all PCA-related complications, visual analogue scale in bed rest, daily activities, and coughing, surgical sites, American Society of Anesthesiologists physical status, and satisfaction to PCA were all analyzed.
Results: A total of 1441 women (71.6 ± 8.4 years) and 730 men (70.9 ± 7.7 years) were analyzed. Elderly women had higher incidences of nausea, vomiting, vertigo, inappropriate sensory and motor blockages, as well experiencing more pain in bed rest and daily activities. Elderly men had more pain experience while coughing but had higher satisfactions to PCA.
Conclusion: Several important sex differences existed in the elderly patients when utilizing PCA as pain management. More concern should be drawn to these differences to minimize PCA-related complications and to avoid the potential hazard of PCA in vulnerable elderly patients. Generalization of this application in other constitutions requires further studies.

1. Introduction

Several experimental and clinical studies have reported an age-related decrease in pain perception, but whether the decrease results from the aging process or other age-associated conditions remains unclear[1,2]. Although reduced pain perception exists in elderly people, postoperative wound pain, which often severely interferes with the respiratory and cardiovascular system, still plays an important role in the postoperative period. A well-prepared pain strategy is especially imperative in these vulnerable patients. With much quicker drug deliveries, easy titration to desired analgesia effects, and less drug overdose concerns, patient-controlled analgesia (PCA) is considered superior to conventional intramuscular opiates injection. Although safer and more effective than conventional opiate injections in pain relieving, the use of PCA still carries lots of potential adverse events, ranging from nausea, vomiting, vertigo, and skin itching, to life-threatening conditions, including respiratory and conscious depress; and more attention to these complications should be paid, especially in elderly patients. In the past decade numerous studies in animals and humans have indicated sexual dimorphism in many regions of the central nervous system[3–5], so it is not surprising that there were lots of experiments drawing their focus on contributions of sex to pain perception and analgesia—and many studies indeed support sex difference mechanisms[6–9]. Although many animal studies have confirmed the fact that opioids act more efficaciously in men, in humans it is not so clear regarding the presence of sex differences in opioid effects[9,10]. In this study, our goals were to confirm the safety of a PCA device in an elderly population, to find whether there are sex differences in PCA-related complications, in opiates and local analgesics requirements, and in the satisfaction to PCA devices.

2. Materials and methods

This retrospective analysis is based on a quality-assurance system for following-up patients that utilized a PCA to ameliorate

☆ Conflicts of interest: All contributing authors declare that they have no conflicts of interest.

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postoperative pain in our hospitals. These patients could have had a PCA device either from an intravenous route or an epidural catheter, as suggested by the surgeons and anesthetists for more pain relief and less unavoidable drug-related complications.

All patients received regular postoperative checks for at least 3 days. The volumes of delivered drugs and other drugs acting as analgesic adjuvants or as interventions for PCA-related complications were totaled. Complications being considered directly related to PCA were carefully searched and surveyed. PCA-related side events included respiratory and conscious depress, skin itching, urine retention, nausea, vomiting, vertigo, and inappropriate blockage of motor and sensory functions of extremities. The respiratory depression effect of PCA was monitored by spontaneous respiratory rate, and set to be alarming whereas the rate was below eight cycles/min. The conscious was classified as follows: Level I, an alert state; Level II, drowsy but immediately responding to commands or stimulations; Level III, a deeper drowsy state with slowly responding to commands and stimulations, and level IV, loss of conscious without any response to commands and stimulations.

The efficiency of PCA was evaluated utilizing an interactive visual analogue pain scale with 100 for the worst experienced pain and 0 for almost free of pain, and we evaluated the wound pain in three dissociated conditions: bed rest, coughing, and daily activities (such as walking in the ward), respectively. For the purpose of further studies, some particular patients' demographics data comprising age, sex, body weight, body height, and American Society of Anesthesiologists (ASA) physical status were all registered in the database. Other collected items included surgical sites, general or regional anesthesia, and patients' satisfaction with the PCA.

All the database items were analyzed using SPSS 21.0 (IBM SPSS Inc., New York, America), with an independent-sample *t*-test procedure for testing difference of means of scale variables, and crosstabs procedure with options of Chi-square test or Fisher's exact test to find differences in proportions for categorical variables. The scale variables were reported in terms of mean ± standard deviation and categorical variables in terms of number and percentage. Statistical significance was set at $p < 0.05$.

The study protocol was approved by the Institute Review Board of our hospital[11,12].

3. Results

From January 1, 2012 to December 31, 2013, our quality-assurance database collected information of 7317 patients; among them, the female group surprisingly dominated in numbers (5791–1526). In the same population, the elderly group (age > 60 years) comprised 2171 cases, also with an accordingly high women to men ratio (1441:730).

In the 2171 elderly patients, the age difference between women and men was not significant (71.6 ± 8.4 vs. 70.9 ± 7.7; $p = 0.06$), but the elderly men were superior to the elderly women in terms of body weight (66.5 ± 25.5 kg vs. 59.5 ± 11.3 kg; $p < 0.001$) and body height (165.3 ± 5.9 cm vs. 153.4 ± 13.2 cm; $p = 0.001$).

Among the elderly patients, 994 women and 433 men chose intravenous morphine as a pain relieving drug, and in elderly men the total volume of morphine delivered at the 1st postoperative day was significantly more than in the elderly women (25.51 ± 24.30 mg vs. 21.91 ± 20.54 mg; $p = 0.007$), but this difference disappeared when body weight was considered (0.45 ± 0.53 mg/kg vs. 0.37 ± 0.34 mg/kg; $p = 0.271$). In the other 241 men and 374 women, the PCA devices pumped the local anesthetic levobupivacaine into the epidural space. The differences of totally pumped volumes of levobupivacaine in elderly men and women were not statistical significance (141.53 ± 49.96 mL vs. 138.45 ± 41.99 mL; $p = 0.402$), but when the body weights were included in the calculation, we found that the elderly female group took higher volumes than the elderly male group did (2.41 ± 0.83 mL/kg vs. 2.26 ± 0.90 mL/kg; $p = 0.37$).

The sex differences of responsiveness to PCA were found. Elderly women experienced more pain than elderly men during bed rest and in daily activities (19.69 ± 13.45 vs.17.57 ± 13.06; $p = 0.001$; 43.77 ± 15.68 vs. 39.99 ± 16.71; $p = 0.001$; respectively; Table 1), but the elderly men had stronger painful sensations than elderly women when coughing (46.81 ± 22.43 vs. 42.11 ± 25.34; $p = 0.001$). After all, with less PCA-related complications and a lower visual analogue pain scale than elderly women, the elderly men were more satisfied with PCA than the elderly female group (92.8% vs. 85.7%; $p = 0.001$; Table 2).

Among all patients, there was no PCA-related respiratory depression reported and only five patients (three women and two men) developed mild drowsiness which only needed close monitoring. Approximately 24.7% of the patients complained of nausea, with women being more vulnerable than men (29.8% vs. 14.5%; $p = 0.001$; Table 3), and 14.3% of the patients complained of vomiting, with women also having a higher incidence rate (18.7% vs. 5.5%; $p = 0.001$). Skin itching was seldom complained of (2.4%), and no sex difference was found (women 2.9% vs. men 1.4%; $p = 0.105$). Due to the Foley tube being a routine setting after most surgical procedures in elderly patients, the real incidence of urine retention could not be accurately estimated. Only 0.21% was reported and no sex difference was found (women 0.2% vs. men 0.3%; $p = 0.067$).

Elderly women complained of inappropriate sensory blocks more than the elderly men (9.6% vs. 3.7%; $p = 0.009$; Table 4). They also complained of inappropriate motor blocks more than the men (6.9% vs. 1.5%; $p = 0.005$). The total incidences of inappropriate sensory and motor blocks were 7.2% and 4.7%, respectively.

The elderly women and men presented much different varieties of diseases that needed surgical intervention ($p = 0.001$; Table 5). In the female group, the surgical interventions involved mainly the lower extremities (44.1%) and lower abdomen (25.1%), whereas in the male group, lower extremities (27.8%) and upper abdomen (22.3%) were the leading two areas, followed by the lower abdomen (19.9%).

The ASA physical status is a standard and routinely used measure to predict a patient's risk for anesthesia and surgery, with a higher grade implying a higher risk. Above half (52.3%; Table 6) of the elderly men were graded as ASA III (moderate risk) and the proportion was significantly higher than in the female group (44.4%; $p = 0.002$). Most of our patients needed general anesthesia for their surgical procedures, with more men needing general anesthesia than the female group (76.3% vs. 63.0%; $p = 0.001$).

4. Discussion

In our patients, women are much more desirous of PCA than men, and in the elderly group, the female to male ratio was near 2:1,

Table 1
Comparisons of visual analog scale of elderly patients in bed rest, daily activities, and coughing.

	Group	*n*	Mean ± SD	*p*
Bed rest	F	709	19.69 ± 13.45	0.001
	M	414	17.57 ± 13.06	
Daily activities	F	709	43.77 ± 15.68	0.001
	M	1425	39.99 ± 16.71	
Coughing	F	528	42.11 ± 25.34	0.001
	M	829	46.81 ± 22.43	

F = female; M = male; SD = standard deviation.