

# Efficacy of subcutaneous morphine patient controlled analgesia compared to intravenous morphine patient controlled analgesia in cesarean section



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## ABSTRACT

**Background:** Cesarean section causes moderate to severe pain in the first 48 hours postoperatively, thus requiring an adequate perioperative pain management, as of the mother can be quickly discharged and immediately can perform daily activities after surgery such as breastfeeding and nurse the baby.

**Objective:** To determine the efficacy of subcutaneous morphine patient controlled analgesia (SC-PCA) in lowering VAS (visual analogue score), total morphine consumption and postoperative side effect of cesarean section compared with intravenous morphine patient controlled analgesia (IV-PCA).

**Methods:** This study is an experimental clinical trial using consecutive sampling technique. Sixty-four subjects were allocated into two groups of PCA morphine subcutaneously (SC-PCA) and the group PCA morphine intravenously (IV-PCA), each consisting of 32 subjects using permuted block randomization. Morphine concentration was

5 mg/ml (group SC-PCA) or the concentration of 1mg/ml (group IV-PCA). Both groups were then analyzed for VAS ratings, total morphine consumption, and adverse effects, postoperatively at 4th, 8th, and 24th hour. Statistic analysis using repeated ANOVA test and t-test with  $p < 0.05$  considered significant.

**Result:** Morphine consumption in IV-PCA group showed lower than SC-PCA (9.41 mg vs 4,9mg)  $p < 0.001$  24 at 24 hours postoperatively. The resting VAS at 4th hours significantly lower in IV-PCA group ( $1.06 \pm 0.71$  vs  $0.81 \pm 1.40$ ,  $p=0.029$ ) and at 8th hours ( $1.03 \pm 0.59$  vs  $0.94 \pm 0.9$ ,  $p=0.048$ ). The moving VAS at 4th hours significant lower in IV-PCA group ( $2.31 \pm 0.47$  vs  $1.45 \pm 2.06$ ,  $p=0.019$ ) but the resting or moving VAS are not different clinically. Side effects of nausea and vomiting are more common in IV-PCA group. We conclude that SC-PCA provides analgesia more effective and decreases side effects in patients undergo cesarean section with spinal anesthesia.

**Keywords:** PCA morphine subcutaneous, spinal anesthesia, cesarean section

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## INTRODUCTION

The advantages of PCA is to be able to get quick pain relieve and the analgesic dose of each patient is also more precise and in accordance to the needs of patients individually by reason of every patient has a different analgesic dose requirement. Furthermore it's much secure and well controlled. With the result reduce opioid's side effects, when the patients received enough opioid, she will not receive another unnecessary dose without pressing the demand button.<sup>1</sup>

The subcutaneous drug was first introduced during the civil war in America in 1863. Basic principles of the subcutaneous cannula placement are: (1) cannula placed on the chest, abdominal wall or thighs; (2) in agitated patients it is better located in the scapula to prevent the cannula detached; (3) infusion catheter should be replaced every 24 hours; (4) cannula must be replaced if edema or hematoma is occurred at the insertion

area; (5) there is blood on the IV tube or catheter obstruction; and (6) needle should be replaced every 5-7 days.

Needle placement duration is also affected by pH and osmolality of the drugs whereby isotonic fluid can reduces the risk of skin irritation.<sup>2,3</sup>

## METHODS

This study is an experimental clinical trial. The sample are all patients underwent cesarean section surgery in the emergency department from July to September 2016 that meet eligibility criteria. Inclusion criteria were: (1) age 18-45 years, (2) physical status ASA II. Meanwhile exclusion criteria were: (1) the patient refused to participate in the study, (2) patient fail to follow the study protocol, (3) BMI  $< 18.9$  kg / m<sup>2</sup>, (4) BMI  $> 32.9$  kg/m<sup>2</sup>, (5) allergic to morphine, (6) previous long term use of analgesics, (7) history of epilepsy, (8) history of

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renal and liver dysfunction, (9) addictive to alcohol, (10) hemodynamically unstable during surgery, (11) bleeding more than 30% of estimated blood volume, (12) duration of surgery >4 hours.

Sixty-four subjects were observed and allocated into two groups: PCA morphine subcutaneously (SC-PCA) and the group PCA morphine intravenously (IV-PCA) each consisting of 32 subjects, using permuted block randomization. Morphine concentrations were 5 mg/ml at SC-PCA group and 1 mg/ml at IV-PCA group. Both groups then analyzed by VAS ratings, total morphine consumption and adverse effects at 4th, 8th, and 24th hours post operatively. Statistic analysis using repeated ANOVA test and t-test with  $p < 0.05$  and was considered significant.

**RESULT**

The average age of subjects in the SC-PCA group were 27 years old ( $\pm 6.5$  years old) and the group IV-PCA was 26 years old ( $\pm 13.5$  years old). Average BMI of SC-PCA group was  $25.58 \text{ kg/m}^2$  ( $\pm 4.02 \text{ kg/m}^2$ ) and

in IV- PCA group was  $27.15 \text{ kg/m}^2$  ( $\pm 3.1 \text{ kg/m}^2$ ). Both variables were not significantly different in statistics.

Educational characteristics using Chi-Square test result divided into four groups: elementary, junior, senior and bachelor degree. Samples with elementary education in the SC-PCA group were 3 patient whereas IV-PCA group is 1 patient. Subjects with secondary education in SC-PCA group were 5 patients, and IV-PCA group were 5 patients. Samples with high school education in SC-PCA group were 23 patients and IV-PCA group were 22 patients. Samples with bachelor degree on SC-PCA group were 3 patients and IV-PCA group were 2 patients and statistics in both groups was not significant with p value 0.736.

On the characteristics of surgical history results of Chi-Square test obtained in 25 patients without history of surgery and 7 patients with a history of surgery in the SC-PCA group, whereas IV-PCA obtained 16 patients with history of previous surgery and 16 patients without history of previous surgery, it statistically significantly different between groups with a p value of 0.018.

**Table 1** Description of sample characteristic based research group

Characteristic		SC-PCA group (n=32)	IV-PCA group (n=32)	Confidence interval 95% SC-PCA	Confidence interval 95% IV-PCA	p value
Age	Year	28,03 $\pm$ 6,25	28,78 $\pm$ 7,68	25,78-30,28	26,01-31,55	
IMT	kg/m <sup>2</sup>	25,57 $\pm$ 4,01	27,15 $\pm$ 3,08	24,13-27,02	26,03-28,26	
Educational	E	1 (3,12%)	3 (9,38%)			
Surgery history	JS	5(15,62%)	5(15,62%)			0,736
	SS	23	22			
	S1	3	2			
	Yes	7(21,9%)	16 (50%)			0,018
	No	25(78,1%)	16 (50%)			

CI = descriptive value <sup>b</sup> = Chi Square p value. E= elementary; HS= Junior high school; SS: Senior high school; S1=bachelor degree

**Table 2** Resting VAS comparative 4th hours, 8th hours and 24th hours

VAS (resting)	Group		P value	Confidence Interval 95% SC-PCA	Confidence interval 95% IV-PCA	Odds Ratio
	SC-PCA n=32	IV-PCA n=32				
4th hours	1,06 $\pm$ 0,71	0,81 $\pm$ 1,40	0,029 <sup>a</sup>	0,80-1,32	0,31-1,32	5,22
8th hours	1,03 $\pm$ 0,59	0,94 $\pm$ 0,91	0,048 <sup>a</sup>	0,82-1,25	0,61-1,27	2,82
24th hours	0,84 $\pm$ 0,62	0,97 $\pm$ 0,64	0,348 <sup>a</sup>	0,62-1,07	0,74-1,20	0,59

<sup>a</sup>= p value from Levene test, CI= descriptive test

**Table 3** VAS motion comparative 4th hours, 8th hours and 24th hours

VAS (moving)	Group		P value	Confidence Interval 95% SC-PCA	Confidence interval 95% IV-PCA
	SC-PCA n=32	IV-PCA n=32			
4th hours	2,31 $\pm$ 0,47	2,06 $\pm$ 1,45	0,019 <sup>a</sup>	2,14-2,48 <sup>b</sup>	1,54-2,59
8th hours	2,5 $\pm$ 0,78	2,09 $\pm$ 0,77 2,13 $\pm$ 0,75	0,379 <sup>a</sup>	2,24-2,76 <sup>b</sup>	1,81-2,37
24th hours	2,06 $\pm$ 0,75		0,750 <sup>a</sup>	1,79-2,34 <sup>b</sup>	1,85-2,40

<sup>a</sup>= p value from Levene test, <sup>b</sup>= descriptive test

**Table 4** Total morphine consumption

Morfin	Kelompok						Nilai p
	PCA subkutan n=32 (mg)	PCA intravena n=32 (mg)	Minimal dan Maksimal Subkutan (mg)	Minimal dan maksimal intravena	CI 95% subkutan	CI 95% Intravena	
Jam ke-4	2,75±2,29	1,31±1,06	0-6	0-5	1,95-3,55	0,93-1,69	<0,001 <sup>a</sup>
Jam ke-8	3,41±2,16	1,78±1,15	1-9	0-6	2,62-4,19	1,36-2,20	<0,001 <sup>a</sup>
Jam ke-24	3,25±3,09	1,81±1,12	1-10	0-4	2,14-4,36	1,41-2,22	<0,001 <sup>a</sup>
Total 24 jam	9,41±6,34	4,90±2,34	1-24	1-10	7,12-11,69	4,06-5,75	<0,001 <sup>b</sup> 0,001 <sup>b</sup>

<sup>a</sup>= p value from Levene test, <sup>b</sup>= p value from effects between subject test, CI=descriptive test

**Table 5** Side effect comparative

Groups	Nausea and vomiting		p value
	Yes	No	
SC-PCA	0 (0,0)	32 (100%)	<0,001
IV-PCA	16 (50%)	16 (50%)	

## DISCUSSION

In this study, the resting VAS value was found statistically different between SC-PCA group and IV-PCA group on 4th and 8th hours but was not significantly different at the 24th hours. However, it was not different clinically because the VAS between the two groups are still in the same grading. Bioequivalence subcutaneous morphine is equal to intravenous analgesia thus providing the same effects. The efficacy of subcutaneous morphine PCA is equally satisfying with the intravenous group as indicated by pain score and was not significantly different between the two groups. Treatment initiation time also affects where treatment was initiated when Bromage score was 1 whereas VAS score between 1 and 2 there is no significant difference in pain between the two groups.<sup>4-7</sup>

In this study total consumption of morphine results in IV-PCA group is 4,5 mg lower than SC-PCA. Bioavailability of morphine after subcutaneous is lower than intravenously at around 80%, this may be caused by the subcutaneous fat which needs larger dose in the subcutaneous group.<sup>8-10</sup>

The side effects such as respiratory depression and pruritus did not occur in both groups, but the side effects such as nausea and vomiting were present in 16 samples of IV-PCA group, and none of in SC-PCA group, it is likely influenced by the slow absorption of subcutaneously which reduce the incidence of nausea and vomiting.<sup>1,5,7</sup>

## CONCLUSION

In this study, we conclude that lower morphine consumption by 4.5 mg in IV-PCA group with the

quality of analgesia that showed by VAS score was not significantly different compared to the SC-PCA group, while the side effects of nausea and vomiting is more frequent in IV-PCA group. According to this conclusions, we may consider the usage of PCA morphine subcutaneously as an alternative postoperative analgesia for post caesarean section patients.

## REFERENCES

- Grass, JA., 2005. Patient Controlled Analgesia. *Anesthesia Analgesia Journal* 101: 544-61.
- Watanaba, S., Pereirera, J., Hanson, J., et al. 2008. *A randomized double blind crossover comparison of continuous and intermitten subcutaneous.*
- O'Doherty, C., Hall, E.J., Schofield, L., et al. 2001. Drugs and syringe drivers: a survey of adult specialist palliative care practice in the United Kingdom and Eire. *Palliative medicine journal* 15: 149-54.
- Mannan, S., Qazi, S., Dar, A. 2010. Comparison between intravenous patient controlled analgesia and subcutaneous morphine in patients after gastrectomy. *The Internet journal of Anesthesiology* 22 (2): 1-6.
- Keita, H., Geachan, N., Dahmani, S. 2003. Comparison between patient controlled analgesia and subcutaneous morphine in elderly patients after total hip replacement. *British journal of anaesthesia*; 90 (1): 53-7.
- Jeon, Y. S., Kim, D. W, Lee. 1999. Comparison of subcutaneous Patient controlled analgesia with intravascular patient controlled analgesia using morphine. *Korean journal anesthesiol.* 37 (5): 831-837.
- Yoshino, A., Nagashima, S., Hashimoto, Y. 2000. Continuous subcutaneous morphine vs intravenous patient controlled analgesia for postoperative pain management in spinal surgery. *European journal of Anaesthesiology* 17 (19); 191-2.
- Macintyre, P. 2001. Safety and efficacy of patient controlled analgesia. *British Journal Anaesthesia* 87 (1): 36-46.
- White., Paul, F. M. D. 2015. Subcutaneous PCA: An alternative to IV-PCA for postoperative pain management.
- Saracoglu, A., Saracoglu, K. T., Umuroglu, T. 2010. The effectivity of fentanyl versus tramadol as intravenous patient controlled analgesia after cesarean section. *ISSN. Turkey*; 19 (6): 739-43.



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