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Original Article

Anaesthesia Section

Intermittent Subcutaneous Morphine for Postoperative Analgesia Following Coronary Artery Bypass Grafting

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ABSTRACT

Introduction: An effective postoperative pain management is of utmost importance following cardiac surgery. Various agents, routes and modes are available for the treatment of postoperative pain. Subcutaneous route of administration is an easy and effective method of postoperative analgesia with improved patient satisfaction and lesser side effects compared to intravenous route.

Aim: To evaluate the efficacy of Subcutaneous Morphine (SCM) as postoperative analgesia following Coronary Artery Bypass Grafting (CABG).

Materials and Methods: This study was designed as a retrospective analytical survey from June 2015 to June 2017. Medical records of all patients over 18 years of age who underwent coronary artery bypass grafting were reviewed. Patients belonging to ASA PS I, II and III, patients above 18 years of age and those posted for coronary artery bypass grafting were included in the study. Patients were divided into two groups: SCM group and Paracetamol (PCT) group, depending on the primary analgesia they received. The two groups were compared using Student's t-test for normally distributed continuous data or non-parametric tests if the data were not normally distributed. Categorical data were compared by Fisher's-exact test. The p-values <0.05 were considered statistically significant.

Results: A total of 102 records were reviewed, out of which 49 patients received SCM and 53 patients had received PCT as their primary postoperative analgesia. It was observed that PCT group required more additional analgesia (intravenous fentanyl/ tramadol) than SCM group which was statistically significant with p-value of <0.001 and the duration of Cardiac Intensive Care Unit (CICU) stay was more in PCT group with p-value of 0.001. Postoperative side effects were significantly more in PCT group.

Conclusion: SCM can be effectively administered intermittently for postoperative analgesia following CABG with similar haemodynamic stability and minimal side effects as compared to intermittent intravenous PCT.

Keywords: Heart bypass surgery, Multimodal analgesia, Postoperative pain, Subcutaneous injection

INTRODUCTION

An effective postoperative pain management has become an important postoperative quality measure following any surgery. Inadequate pain relief can cause undue sympathetic stimulation and may worsen postoperative outcome in terms of increased duration of hospital stay and decreased patient's satisfaction. The main goal for postoperative pain management is to alleviate pain and discomfort with less side effects [1,2].

Various agents, routes and modes are available for the treatment of postoperative pain. Although opioid based analgesia has been considered as mainstay of pain management, increasingly more evidence exists to support a multimodal approach which is goal directed [2,3]. Intermittent parenteral bolus of morphine is commonly used for postoperative analgesia. It is given by intramuscular or intravenous injection, though the subcutaneous route shows the highest advantage. Advantages of SCM via indwelling 22G IV cannula [2,3] include: a) Simple and easy technique; b) Less painful (no phlebitis risk); c) Faster onset of action; d) Longer duration of action; e) Less side effects like nausea, vomiting and sedation; f) Greater patient acceptance.

SCM has been extensively studied for its use in palliative care and chronic pain management but available evidence supporting its benefit as pre-emptive or postoperative analgesia is very limited and the strength is not sufficient to change the clinical guidelines. A small number of studies evaluating the benefits of SCM postoperatively have concluded that SCM group had less analgesic consumption with fewer side effects [4-6].

Hence, a retrospective study was conducted to evaluate the efficacy of SCM as postoperative analgesia following coronary artery bypass grafting in terms of total dose of primary analgesia required, total dose of additional analgesia required, duration of CICU stay, side effects if any, and duration of hospital stay.

MATERIALS AND METHODS

This retrospective analytic survey was conducted at K S Hegde Hospital, Deralakatte, Mangalore; from June 2015 to June 2017. After obtaining Ethical Committee Approval (INST.EC/EC/107/2017-2018), a analysis of the medical records of all patients over 18 years of age who underwent coronary artery bypass grafting was performed. The data was divided into two groups: SCM group and PCT group depending on the primary analgesia the patient received. As per the hospital protocol, SCM (0.1 mg/kg) is administered via indwelling 22G IV cannula inserted in subcutaneous plane of left forearm.

Inclusion criteria: Patients belonging to ASA PS I, II and III, patients above 18 years of age and those posted for coronary artery bypass grafting were included in the study.

Exclusion criteria: Patients with incomplete or illegible medical records and those with intraoperative complications (requiring intra-arterial balloon pump postoperatively) were excluded from the study.

The following perioperative data were extracted from the medical record: demographic data and anaesthesia. The following postoperative pain related data were extracted from the medical records: (i) Dose of additional analgesia(IV fentanyl/ IV tramadol) over 24 h, (ii) Hemodynamic parameters at 0, 6, 12 and 24 h, (iii) Side effects such as nausea, vomiting, pruritis, and respiratory depression (Oxygen saturation <90%). The additional data included: Duration of CICU stay.

STATISTICAL ANALYSIS

The normality of data was first examined by the Shapiro Wilk's test. The two groups were compared using Student's t-test for normally distributed continuous data or non-parametric test if the data were not normally distributed. Categorical data were compared by Fisher's-exact test. The p-values <0.05 were considered statistically significant.

RESULTS

There was no statistically significant difference in the demographic profile and haemodynamic variables of the two groups [Table/Fig-1]. It was observed that SCM group required less additional fentanyl and less additional tramadol compared to PCT group which was statistically significant with p-value of <0.001 [Table/Fig-2]. It was also noted that there was a statistically significant side effects observed in PCT group compared to that of SCM group with p-value of <0.001 [Table/Fig-2]. Additional parameter noted was duration of CICU stay which was longer in group PCT compared to SCM group with a p-value of 0.001 [Table/Fig-3].

Parametres	Group	N	Mean	Std. deviation	p-value
Demographic profile					
Age (years)	SCM	49	58.63	8.504	0.067
	PCT	53	61.87	7.776	
Weight (kg)	SCM	49	61.82	9.291	0.302
	PCT	53	59.96	8.751	
Haemodynamic parametres [HR (bpm)]					
0 hr	SCM	49	90.1	10.978	0.763
	PCT	53	90.85	13.73	
6 hr	SCM	49	87.86	9.719	0.553
	PCT	53	89.11	11.435	
12 hr	SCM	49	86.65	9.255	0.413
	PCT	53	88.28	10.649	
24 hr	SCM	49	85.53	8.83	0.387
	PCT	53	87.17	10.097	
Oxygen saturation [SpO_2 (%)]					
0 hr	SCM	49	99.86	0.408	0.916
	PCT	53	99.85	0.361	
6 hr	SCM	49	99.65	0.561	0.312
	PCT	53	99.75	0.434	
12 hr	SCM	49	99.59	0.497	0.528
	PCT	53	99.45	1.462	
24 hr	SCM	49	99.78	0.422	0.837
	PCT	53	99.79	0.409	

[Table/Fig-1]: Demographic and haemodynamic variables over 24 hours.
HR: Heart rate; bpm: Beats per minute; SpO_2- Oxygen saturation; hr: Hour

Requirement of additional analgesia	SCM group N=49		PCT group N=53		Pearson chi-square	p-value
	Yes (%)	No (%)	Yes (%)	No (%)		
Additional fentanyl	12 (24.5)	37 (75.5)	52 (98.1)	1 (1.9)	59.039	**<0.001**
Additional tramadol	4 (8.2)	45 (91.8)	42 (79.2)	11 (20.8)	51.957	**<0.001**
Side effects	12 (24.5)	37 (75.5)	44 (83)	9 (17)	35.227	**<0.001**

[Table/Fig-2]: Patients requiring additional fentanyl, tramadol requirement over 24 hours and side effects if any between the two groups.
SCM: Subcutaneous morphine; PCT: Paracetamol

Duration of CICU stay (in days)	SCM group		PCT group		Total
	N=49	%	N=53	%	
2	0	0	1	1.9	1%
3	34	69.4	16	30.2	49%
4	10	20.4	24	45.3	33.3%
5	2	4.1	10	18.9	11.8%
6	3	6.1	1	1.9	3.9%
11	0	0	1	1.9	1%

[Table/Fig-3]: Duration of CICU stay between the two groups.
Pearson chi-square: 20.453, p-value: 0.001; SCM: Subcutaneous morphine; PCT: Paracetamol, CICU: Cardiac intensive care unit

DISCUSSION

This study was conducted to note if intermittent SCM was helpful in postoperative pain management following CABG. The comparison of demographic and haemodynamic variables revealed no significant differences between the two groups. It was found that requirement of additional analgesia was less in SCM group with lesser side effects and shorter duration of CICU stay compared to that of PCT group and these differences were statistically significant with p-value of <0.001.

A recent review on the efficacy of different modes of analgesia in postoperative pain management and early mobilisation in postoperative cardiac surgical patients concluded that the use of PCA with opioids in conjunction with local subcutaneous anaesthetic continuous infusions is effective for longer duration and this approach has scope of becoming the cornerstone for pain management post-cardiac surgery in ICUs [4].

Similar results were observed by Machida M et al., [5]. As they concluded that continuous SCM group required less analgesia and had fewer side effects with improved patient satisfaction. Another study [6] compared effects of continuous SCM, continuous Epidural Morphine, and Diclofenac Sodium as pre-emptive analgesia for postoperative pain; concluded that continuous SCM is an attractive method for postoperative analgesia with technical ease, brought some analgesic effects with a low rate of complications.

The studies evaluating the use of SCM as postoperative analgesia following cardiac and non-cardiac surgeries concluded that SCM is a safer alternative with minimal complications [7-9].

Limitation(s)

The subcutaneous injection is not the preferred route of administration in patients with hypotension postoperatively as this reduces the subcutaneous perfusion there by affecting the drug absorption.

CONCLUSION(S)

As there is limited data available in literature regarding postoperative uses of SCM, this demands further studies to understand its scope as postoperative analgesia as well as preemptive analgesia. However, this study helps in clarifying another clinically relevant research question, of comparing SCM with intravenous analgesia. Intermittent SCM can be effectively administered for postoperative analgesia following CABG with similar haemodynamic stability and minimal side effects and shorter duration of CICU stay as compared to intermittent intravenous analgesia.

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