

To Observe the Effects of Sevoflurane and Isoflurane in Hemodynamic Parameters During off-pump Coronary Artery Bypass Graft Surgeries at Tertiary Care Center of Central India.

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Abstract

Introduction: Perioperative course and outcome of patients undergoing cardiac surgery is affected by inhalational anaesthetic agents which we use for Maintenance. Hence the present study comprising of observing Sevoflurane and Isoflurane with respect of hemodynamic effects, and amount of analgesic needed during surgery undergoing off-pump coronary artery bypass (OPCAB) surgery.

Materials: In present hospital based observational prospective study a total of 50 cases were observed after written and informed consent of the participants or their relatives. Before the start of the procedure demographic data of the patients were recorded in terms of age, height and weight. These cases were operated for coronary artery bypass grafting at tertiary care centre. Out of these 25 (Group A) cases were administered sevoflurane and rest 25 (Group B) were administered isoflurane to observe the hemodynamic effects during the procedure.

Results: Differences between the groups. The mean heart rate at baseline, 2 minute after induction, after anastomosis and before I.C.U shift was respectively (88.44±7.53, 86.12±6.0, 93.48±3.28, 90.52±8.05) beats/min in group A and mean heart rate baseline, 2 minute after induction, after anastomosis, before I.C.U shift was respectively (87.64±7.84, 84±9.79, 96.72±7.84, 91.64±5.15) beats/min in group B. We found that heart rate increased from baseline in both the groups in postoperative period, but not statistically significant. The mean arterial blood pressure (MAP) at baseline, 2 minute after induction, after anastomosis and before I.C.U shift was respectively (94.16±10.78, 85.16±11.57, 75.08±5.77, 77.52±7.03) mmHg in group A and mean arterial blood pressure (MAP) at baseline, 2 minute after induction, after anastomosis and before I.C.U shift was respectively (91.24±10.42, 86.12±8.26, 76.28±6.06, 76.36±4.56) mmHg in group B.

Conclusion: Sevoflurane and isoflurane can safely be used for patients undergoing coronary artery bypass graft cardiac surgery without compromising haemodynamic parameter. Thus, Sevoflurane may be safely utilised in patient undergoing CABG heart surgery.

Keywords: Sevoflurane, Isoflurane, Coronary Artery Bypass Graft Surgery, Haemodynamic Parameters.

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Introduction

Perioperative course and outcome of patients undergoing cardiac surgery is affected by inhalational anaesthetic agents which we use for Maintenance[1]. This provide adequate depth of anaesthesia and reduces analgesic dosage.

Two routinely used inhalational agent for off pump cardiac surgeries for maintenance of anaesthesia is Isoflurane (1979) and Sevoflurane (1995)[2]. The new volatile inhaled anaesthetics Sevoflurane possesses a blood-gas partition coefficient of 0.6, which is lower than that of other currently used inhaled anaesthetics so Sevoflurane provides a smooth anaesthetics induction, rapid emergence from anaesthesia and no organotoxicity[3].

The Sevoflurane which is new as compared to isoflurane has some benefits, like its less soluble than Isoflurane, because of this it has faster onset and offset of action. It has less irritating nature to the upper airway and non-pungent as Isoflurane. Isoflurane is an isomer of enflurane, the same nephrotoxic fluoride metabolite that causes problems with enflurane may cause problems with isoflurane[4]. With isoflurane, however, this molecule is less of a problem because it undergoes substantially less metabolism. Although isoflurane lowers arterial and systemic blood pressure, cardiac output is preserved due to an active carotid baroreceptor response and decreased afterload. In fact, unlike other volatile agents, isoflurane may result in the larger reduction in systemic vascular resistance, with no increased risk of ischemic events as compared to other agents [5].

A significant number of experimental studies have shown that inhalational anaesthetics offer myocardial protection from ischemia. Volatile anaesthetics have been shown to exert protection against myocardial ischemia and reperfusion injury during coronary artery bypass graft (CABG) surgery. This is referred as

pharmacological preconditioning[2,6]. Ischemic preconditioning and anaesthetic preconditioning share similar molecular mechanisms, including activation of guanine nucleotide- binding proteins, activation of multiple kinases, mediation of nitric oxide formation and reactive oxygen species release, maintenance of intracellular and/or mitochondrial Ca^{2+} homeostasis, and moderation of the opening of ATP-sensitive potassium channels [7].

Hence the present study comprising of observing Sevoflurane and Isoflurane with respect of hemodynamic effects, and amount of analgesic needed during surgery undergoing off-pump coronary artery bypass (OPCAB) surgery.

Material and Methods

In present hospital based observational prospective study a total of 50 cases were observed after written and informed consent of the participants or their relatives. Before the start pf the procedure demographic data of the patients were recorded in terms of age, height and weight. These cases were operated for coronary artery bypass grafting at tertiary care centre. Out of these 25 (Group A) cases were administered sevoflurane and rest 25 (Group B) were administered isoflurane to observe the hemodynamic effects during the procedure.

While considering haemodynamic effects patients heart rate (HR), mean arterial pressure (MAP), central venous pressure (CVP), and cardiac index (CI) were observed at regular intervals ranging from start of the procedure till the patient gets shifted to ICU. Data collection was made by using Microsoft excel 2013 and graph pad prism 8 was used for applying statistical tests. Statistically paired T test was applied to numerical data to find out the significance when p value was less than

0.05 and finally significant results were considered.

Results

Considering the demographic data, the age groups ranged from 54 to 70 years in both the groups. The mean age of patients in group A was 61.52 ± 2.38 years. Whereas, the mean age of patients in group B was 59.72 ± 3.85 years. In the group A we had 21 males and 4 female and in group B had 20 males and 5 females. In group A the mean

weight of the patients was 64 ± 3.76 kg. While the mean weight in group B was $62.12 \text{ kg} \pm 6.00$ kg.

The mean height in group A was 172.2 ± 4.50 cms and in group B was 172.92 ± 4.05 cms.

The two groups were comparable in terms of demographic data as there were no statistically significant differences between the groups in terms of age, sex and weight, height as depicted in table 1.

Table 1: Distribution of cases according to age, weight and height.

	Group A	Group B	P value
Age	61.52 ± 2.38	59.72 ± 3.85	0.0728
Weight	64 ± 3.76	62.12 ± 6.00	0.1097
Height	172.2 ± 4.50	172.92 ± 4.05	0.4954

Above table shows that the heart rate at various surgical steps. It was observed that heart rates were comparable (statistically insignificant, p -value > 0.05) in both groups at all-time intervals.

The heart rate tended to be higher in group B as compared to group A after coronary anastomosis, even though the difference was found to be statistically insignificant. (i.e. P -value > 0.05) as shown in table 2

Table 2: Comparison of heart rate (HR) at various intervals.

	Group A	Group B	P value
	Sevoflurane	Isoflurane	
Baseline	88.44 ± 7.53	87.64 ± 7.84	0.7457
2 min after Induction	86.12 ± 6.00	84 ± 9.79	0.4040
After Anastomosis	93.48 ± 3.28	96.72 ± 7.84	0.0897
Before Sifting in ICU	90.52 ± 8.05	91.64 ± 5.15	0.6233

It was observed that MAP was decrease from baseline up to the shifting of patient in ICU in both groups. But no statistically significant difference was present

Table 3: Comparison of mean arterial pressure (MAP).

	Group A Sevoflurane	Group B Isoflurane	P value
Baseline	94.16 ± 10.78	91.24 ± 10.42	0.2450
2 min after Induction	85.16 ± 11.57	86.12 ± 8.26	0.7666
After Anastomosis	75.08 ± 5.77	76.28 ± 6.06	0.5368
Before Sifting in ICU	77.52 ± 7.03	76.36 ± 4.56	0.5015

Considering the results for central venous pressure (CVP) following results were made as depicted in table 4:

Table 4: Comparison of central venous pressure (CVP) at various intervals

	Group A	Group B	P value
Baseline	9.64±2.09	8.48±2.57	0.1361
2 min after Induction	10.12±1.88	9.64±1.01	0.1963
After Anastomosis	9.12±3.35	8.84±1.97	0.6313
Before Sifting in ICU	8.56±2.86	8.84±1.97	0.5634

It was observed that intraoperative CVP were comparable (statistically insignificant, p value >0.05) in both groups

Considering the cardiac index following results were made as depicted in table 5:

Table 5: Comparison amongst group with cardiac index (CI)

	Group A	Group B	P value
Baseline	3.12±0.58	3.40±0.56	0.0897
2 min after Induction	3.04±0.87	3.16±0.67	0.4781
After Anastomosis	3.84±0.46	3.6±0.56	0.083
Before Sifting in ICU	4.04±0.72	3.76±0.51	0.1996

The two groups were comparable in terms of cardiac index as there were no statistically significant differences between the groups.

The mean heart rate at baseline, 2 minute after induction, after anastomosis and before I.C.U shift was respectively (88.44±7.53, 86.12±6.0, 93.48±3.28, 90.52±8.05) beats/min in group A and mean heart rate baseline, 2 minute after induction, after anastomosis, before I.C.U shift was respectively (87.64±7.84, 84±9.79, 96.72±7.84, 91.64±5.15) beats/min in group B. We found that heart rate increased from baseline in both the groups in postoperative period, but not statistically significant. The mean arterial blood pressure (MAP) at baseline, 2 minute after induction, after anastomosis and before I.C.U shift was respectively (94.16±10.78, 85.16±11.57, 75.08±5.77, 77.52±7.03) mmHg in group A and mean arterial blood pressure (MAP) at baseline, 2 minute after induction, after anastomosis and before I.C.U shift was respectively (91.24±10.42, 86.12±8.26, 76.28±6.06, 76.36±4.56) mmHg in group B. The MAP decreased significantly from baseline but was comparable in both the groups throughout postoperative period. The mean baseline central venous

pressure (CVP) at baseline, 2 minute after induction, after anastomosis and before I.C.U shift was respectively (9.64±2.095, 10.12±1.88, 9.12±3.35, 8.56±2.86) mmHg in group A and mean baseline central venous pressure (CVP) at baseline, 2 minute after induction, after anastomosis and before I.C.U shifting were recorded respectively (8.48±2.57, 9.64±1.01, 8.84±1.97, 8.84±1.97) mmHg in group B. The CVP was comparable in both the groups throughout postoperative period.

The mean cardiac index (CI) at baseline, 2 minute after induction, after anastomosis, before I.C.U shift was respectively (3.12±0.58, 3.04±0.87, 3.84±0.46, 4.04±0.72) l/min/m² in group A and mean cardiac index (CI) at baseline, 2 minute after induction, after anastomosis, before I.C.U shift was respectively (3.40±0.56, 3.16±0.67, 3.6±0.56, 3.76±0.51) l/min/m² in group B.

Discussion

Hemodynamic stability is an essential requirement for patients undergoing cardiac surgery. Measuring vitals H.R., MAP, CVP, CI, at various surgical steps, revealed that they were comparable (statistically insignificant, p value >0.05) in both groups. There was a tendency to decrease blood

pressure and cardiac output with each volatile agent but comparatively hemodynamics were more stable in group A, however these findings were statistically not significant. By Satoru Tanaka[8], with stepwise increase isoflurane concentration administered elicits tachycardia and hypertension. In contrast, sevoflurane do not induce hyperdynamic responses after increases in anesthetic concentration by 0.9 MAC to a maximum of 2.7 MAC. In present study there was insignificant change in heart rate and other hemodynamic parameter.

The mean cardiac index (CI) at baseline, 2 minute after induction, after anastomosis, before I.C.U shift was respectively (3.12±0.58, 3.04±0.87, 3.84±0.46, 4.04±0.72) l/min/m² in group A and mean cardiac index (CI)) at baseline, 2 minute after induction, after anastomosis, before I.C.U shift was respectively (3.40±0.56, 3.16±0.67, 3.6±0.56, 3.76±0.51) l/min/m² in group B. The change in CI from baseline in both groups but not statistically significant. They do not differ in providing hemodynamic stability or maintenance of contractile function during and after aortocoronary grafts by Nhien LeJean-François. Sevoflurane has been shown to provide stable cardiovascular conditions and a better heart rate profile in volunteers and patients undergoing elective surgery compared to other volatile anaesthetics by Ebert TJ[9]. In the current study, both agents showed similar intraoperative hemodynamics. In another study by Bennet SR and Negargar S [10,11] both sevoflurane and isoflurane showed similar hemodynamic effects at 0.5 and 1.0 minimum alveolar concentration (MAC), but sevoflurane showed a tendency to have lower HR and CI compared to isoflurane. In the present study there was no significant difference found in both the groups.

Conclusion

Thus, from the present study it can be concluded that Sevoflurane can safely be used for patients undergoing coronary

artery bypass graft cardiac surgery without compromising haemodynamic parameter. Sevoflurane provided a better hemodynamic profile in terms of heart rate, blood pressure cardiac index. Thus, Sevoflurane along with opioids (like fentanyl) may be safely utilised in patient undergoing CABG heart surgery.

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