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Comparison Between Isoflurane and Sevoflurane on Pulse Rate in Patients Under Going General Surgery

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Abstract

Inhalational agents are very important to maintain the depth of anesthesia, provide analgesia and muscle relaxant. Many factors have effect on anesthetic gases, including the type of anesthetic agent and its MAC and other properties and postoperative stays. This study was designed to evaluate the effect of isoflurane and sevoflurane as inhalational agents on the pulse rate (PR) during general anesthesia.

Thirty (30) patients aged between 7 - 68 years old were enrolled in this study. Males were 13 and females were 17, in all selected patients, PR was recorded at baseline, intubation at 5min,10min,15min,20min,25min, 30min and 40min, extubation, and recovery.

The result showed no significant differences in pulse rate at baseline in both gases, while there was a significant difference between the two gases at intubation period with no significant change in pulse rate in both gases at 5min,10min,15min,20min,25min,30min,40min, extubation and recovery.

Keywords: Isoflurane; Sevoflurane; pulse rate; inhalational agents.

1. Introduction

Inhalational anesthetics agents have been used for surgical anesthesia and analgesia, in 1954 Charles Suckling presented the first modern halogenated inhalational anesthetics agent, halothane [1]. Then, other halogenated inhalational anesthetic agents, including enflurane and isoflurane, were introduced [2]. Sevoflurane and desflurane are the most modern contributors of inhalational agents [1,2].

Regarding anesthetics agents, they attain in the alveoli and immediately pass through the alveolar sac, the bloodstream transmit the agents to all perfused organs [1,2]. For an anesthetic agent, the blood gas division grade and the proportional solubility determine the rate of raise in concentration of alveoli (end-tidal) across inspired concentrations [1,2].

In inhalational anesthesia, the mean alveolar concentration (MAC) has been uses as a standard to determine the efficiency of agents [3]. The definition of MAC is the concentration of an inhalational drug that prohibit muscular movements in response to the surgical energizing in 50% of individuals. The values of MAC vary for several agents and are following to the patients' ages for example, MAC of sevoflurane in neonates is reached to 3.3%, and is about 2% in adults aged 40–50 years [3].

In our study, the anesthetic criteria involve ordinary premedication drugs, pre-anesthetics medications are of major interest under clinical status. Intravenous agents mainly used in induction of anesthesia have rapid induction and facility of administration [4].

During induction of anesthesia, intravenous and inhalational anesthesia can affect cardiovascular execution; this includes effects on the rate of the heart, cardiac output, cardiac conduction system, systemic vascular resistance, blood pressures, myocardial contractility and even in the flow of blood in coronaries [5]. However, the correct choice of intravenous and inhalational anesthesia is commonly related to the patient and the status of cardiovascular system, e.g. the availability of hypovolemia and failure of the heart [6].

The uses of anesthetics volatile agent (e.g., halothane, sevoflurane, desflurane, and isoflurane) lead to dose-referred effects on cardiovascular stability. Like the agents lead to a dose- following reduce in the mean arterial blood pressure, which causes decreases in resistance of systemic vessels, sympathetic output, contraction of myocardium, or due to all of these reasons [7].
In compensation with nitrous oxide, isoflurane cause raises in the cardiac sympathetic action, but sevoflurane cause falls in cardiac sympathetic and parasympathetic action. Both cardiac parasympathetic and sympathetic balance action was increased in sevoflurane [8].
The definition of pulse rate (PR) is the number of heart beats per minute and measured by pulse Oximetry, any decreasing of blood oxidation is critical in medicine, e.g. in surgical implementation and critical care, and may lead to death of cells and damage of the brain in a minute [6].

2. Patients and Methods

This prospective study was carried out at Baghdad Hospital, Medical City complex, Baghdad / Iraq from the 2nd of January 2020 – the 20th of February 2020. Thirty patients aged between 7 - 68 years old 17 undergoing general surgery were enrolled in this study. Males were 13 and females were 17.
Pre-anesthetic checkup was performed before surgery and pre-operative routine investigations: (complete blood count, coagulation profile, electrocardiogram, blood sugar, and liver function tests). All patients were fasting for 8-10 hours before the proposed time of surgery. After application of standard monitors and recording of heart rate, blood pressure and oxygen saturation, all patients were given (tramadol 1.5 mg\kg, dexamethasone 0.1 mg\kg, metoclopramide 0.1 mg\kg, ranitidine 0.9 mg\kg) as premedication, and propofol, ketamine 0.5 mg \kg (1.5mg \kg), atracurium as a muscle relaxant (0.5 mg \kg) were used for all patients, while inhalational agent were either isoflurane (1.2%) or sevoflurane (1.8%).
In all selected patients, PR was recorded at baseline, intubation at 5min, 10min, 15min, 20min, 25min, 30min, 40min of the time of operation, extubation, and recovery by using pulse oximeter. Intravenous fluid was given intraoperatively until the end of surgery. After reversal of muscle relaxant extubation was done smoothly and the patients were discharged to the recovery room with continuous monitoring of blood pressure, PR and oxygen saturation. The statistical operations is performed by SPSS, using (Mean ± standard deviation, t-test and P-value) to evaluate the significance of the results.
The study was approved by the Ethics Committee of Baghdad Hospital, Medical City complex, Baghdad/Iraq. Verbal and written informed consent was obtained from patients before inclusion.

3. Result

Males were 13(43.3%) and females were 17(56.7%). The number of patients in the aged group (<20-39 years) was 14(46.7%) and 16(53.3%) in the (40-68 years) as shown in table (1).

Table 1. Distribution of group study by Age groups and Gender

		No.(n=30)	%
Age groups (years)	(<20-39)	14	46.7
	(40-68)	16	53.3
Gender	Male	13	43.3
	Female	17	56.7

The highest mean of PR of isoflurane was 112.27 whereas the lowest was 80.73, and the highest mean of pulse rate of sevoflurane was 113.07. The lowest was 87.2 as shown in table (2).

Table 2. Comparison between values of PR among Inhalational agents

	Inhalational agent	Mean± Std. Deviation	t-test	P-Value	C.S
PR baseline	Isoflurane	92.20±16.433	1.687	.103	P>0.05
	Sevoflurane	103.13±18.981			(NS)
PR in intubation	Isoflurane	96.53±18.958	2.397	.023	P<0.05
	Sevoflurane	113.07±18.817			(S)
PR at 5 min	Isoflurane	92.33±16.330	1.575	.126	P>0.05
	Sevoflurane	101.67±16.127			(NS)
PR at 10 min	Isoflurane	89.53±18.256	1.083	.288	P>0.05

	Sevoflurane	96.47±16.780			(NS)
PR at 15 min	Isoflurane	91.60±13.948	0.012	.990	P>0.05
	Sevoflurane	91.67±15.578			(NS)
PR at 20 min	Isoflurane	88.40±14.701	0.919	.366	P>0.05
	Sevoflurane	93.93±18.109			(NS)
PR at 25 min	Isoflurane	80.73±9.662	1.946	.062	P>0.05
	Sevoflurane	91.93±20.091			(NS)
PR at 30 min	Isoflurane	83.93±11.158	0.578	.568	P>0.05
	Sevoflurane	87.20±18.838			(NS)
PR at 40 min	Isoflurane	86.47±14.774	0.424	.675	P>0.05
	Sevoflurane	88.80±15.396			(NS)
PR at extubation	Isoflurane	112.27±19.455	0.093	.927	P>0.05
	Sevoflurane	111.67±15.860			(NS)
PR at recovery	Isoflurane	102.20±23.653	0.447	.658	P>0.05
	Sevoflurane	98.60±20.350			(NS)

In table (2), the PR at baseline showed no significant difference of each gas. At intubation there is a significant change in PR ($P<0.05$). At 5min ,10 min, 15 min, 20 min, 25 min, 30 min, 40 min, extubation and recovery there was no significant difference showed in PR.

4. Discussion

Inhalational anesthetics agents have been used for surgical anesthesia and analgesia, all volatile anesthetics which cause dose-dependent effects on cardiovascular function especially PR, this study shows the effect of sevoflurane and isoflurane on the pulse rate in different intervals, Comparison of PR at baseline for each gas; there was a significant difference in PR at intubation, no significant difference at 5min ,10min, 15min, 20min, 25min, 30min and 40min, extubation and recovery.

Recent studies found there was a significant difference in PR at intubation when using both sevoflurane and isoflurane, it is may due to autonomic nervous stimulation during forced applied of laryngoscop or intubation sometimes lead to changes in hemodynamic parameters [9, 10].

Similar to other studies, sevoflurane causing depression in myocardium, some hemodynamic instability at high anesthetic concentrations in the deprivation of surgical stimulation, as a result the cardiovascular effects of sevoflurane were similar to those of isoflurane, this is in agreement with [11]. Nevertheless, the sevoflurane is stable on heart rate, this is in agreement with [12] who used sevoflurane in nitrous oxide oxygen mask induction in hyperventilated male patients and found no effect on the mean arterial blood pressure or the heart rate [12].

Although there is an increase in PR of humans when undergoing general anesthesia at intubation when using isoflurane or sevoflurane, but using of sevoflurane provided an evenly safe and efficient control of cardiovascular homeostasis as isoflurane, with a rapid discharge from recovery room which is in agreement with [13].

5. Conclusion

Sevoflurane and isoflurane are anesthetic gases that have significant effect on heart rate during intubation only, so that is reliable with patient who have heart problems, a further recommended study is needed to record the effect of sevoflurane and isoflurane on blood pressure in additional to PR.

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