



Research Article

A Comparative Study of Hemodynamic Status of Patients under General and Spinal Anesthesia

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Abstract

Introduction: The patients should be in anesthetic state achieved through spinal or general anesthesia for surgical procedures due to stimulation of pain in this process. As each anesthetic method has its own complications and there is no specific formula for selection of anesthesia type that can be generalized to everyone, this study was a comparative examination of the hemodynamic status of patients with general and spinal anesthesia during surgeries.

Methods and materials: In this descriptive cross sectional study, 126 patients to undergo surgery under general and spinal anesthesia were examined. Systolic and diastolic blood pressure, Map, pulse and Spo2 of the patients were measured and recorded before surgery, at minutes 10 and 20 after spinal and general anesthesia; data analysis was done with SPSS v22 and using descriptive and inferential statistics.

Results: The results indicated that systolic and diastolic blood pressure decreased in both types of anesthesia with a significant difference in spinal anesthesia ($P < 0.0001$). Pulse also reduced in both methods with a significant statistical difference in general anesthesia ($P = 0.006$). There were statistically significant differences between two groups in the reduction of Map. Spo2 was relatively constant in general anesthesia but reduced in spinal anesthesia, with a statistically significant differences in both methods ($P < 0.0001$).

Conclusion: The results showed that some hemodynamic indices are related to the type of anesthesia method (general or spinal).

Keywords

Surgery; Anesthesia method; General anesthesia; Spinal anesthesia

Introduction

Surgery is an action for diagnosis or treatment of diseases, injuries and abnormalities needing a cut on the skin or mucus. The surgery is done on the patient for treating or preventing a disease by a specialist; diagnostic and therapeutic procedures may be conducted if necessary [1]. In surgery, given the cut in the tissue and stimulation of pain, the patient must be in a completely analgesic condition, for which there are different methods, including anesthetic procedures [2].

Acceptable anesthetic techniques in surgical procedures should include indicators such as speed and the reversal of its complications, should maintain the hemodynamic status of the patient during the operation without blood transfusion, and anesthesia should have a durable recovery time and postoperative nausea and vomiting and the need for additional doses of analgesics [3]. These methods include general and spinal anesthesia. However, any anesthetic method, either general or spinal anesthesia has some complications [4].

The commonest anesthetic procedure is general anesthesia [5], inducing a reversible drug induction with a change in behavioral and physiological characteristics (loss of consciousness), amnesia, inactivity and analgesia along with the sustainability of the nervous-autonomic-heart system and vascular-regulating body temperature [6]. American doctors first used this method with about 21 million people currently undergoing anesthetic surgery in the United States [1]. During general anesthesia, mechanical ventilation needs laryngoscopy and intratracheal intubation that might cause hemodynamic changes due to painful and intensive stimuli following laryngoscopy and intubation. Following these stimuli, there is the potential increase in blood pressure and pulse in patients, which is harmless to patients with normal circulation, but can be dangerous in patients with high blood pressure or patients with coronary artery disease [6,7].

Besides this method, other anesthetic methods such as spinal anesthesia are used, especially in abdominal surgery. In spinal anesthesia, the medication is injected in the waist of the patient where the spinal cord leading to numbness of one part of the body (such as the uterus for delivery), while other senses of the patient, such as hearing and sight are quite active. Selection of the type of anesthetic drug is based on the duration of the surgical procedure [5]. Spinal anesthetic complications include neurological factors, headache after dorsal rupture, high-level spinal anesthesia, cardiovascular and respiratory complications, infection, back pain, nausea, vomiting, urinary retention, itching and shivering [8]. Hypotension is the commonest complication of spinal anesthesia reported to be present in 50-100% of patients in various studies [9].

Spinal anesthesia is very popular among anesthesiologists given its ease of separation and the need for low levels of topical anesthetic and relatively less complications compared to general anesthesia [10,11].

In a study by Makhmar Dari et al. on patients candidate for surgery for hernia and undescended testis by two methods of spinal anesthesia with lidocaine 2% and general anesthesia showed that spinal anesthesia reduced the costs and increased efficiency in the operating room but led to a severe drop in blood pressure [12].

The results of the study by Rasouli et al. [13] conducted as a clinical trial showed that the prevalence and the intensity of incidence of hypotension in preecliptic patients were similar in comparison with healthy pregnant women during cesarean section with spinal anesthesia [13].

As anesthesia procedures are done based on the physicians' opinion, surgery type, and its possible complications, as well as the patients' request and have different complications and less attention

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is paid to hemodynamic complications of these anesthetic methods, this study was a comparative study of hemodynamic status in patients undergoing general anesthesia and spinal anesthesia in surgical procedures.

Methods

This descriptive-correlational study was conducted from July to September of 2017 on patients referring to Khatam-al-Anbia (PBUH) Hospital in Iranshahr who were candidates for surgery. The sample size was 126 from among 370 patients who were candidates for surgery. Inclusion criteria included: personal satisfaction with participation in the study, elective or emergency surgery (surgical procedures include all types of surgeries) and surgical procedures requiring general and spinal anesthesia. The samples were matched regarding type of surgery, age and hemodynamic status before surgery, and the samples with difficult to cure illnesses were excluded from the study.

Collecting data

Data was collected using a researcher-made questionnaire developed based on the objectives of the study, which was confirmed by four anesthetists and five faculty members. The questionnaire included questions about the demographic characteristics and the checklist for the hemodynamic status of the patients.

Data was started to be collected and recorded in the checklist after positioning of the patients on the operating room bed and the attachment of the instrument of control (Pulse Oximeter and non-invasive barometric measurements) of BP, HR, MAP and SPO² before, at 10 and 20 minutes after spinal and general anesthesia, at the end of operation, and recovery. It is noteworthy that all Pulse Oximeter devices and blood pressure gauges were from one brand and were calibrated for assurance before the start of the project.

Data analysis

The results were obtained using descriptive statistics (frequency) and inferential statistics (independent t test and paired t test) for analysis of the intra-group and inter-group mean differences. In all data calculations, version 22 of SPSS software was used.

Results

The results of the study showed that the samples examined for pain were in the age range of 6 to 76 and were mostly (77%) male. The major reason for surgery was due to musculoskeletal system (trauma, fracture, etc.) with 27.7% of the cases, followed by hernia with 27%.

The surgery was completed in the interval from 20 to 75 minutes with mostly completion at 30 minutes (40.5%) (Table 1).

Regarding changes in hemodynamic status, the results indicated that systolic and diastolic blood pressure reduced in both types of anesthesia (in general anesthesia from 117/73.5 to 115/70.1 and in spinal anesthesia from 129/75.5 to 115/69.4 mmHg), but this decrease in the mean had significant differences only in spinal anesthesia ($P < 0.0001$). Pulse changes in both general and spinal anesthesia reduced from 93 to 86 and from 77 to 69 beats per minute, respectively. This decrease had statistically significant differences in general anesthesia ($P = 0.006$). Moreover, the mean arterial pressure in the two groups of general anesthesia and spinal anesthesia increased from 99.3 to 99.5 and decreased from 98.9 to 78.7, respectively, which were both statistically significant decreases. Arterial oxygen pressure was relatively stable in general anesthesia (91-91.5%), but in spinal anesthesia, it decreased from 100% to 90%. There was a statistically significant difference in the stability and reduction in both methods ($P < 0.0001$) (Table 1).

Discussion

The results of this study showed that each of the two types of general and spinal anesthesia had different effects on the hemodynamic status of patients. In both general and spinal anesthesia, there was a decrease in blood pressure, but in spinal anesthesia, blood pressure drop had a significant difference. In the study by Ameli et al. [10], the results showed that the mean systolic, diastolic and mean arterial blood pressure significantly reduced at the time of recovery in comparison with other times [10]. In the study by Rassouli et al. [13] conducted in form of clinical trial, the results indicated that the incidence and severity of hypotension in prececelopatic patients compared with healthy pregnant women during cesarean section was similar to spinal anesthesia [13]. The two mentioned studies are consistent with the present study, but Mortazavi et al. [14] showed that in both methods of intubation through the mouth and nose, blood pressure and pulse rate of patients increased, and the difference in the increase in nasal intubation compared to the other method was statistically significant [14].

Moreover, the results of this study indicated that both general and spinal anesthesia significantly reduced pulse without any significant difference. In a study by Ameli et al. [10], the results showed a significant increase in the mean pulse rate, which differs from this study [10]. This difference might be due to the age difference of the studied groups. The results of the study by Montazeri et al. [15] showed that the average changes in heart rate at 15 and 30 minutes after induction of anesthesia in the laryngeal mask group was lower than in the other two groups [15,16].

Table 1: The mean difference of hemodynamic changes in surgeries under general and spinal anesthesia.

Hemodynamic symptoms	Mean and SD		t	P value
	General anesthesia	Spinal anesthesia		
Preoperative systolic blood	117 ± 17	129 ± 18	3.575	0.0001
Postoperative systolic blood	114.4 ± 23.5	115.7 ± 17	0.3	0.7
Preoperative diastolic blood pressure	73.5 ± 15	77.5 ± 11	1.618	0.1
Postoperative diastolic blood pressure	71 ± 17	68 ± 11	1.2	0.2
Preoperative pulse	93 ± 19	85 ± 19	2.3	0.01
Postoperative pulse	92 ± 19	81 ± 19	3.18	0.002
Preoperative Spao ₂	99 ± 1	98 ± 1.2	1.7	0.07
Postoperative Spao ₂	98 ± 1.7	98 ± 1.5	0.9	0.35
Preoperative pao ₂	91 ± 16	100 ± 16	3	0.003
Postoperative pao ₂	95 ± 16	90 ± 11	1.9	0.057

According to the results of this study, in the spinal anesthesia group, there was a significant difference in the level of arterial oxygen saturation in the anesthetic group, whereas in the surgery under general anesthesia, the arterial oxygen saturation was more stable. Aameli et al. [10] concluded that the mean arterial oxygen saturation reduced upon entering recovery compared to other times, which is consistent with the present study [10].

Conclusion

According to the results of the present study about the hemodynamic status of patients in various surgeries in the common practices of general and spinal anesthesia, one can conclude that the pre-operative hemodynamic status can play a critical role in selection of the type of anesthesia. Thus, attention to the complications of each type of anesthesia on the hemodynamic status of patients during and after surgery should be considered by specialists.

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