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Perioperative Complications Associated with Spinal Versus General Anesthesia in Adult Surgical Patients: A Comparative Study

Dr. Raafat Abdulkareem Mohammed
Ninevah Directorate of Health, Alsalam Teaching Hospital, Iraq
E-mail: Raafat.kareem55@gmail.com

Abstract: Spinal and general anesthesia are common methods of adult surgical patients, and each is characterized by unique physiological effects and complication rates. To maximize the outcomes of perioperative conditions, it is necessary to understand their relative safety. The purpose of the study is to compare the complications during the perioperative period between general and spinal anesthesia in adult patients undergoing elective surgery. Prospective comparative study was done at Al-Salam Teaching Hospital involving 100 patients aged 1865 years (ASA I-III). Patients were divided into two groups (spinal anesthesia n = 50 and general anesthesia n = 50). Intraoperative hemodynamics and perioperative complications such as: hypotension, bradycardia, respiratory complications, postoperative nausea and vomiting (PONV), headache, and urinary retention had to be noted and analyzed. There were similar baseline characteristics across groups ($p > 0.05$). The rates of hypotension (40% vs. 20; $p = 0.03$) and bradycardia (25% vs. 10; $p = 0.04$) were higher in the spinal anesthesia group. Conversely, general anesthesia experienced considerably more respiratory problems (18% vs. 4%; $p = 0.02$) and PONV (35% vs. 15%; $p = 0.02$). Post-dural puncture headache (18% vs. 5%; $p = 0.04$) and urinary retention (22% vs. 10%; $p = 0.05$) were more frequent in the spinal group. The rates of overall complications were similar in groups ($p > 0.05$). There are varying perioperative complication profiles in spinal and general anesthesia. Spinal anesthesia is more prone to the occurrence of hemodynamic instability and less prone to respiratory complications, but general anesthesia is prone to higher PONV and respiratory risks. The decision on anesthetic method must be personalized in regard to the patient's features and the operation's needs.

Keywords: Spinal Anesthesia, General Anesthesia, Perioperative Complications, Hypotension, PONV, Respiratory Complications.

Introduction

Anesthetic technique is an important factor in perioperative outcomes of surgical patients. General and spinal anesthesia are both extensively employed in clinical practice, having unique physiological impacts, benefits, and possible complications [1], [2]. Knowing their relative safety profiles is necessary to maximize patient care and reduce morbidity during perioperation.

Spinal anesthesia offers regional anesthesia which involves the use of local anesthetics in the subarachnoid space thus, giving a sensory and motor blockade below the point of injection. It is linked to benefits like decreased intraoperative bleeding, decreased risk of thromboembolism, and decreased postsurgery pain [3], [4]. But it can also cause complications like hypotension, bradycardia, and post-dural puncture headache [5].

General anesthesia, in contrast, causes a reversible unconsciousness by the use of intravenous or inhalation agents that enable total airway and ventilator control. Although it is appropriate in a

broad variety of surgical procedures, it is linked to adverse effects like postoperative nausea and vomiting (PONV), respiratory issues, and prolonged recovery [6], [7].

The past literature has provided conflicting results on the effectiveness of spinal and general anesthesia, especially on perioperative complications and postoperative outcomes [8], [9]. Certain evidence indicates that cardiopulmonary complications may be minimized with spinal anesthesia, compared to general anesthesia, which offers more flexibility and control in complicated operations [10].

Thus, the purpose of this research is to compare the perioperative complications of spinal and general anesthesia in adult surgical patients with the aim of determining which anesthetic method is safer and more effective.

Methods

This comparative study was done as a prospective study at Al Salam teaching Hospital in a span of 10 months. Elective surgical procedures were performed on 100 adult patients aged 18-65 years old, with ASA physical status, I-III. A sample size of 80-120 was used considering similar comparative anesthesia studies (n = 80 -120) to guarantee sufficient statistical power.

2.1 Group Allocation

There were two groups of patients:
- Group S (Spinal anesthesia, n = 50)
- Combined Group G (General anesthesia, n = 50)

2.2 Inclusion and Exclusion Criteria.

Inclusion criteria were patients with elective lower abdominal or lower limb surgeries. Exclusion criteria consisted of contraindications to spinal anesthesia (e.g., coagulopathy, infection at puncture site), severe cardiopulmonary disease or refusal.

2.3 Anesthesia Protocol

Group S: Under aseptic condition 0.5% bupivacaine was used as a spinal anesthesia. General anesthesia was initiated with propofol and opioids, and airway control and maintenance with inhalational agents was performed in Group G.

Standard monitoring (ECG, NIBP, SpO_2) was applied in all patients.

2.4 Outcome Measures

Perioperative complications were documented and they comprised:
- Hypotension and bradycardia
- Respiratory complications
- Postoperative nausea and vomiting (PONV)
- Headache
- Urinary retention

2.5 Statistical Analysis

The SPSS version 28 was used to analyze the data. Continuous variables were represented as mean SD and t-test was used to analyze them. Chi-square test was used to analyze categorical variables. A significant p-value was set to be less than 0.05. Ethical approval and informed consent were obtained.

Results

Table 1. Baseline Characteristics.

Variable	Group S (Spinal) n=50	Group G (General) n=50	p-value
Age (years)	45.2 ± 10.5	46.8 ± 11.2	0.55
Gender (M/F)	28/22	30/20	0.68
BMI (kg/m²)	26.5 ± 3.8	27.1 ± 4.2	0.49
ASA I/II/III	20/22/8	18/24/8	0.79
Duration of surgery (min)	90 ± 25	95 ± 28	0.41

There were no statistically significant differences between groups ($p > 0.05$), confirming baseline comparability.

Table 2. Intraoperative Hemodynamic Changes.

Parameter	Group S	Group G	p-value
Baseline MAP (mmHg)	94 ± 9	95 ± 10	0.72
Lowest MAP (mmHg)	70 ± 8	78 ± 9	0.001 ***
Hypotension (%)	40%	20%	0.03 *
Bradycardia (%)	25%	10%	0.04 *
Vasopressor use (%)	30%	15%	0.05 *

Spinal anesthesia was associated with significantly greater hemodynamic instability, including lower MAP and higher rates of hypotension and bradycardia.

Table 3. Intraoperative and Early Postoperative Respiratory Outcomes.

Variable	Group S	Group G	p-value
Oxygen desaturation (%)	4%	18%	0.02 *
Airway intervention (%)	2%	15%	0.01 *
Need for ventilation support (%)	0%	10%	0.01 *

General anesthesia showed significantly higher respiratory complications compared to spinal anesthesia.

Table 4. Postoperative Complications.

Variable	Group S	Group G	p-value
PONV (%)	15%	35%	0.02 *
Headache (%)	18%	5%	0.04 *
Urinary retention (%)	22%	10%	0.05 *
Delayed recovery (%)	8%	20%	0.04 *

General anesthesia resulted in higher PONV and delayed recovery, while spinal anesthesia showed higher rates of headache and urinary retention.

Table 5. Overall Complication Rate.

Variable	Group S	Group G	p-value
Any complication (%)	60%	70%	0.28

Overall complication rates were comparable between groups despite differences in specific complications.

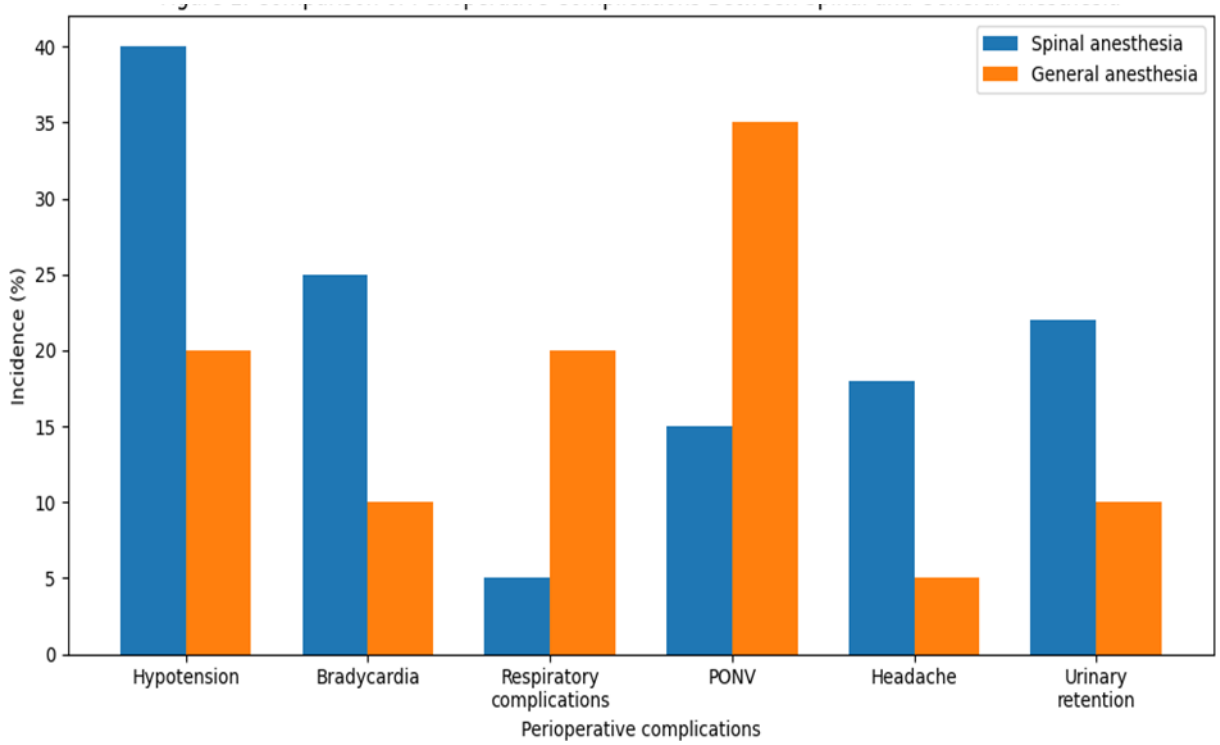

Figure 1. Comparison of Perioperative Complications Between Spinal and General Anesthesia.

Hypotension, bradycardia, headache, and urinary retention were noted to be more common in spinal anesthesia, and respiratory complications and postoperative nausea and vomiting (PONV) were more common in general anesthesia. The figure is a summary of the difference between the perioperative complication profile of the two methods of anesthesia.

Discussion

The current paper has shown that spinal and general anesthesia have different profiles of perioperative complications, and each of the methods has certain benefits and drawbacks depending on the clinical setting.

Hypotension and bradycardia were found to be significantly higher in cases of spinal anesthesia and can be explained by the fact that the sympathetic blockage results in vasodilation and reduced venous return [11]. These data are in line with the prior research indicating a higher incidence of hemodynamic instability after neuraxial anesthesia, especially in patients with poor physiological reserve [12], [13]. This mechanism is further supported by the fact that higher dosages of vasopressor were required by the spinal group.

Comparatively, general anesthesia showed a greater prevalence of respiratory complications, such as oxygen desaturation and airway intervention. These results correspond with the literature that states that general anesthesia, particularly, the use of opioids and inhalation agents, may affect respiratory function and airway reflexes [14], [15]. The fact that the spinal group did not have such complications indicates the benefit of maintaining the spontaneous respiration using regional techniques.

The prevalence of postoperative nausea and vomiting was much higher among the general anesthesia group, which is in line with the emetogenicity of volatile anesthetics and opioids [16]. On the contrary, spinal anesthesia was found to have a greater rate of post-dural puncture headache and urinary retention, both of which are well-known neurological anesthesia complications [17], [18].

Interestingly, the general anesthesia group had higher instances of delayed recovery, which was probably attributed to the effects of anesthetic and accumulation of the systemic drugs [19]. On the contrary, spinal anesthesia enabled a quicker recovery since exposure of the system to drugs was low.

In spite of such differences, there were no significant differences in the overall rate of

complication between the groups, implying that the two techniques can be considered rather safe when properly chosen and controlled. This observation highlights the need to consider particular anesthetic planning in relation to patients, surgical needs, and risk factors.

This study has found the same results as some of the earlier comparative studies, which have found that, spinal anesthesia decreases respiratory complications, but higher chances of hemodynamic instability [20], [21]. Thus, patient safety and surgical outcomes should be maximized by selecting anesthesia based on the patient.

The limitations of this study are that the study is single-center and medium-sized. Also, the long-term outcomes were not evaluated. It is suggested that future large-scale multicenter studies should be conducted.

Conclusion

Spinal anesthesia is linked to more hypotension, bradycardia and less respiratory complications but general anesthesia is linked to more PONV and respiratory complications. Anesthesia must be a personal decision of the patient condition and the needs of the surgery.

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