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Original Research

Comparison Between General and Spinal Anesthesia in the Effect on Hemodynamic Stability in Patients Undergoing Hernia Repair in Hospitals in Karbala, Iraq

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ABSTRACT

Background: Among the various methods, drugs, strategies, and guidelines for optimal anesthesia selection, the anesthesia and critical care staff primarily aim to choose the anesthetic with the least risk to the patient. Spinal anesthesia is one of the most effective and commonly used forms of anesthetic for hernia repair procedures. This study aims to provide an updated and accurate analysis of patients undergoing hernia repair at Karbala's Al-Hassan Hospital and Al-Hussein Medical City. **Methods:** We divided 100 patients who underwent herniotomy into two groups based on the type of anesthesia received: 50 patients received spinal anesthesia (SA), and 50 received general anesthesia (GA). The analysis included patient age, weight, changes in blood pressure, and pulse rate. To ensure comprehensive monitoring, patients aged 20 to 90 years were followed before, during, and after the procedure. **Results:** The results indicate greater hemodynamic stability in patients who received SA, with approximately 56% of patients demonstrating stable parameters compared to 40% in the GA group. However, higher blood pressure was observed more frequently in the GA group (32%) compared to the SA group (24%). Similarly, lower blood pressure was more common in GA (28%) than in SA (20%). Heart rate analysis revealed that SA resulted in greater stability, with 56% of patients maintaining a stable heart rate, compared to 32% in the GA group. Conversely, an increased heart rate was observed in 34% of patients in the SA group compared to 60% in the GA group. A decreased heart rate was reported in 10% of SA patients and 8% of GA patients, further supporting the conclusion that SA provides more stable outcomes. **Conclusions:** Spinal anesthesia was found to be superior to general anesthesia in maintaining heart rate and blood pressure stability at normal or minimally fluctuating levels.

Keywords: Spinal anesthesia; hemodynamic stability; hernia repair; blood pressure

1. INTRODUCTION

Hernia treatment methods present several challenges, including the need for anesthesia during the procedure and pain relief medication afterward. Open inguinal hernia surgery is conducted under both spinal and general

anesthesia.[1] Although there is limited information about the long-term effects of chronic hypertension in children, it is known that children with hypertension can experience organ damage and are at risk of developing hypertension as adults.[2] Hypertension is a significant risk factor for stroke, coronary artery disease, and kidney damage in adults. The American Society of Anesthesiologists' standard for monitoring involves observing the patient's temperature, circulation, breathing, and oxygen levels. A second pulse oximeter is needed to assess pre- and post-ductal oxygen levels in addition to standard monitoring.[3]

To lower arterial blood pressure, propofol reduces heart contractility, preload, and systemic vascular resistance. Higher doses, heart issues, and extremes in age can worsen these effects. Pain after injections and rare occurrences of thrombophlebitis are reported by about 58% of users of injectable propofol.[4] Minor to moderate diastolic or systolic hypertension does not heighten the risk of anesthesia, even though the blood pressure of most patients should return to normal a few months before surgery. Minor to moderate increases should not be treated immediately in the days leading up to surgery. Significant blood pressure increases are connected to heightened surgical risks and should be closely managed before surgery.[5]

Various hernia repair techniques, including Shouldice, Darning, Modified Bassini, Lichtenstein mesh repair, and the newer laparoscopic method, have been documented since Bassini's first description of inguinal hernia repair in 1887.[6] The two primary causes of maternal illness and death during general anesthesia are the inhalation of stomach contents and failed endotracheal intubation. Patients with additional risk factors increasing their aspiration risk should receive intravenous ranitidine (50 mg), metoclopramide (10 mg), or both, one to two hours before general anesthesia induction.[7]

Because propofol reduces preload, heart contractility, and systemic vascular resistance (by inhibiting sympathetic vasoconstrictor activity), its main effect on the cardiovascular system is a reduction in arterial blood pressure. After induction, hypotension is usually reversed by the stimulation that occurs during laryngoscopy and intubation. Propofol-induced hypotension is also associated with other factors, such as high doses, rapid injections, and older age. The usual response of arterial baroreflexes to hypotension is greatly reduced by propofol.[8]

When looking at sevoflurane or isoflurane combined with 67% nitrous oxide, it was found that it was not appropriate to compare the two for inducing a single vital-capacity breath inhalation in 67 individuals.[9] In 68 unplanned children aged 1–3 years having adenoidectomy, the hemodynamic reactions to halothane induction and maintaining anesthesia were compared with those of sevoflurane.[10] The three anesthetic options available for open groin hernia surgery are not suitable for all procedures. The best anesthetic method needs to fulfill specific requirements. It should be as safe as possible, easy to use, and cause minimal postoperative issues. It must be affordable, allow for fast recovery without side effects after surgery, and be painless for the patient.[11]

Research in clinical pharmacology for obese patients indicates that the FFM (Fat-Free Mass) scalar may be a more suitable option for bolus dosing.[12] Another factor that increases the risk of heart damage after noncardiac surgery is low blood pressure after surgery.[13]

We created clear strategies to prevent this problem and eliminate all issues that increase morbidity and mortality. This study aims to compare the effects of spinal and general anesthesia on hemodynamic stability during hernia repair procedures. The findings are expected to help identify the safer anesthetic option, minimize anesthesia-related complications, and improve patient outcomes. Additionally, the results could guide clinicians in making evidence-based decisions while enhancing patient safety and satisfaction.

2. METHODS

2.1 Study Design

In this study, a total of 100 patients underwent hernia surgeries, split into two equal groups of 50 each, with one group receiving general anesthesia and the other spinal anesthesia. An assessment was carried out on various factors, including the patients' age, weight, changes in blood pressure, and heart rate. The participants, aged between twenty and ninety, were divided into two separate groups: one for spinal anesthesia (SA) and the other for general anesthesia (GA). A list of observable elements was created in the operating room, organized into three specific time periods: before, during, and after the surgery. The information gathered included blood pressure

measurements and related variables, such as cases of high or low blood pressure, heart rate changes, and mean arterial pressure (MAP), which could indicate if the patient was experiencing shock due to fluid loss or heart problems. Special caution was required with inhaled anesthetics, as they can cause low blood pressure. The minimum alveolar concentration (MAC) is defined as the level of inhaled anesthetic needed to stop movement in 50% of people in response to a standard stimulus like surgery.

2.2 Data Analysis

This metric allows for comparisons of strength among various anesthetic agents and acts as a benchmark for experimental assessments. Spinal anesthesia is a suitable alternative to general anesthesia, effectively relieving pain during surgery by numbing the lower body while allowing patients to remain awake during the procedure. Most surgeries performed below the waist can be conducted using spinal anesthesia. An anesthetist administers spinal anesthesia using Bupivacaine, which is considered the preferred and most commonly used agent in surgical procedures. Conversely, propofol, the preferred drug for general anesthesia, has a significant effect on systemic blood pressure compared to other induction agents. This is mainly due to considerable vasodilation occurring in both arterial and venous systems, leading to decreases in both preload and afterload. The effect on systemic blood pressure becomes especially severe with older age, in patients with reduced intravascular fluid capacity, and after rapid administration. Additionally, the hypotensive effects are exacerbated by the reduction of the usual baroreflex response, resulting in only a slight increase in heart rate despite the vasodilation.

2.3 Ethical Clearance

The first step was to obtain legal approvals to conduct this research in health institutions in our city. Ethical clearance was granted by the Research Committee of Karbala Health Directorate under the supervision of the Center for Training and Human Development. The study was approved under project number (2024-03), as outlined in the official clearance document. This approval facilitated data collection and ensured compliance with ethical standards.

3. RESULTS

Table 1 demonstrates that heart rate stability was greater in the SA group (56%) than in the GA group (32%). The increase in heart rate was more pronounced in the GA group (60%) compared to the SA group (34%). However, the decrease in heart rate was slightly higher in the SA group (10%) than in the GA group (8%), indicating overall greater stability with spinal anesthesia.

Table 1. Distribution of patients according to the change in heart rate

Patient group	Increase in heart rate n (%)	Remain n (%)	Decrease in heart rate n (%)	Total n (%)
GA group	30 (60%)	16 (32%)	4 (8%)	50 (100%)
SA group	17 (34%)	28 (56%)	5 (10%)	50 (100%)
Total	47 (47%)	44 (44%)	9 (9%)	100 (100%)

In this study, as shown in Table 2, blood pressure was more stable in the spinal anesthesia (SA) group, with 56% of patients maintaining consistent levels, compared to 40% in the general anesthesia (GA) group. Increased blood pressure was higher in the GA group at 32%, compared to 24% in the SA group. Conversely, decreased blood pressure was more common in the GA group at 28%, compared to 20% in the SA group. These findings suggest that spinal anesthesia offers greater stability in blood pressure compared to general anesthesia.

In this study, as depicted in Figure 1, blood pressure remained more stable in the SA group (56%) compared to the GA group (40%). Without treatment, blood pressure increased more in the GA group (32%) than in the SA group (24%) and decreased more in the GA group (28%) compared to 20% in the SA group.

The data show that spinal anesthesia provides more stable mean arterial pressure than general anesthesia.

Similarly, blood pressure (Figure 2) remained more stable in the SA group (56%) compared to the GA

group (40%). Blood pressure increases were more frequent in the GA group (32%) than in the SA group (24%), while decreases were also more common in the GA group (28%) compared to the SA group (20%).

Table2. Distribution of patients according to the change in blood pressure

Patient group	Increase in blood pressure n (%)	Remain n (%)	Decrease in blood pressure n (%)	Total n (%)
GA group	16 (32%)	20 (40%)	14 (28%)	50 (100%)
SA group	12 (24%)	28 (56%)	10 (20%)	50 (100%)
Total	28 (28%)	48 (48%)	24 (24%)	100 (100%)

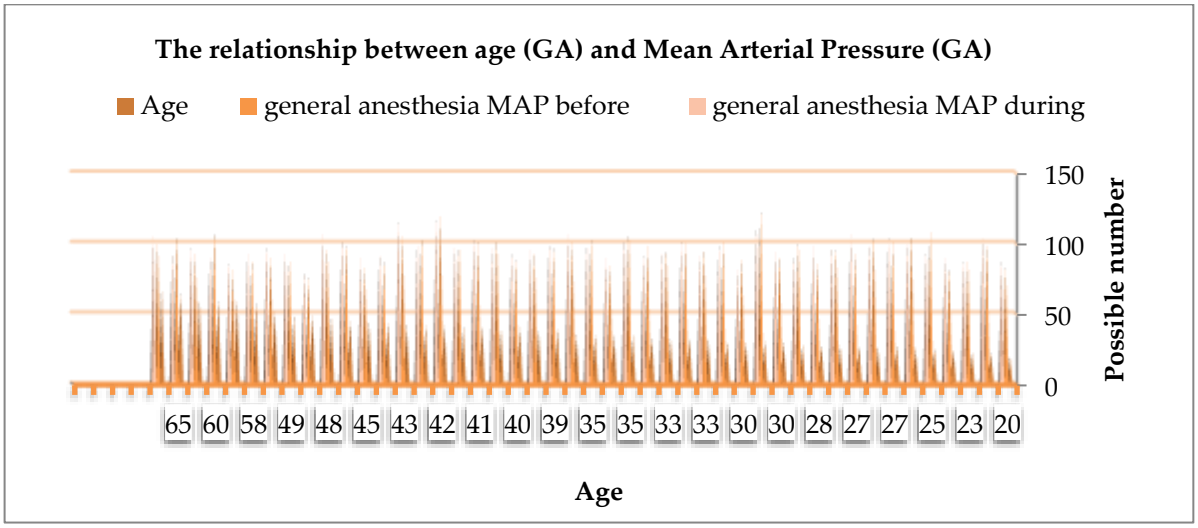

Figure 1. Relationship between age (GA) and mean arterial pressure (GA)

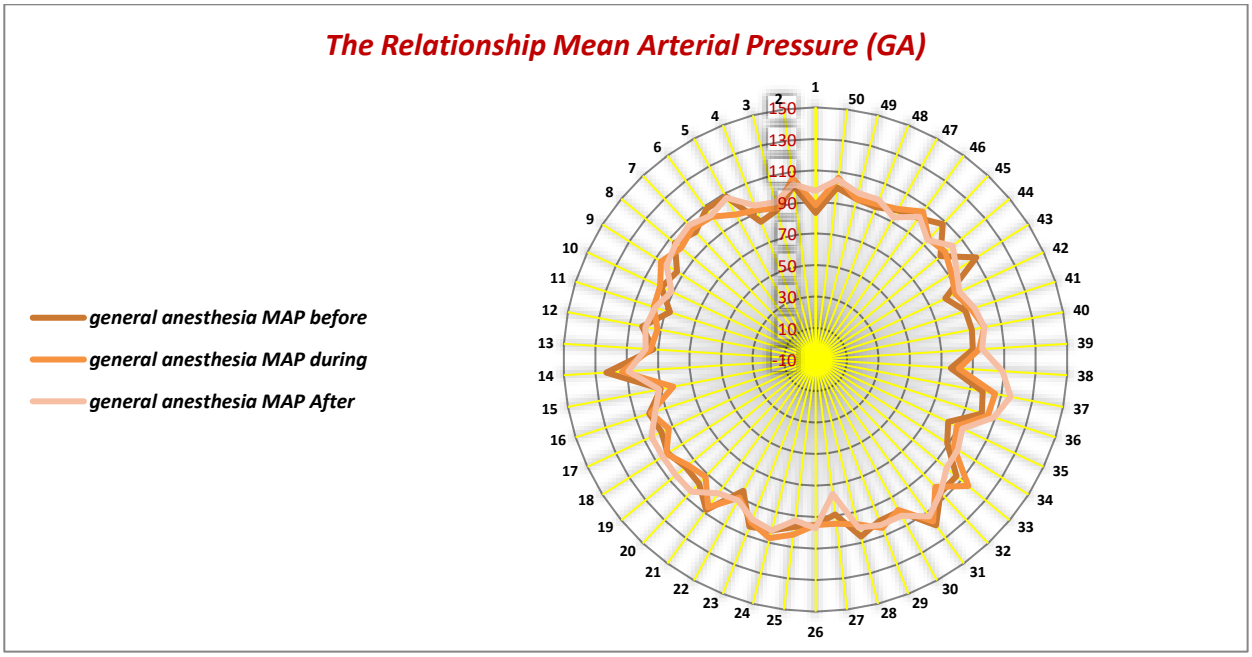

Figure 2. The relationship between mean arterial pressure in GA and SA

The patient ages ranged from 20 to over 90 years, with an average age of 48 years (Figure 3). The age group with the highest incidence in the study was 26–40 years, which accounted for 46% in the GA group and

44% in the SA group. The next most affected group was 41–55 years (24% in GA and 30% in SA), followed by patients aged 55 years or older (12% in GA and 18% in SA). The lowest incidence was in patients younger than 25 years, making up only 8% in the SA group.

The study included both male and female patients (Figure 4). Males accounted for 54% of the SA group (33 patients) and 27 patients in the GA group, while females accounted for 66% in the SA group.

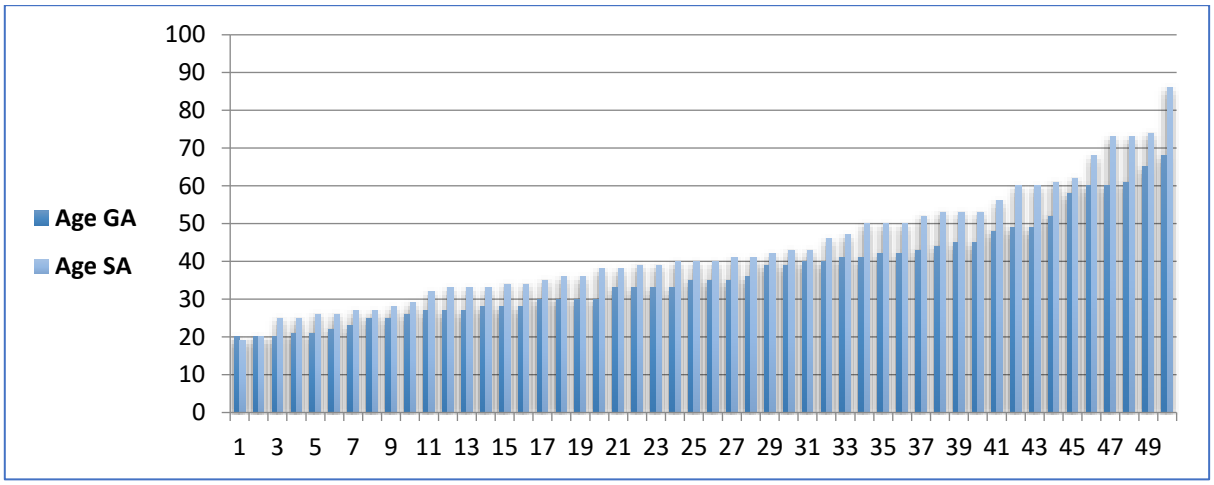

Figure 3. Relationship between age in GA vs. SA groups

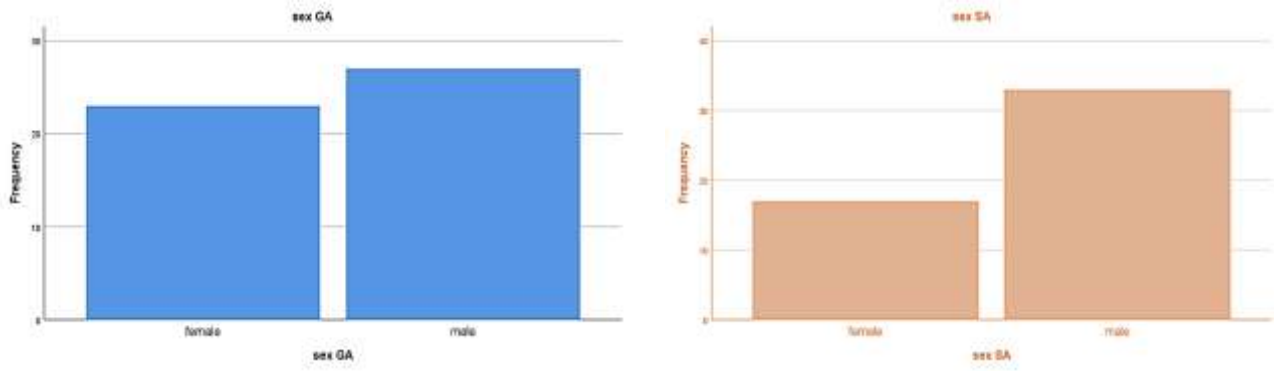

Figure 4. Relationship between sex in GA vs. SA groups

4. DISCUSSION

According to Courtney J. Balentine, inguinal hernia repair is the most frequently performed general surgery in the U.S. Approximately 15% to 20% of these surgeries are conducted under general anesthesia, while the remaining 80% utilize local anesthetic techniques. It is observed that the preference for local anesthesia over general anesthesia in inguinal hernia surgeries tends to increase with patient age.[15]

Bay-Nielsen reports that regional anesthesia is associated with the highest complication rates, while local infiltration results in the fewest complications. The elective groin hernia repair procedure has a mortality rate of 0.12% within 30 days. Moreover, patients who passed away within a week following surgery were more likely to have received regional anesthesia.[16]

Anthony Rodgers suggests that neuraxial blockade reduces major complications, such as postoperative mortality. However, further studies are required to determine the extent of these benefits and whether they arise solely from avoiding general anesthesia. The complications of interest include overall mortality, deep vein thrombosis (DVT), pulmonary embolism, myocardial infarction, the need for transfusions, pneumonia, infections, respiratory complications, and renal failure.[17]

David L. Reich observed that severe hypotension following the induction of anesthesia is quite common, particularly during the 5–10 minutes post-induction. This finding indicates that, for patients older than 50 years with an ASA physical status ≥III, it may be prudent to consider alternatives to propofol for the induction of anesthesia. In clinical practice, 9% of such

patients experience significant hypotension within the first 10 minutes of anesthetic induction.[18]

We evaluated the cardiovascular stability of patients undergoing spinal versus general anesthesia. Their findings indicate that spinal anesthesia provides greater stability compared to general anesthesia for hernia repair surgeries. Although potential complications may arise, the cardiovascular system remains unaffected with appropriate measures. Optimal benefits should be achieved through careful and precise practices, while vigilance is necessary to identify and address any circulatory abnormalities that deviate from expected trends.

An ideal anesthetic agent would combine properties that ensure rapid onset, swift recovery, and minimal hemodynamic effects. Propofol, commonly used for Total Intravenous Anesthesia (TIVA), requires careful dose adjustments for vulnerable populations. Ketamine, while offering unique benefits through NMDA receptor antagonism, can strain cardiac physiology due to its dual effects. Similarly, bupivacaine is a reliable choice for regional blocks but carries risks of cardiovascular toxicity at higher doses. Effective perioperative management is crucial, including vigilant monitoring of blood pressure and cardiac function and ensuring proper airway control to address any complications promptly. Recognizing these limitations highlights the need for tailored anesthetic protocols to optimize patient safety and outcomes.

5. CONCLUSION

In conclusion, the selection of an appropriate anesthetic technique is paramount for ensuring hemodynamic stability during surgical procedures. General anesthesia is associated with notable fluctuations in heart rate, mean arterial pressure, and blood pressure, whereas spinal anesthesia offers a more stable cardiovascular profile. Optimizing patient outcomes requires effective management strategies, including the use of carefully tailored combinations of anesthetic agents such as fentanyl combined with isoflurane, sevoflurane, or propofol. Additionally, the cardioprotective properties of volatile anesthetics contribute to enhanced myocardial protection and improved perioperative safety, underscoring their value in modern anesthetic practice.

Ethical Approval

Ethical clearance was granted by the Research Committee of Karbala Health Directorate under the supervision of the Center for Training and Human Development (Ref. no. 2024-03).

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Competing Interests

All the authors declare that there are no conflicts of interest.

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Underlying Data

Derived data supporting the findings of this study are available from the corresponding author on request.

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