DOI: https://doi.org/10.53350/pjmhs020231712199

ORIGINAL ARTICLE

Changes in Haemodynamic Variables during total Abdominal Hystrectomy: Comparison of General and Spinal Anesthesia

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ABSTRACT

Background: Surgical patients may be exposed to stress response that may be presented with hypertension, tachycardia, arrhythmia and myocardial ischemia. Stress response may expose the patients for serious outcome, especially patients with cardiovascular disease.

Objective: To evaluate the effect of general anesthesia and spinal anesthesia on the perioperative hemodynamic stability in patients undergoing total abdominal hysterectomy.

Study Design: Prospective, randomized clinical trial

Place and Duration of Study: Department of Anesthesia, Divisional Headquarters Teaching Hospital Mirpur AJK from 1st January 2022 to 30th June 2023.

Methodology: Two hundred patients scheduled for elective total abdominal hysterectomy classified randomly into two groups; general anesthesia (GA) and spinal anesthesia (SA) and they were equally divided 100 in each group. The primary outcome was hemodynamic stability as assessed by changes in the heart rate, blood pressure, electrocardiography changes and SPO2 (pulse oximetry).

Results: The GA group showed significant increases in heart rate and systolic blood pressure, with heart rate rising from 80 bpm at baseline (T0) to 98 bpm at 15 minutes (T1), peaking at 102 bpm at 30 minutes (T2), and gradually decreasing to 90 bpm by the end of surgery (T5). Systolic blood pressure increased from 120 mmHg at baseline to 145 mmHg at 30 minutes (T2) and remained elevated at 130 mmHg by the end of surgery (T5). In contrast the SA group experienced minimal fluctuations, with heart rate remaining stable around 82 bpm at baseline, reaching only 85 bpm by the end of surgery.

Conclusions: General anesthesia causes minimal changes in hemodynamic variables compared to spinal anesthesia in patients undergoing total abdominal hysterectomy.

Keywords: Spinal anesthesia, General anesthesia, Tachycardia, Hypertension, Hypotension.

INTRODUCTION

General anesthesia is routinely used for major abdominal surgery. Medical complications become more severe for patients who meet either criteria of being elderly or having three or more severe systemic diseases according to American Society of Anesthesiologists classification (≥III).[1] The medical advantages of spinal anesthesia comprise useful application in patients at high surgical risk and its quick onset together with brief anesthetic effectiveness. The anesthesia provides stable sensory and motor blocks and doctors can decrease initial doses using additional medications to keep vital signs normal and extend the duration of anesthesia.[2] Despite producing lower cardiovascular and respiratory issues.[3] A continuous noninvasive system for monitoring heart rate detection entered the market during spinal procedures[4] and general anesthesia instances.[5]

The severity of stress produces substandard health results for patients undergoing any surgical procedure such as hysterectomy.[6] Research confirmed that women show greater surgical stress compared to men due to the combination of hormone imbalances and blood pressure changes which include (catecholamines, cortisol, glucagon and growth hormones). The body experiences protein plasma elevation together with sodium retention and potassium excretion followed by blood glucose increase because of this changes.[7] The changes in hemodynamic patterns subsequently lead to neural alterations and renal as well as cardiovascular damage.[8]

Surgical stress leads to the activation of sympathetic nervous system which both activates catabolic hormone release while simultaneously shut downing pituitary gland function. The heart rhythm and blood pressure change because of this phenomenon while dopamine and noradrenaline and cortisol and adrenaline biochemical levels shift.[9] Patient hospitalization becomes extended due to these problems while comorbidities appear at higher risk.[10]

The purpose of the present study was to evaluate the effect of general and spinal anesthesia on the perioperative hemodynamic stability using of continuous non-invasive arterial pressure (CNAP) monitoring in patients undergoing total abdominal hysterectomy.

Received on 19-07-2023
Accepted on 05-11-2023

MATERIALS AND METHODS

This is a prospective, randomized clinical trial where a randomized study included 200 patients scheduled for elective total abdominal hysterectomy (TAH) from Department of Anesthesia, Divisional Headquarters Teaching Hospital Mirpur AJK from 1st January 2022 to 30th June 2023. A local ethical committee granted approval before collecting written informed consents from every patient. All patients received examination through the American Society of Anesthesiologists physical Status Score (ASA) at three levels (I, II and III). The preoperative evaluation took place through assessments performed by anesthesiologists for every patient. Random selection for general or spinal anesthesia occurred through a lottery procedure involving patients. The selected elective total abdominal hysterectomy patients without any comorbidity and between age of 25 to 65 years. The participants confirmed with diagnosis of ASA 4 and 5 conditions were eliminated due to allergies to Nalbuphine and tramadol opioids and opioids, NSAID'S and lidocaine and magnesium and paracetamol and Benzodiazepines and ketamine. Additionally, patients with pregnancy or lactation concerns and obesity and psychiatric conditions were excluded. Those patients having sympathetic response to pain by increasing blood pressure and heart rate more than 20% from the initial value, without any blood loss with continuous sweating were also excluded from spinal group.

The doctors used electrocardiography (ECG) along with chest X-ray to examine the heart and its valves for medical and treatment purposes. Hospital staff administered the hypertension and ischemic heart disease and arrhythmia medications to all patients at least two hours before beginning anesthesia. The anesthesia procedure in group GA (general Anesthesia group, n=100) commenced with preoxygenation (100% oxygen) followed by intravenous Nalbuphine (2mg/kg) then Propofol (2mg/kg) along with Atracurium (0.5mg/kg) for induction before tracheal intubation under anesthesia maintenance by Isoflurane (1-2%) and Atracurium (0.1mg/kg after 25min) and oxygen & Nitrous oxide (50%:50%). The Group SA participants (n = 100) received an intravenous crystalloid infusion (500-1000 ml) before the provider performed sterile skin cleaning accompanied by subcutaneous lidocaine 2% infiltration of 3 ml. B. Braun Melsungen AG Germany produced An Spinocan® needle G 25 (G, ¥, L: 23G*3.5") for use. Staff anaesthetized the subarachnoid space using the Spinal needle during a sterile procedure at L4-5 or L3-4 intervertebral space. Confirmation of Space was achieved when free cerebrospinal fluid flow became established after completing the free flow test. Inj. The medical staff administered 2ml of Bupivacaine-SP (Bupivacaine HCL 15mg + Dextrose Anhydrous 165mg) in the Subarachnoid space. After two minutes the sensory block condition was evaluated through pin prick and cold application tests using a three-point scale until sensory block onset. A modified Bromage three point score assessed the motor block affecting the lower extremity.[6] The pain relief measurement employed the pain verbal scale.[7] The assessment tool used a modified Wilson sedation scale which ranged from one to four.[8] All patients received their intraoperative fluids while CNAP readings and patient condition steered the administration process. Nalbuphine administration at 0.5 mg/kg through intravenous route was the first step for managing intraoperative tachycardia (heart rate ≥100 bpm) and systemic hypertension (systolic arterial blood pressure ≥20% above baseline). If this treatment failed to provide sufficient results, the administrative concentration of Isoflurane was gradually increased to 2-2.5% for the patients in the GA group. Additionally, nitroglycerine infusion at rates between 0.5 to 1 µg/kg/min was initiated if hypertension lasted longer than five minutes. Doctors treated intraoperative hypotension by administering bolus ephedrine doses with fluids followed by dopamine therapy as well as epinephrine or norepinephrine when necessary. The healthcare team managed bradycardic patients through an atropine administration at 0.05 mg/kg. After surgery patients received general or spinal anesthesia the medical staff transferred them to the intensive care unit where they received closed monitoring as well as observation for three to four days. The ST-segment analysis of automatic ECG monitoring system tracked the heart rate together with arrhythmias and ST segment modifications in leads ii and v. The measured variables consisted of hematocrit value, arterial oxygen saturation and Nalbuphine total dose alongside arterial blood gases, temperature and urine output. The patients hemodynamic data were collected at the following time points; T0: baseline reading; T1: 15 minutes after induction; T2: 30 minutes after induction; T3: one hour after induction; T4: two hours after induction; T5: at the end of surgery; T6: on admission in ICU; T7: one hour after admission in ICU; T8: 6 hours after admission in ICU; T9: 12 hours after admission in ICU; T10: 24 hours after admission in ICU. power analysis was performed using the Chi square test for independent samples on frequency of intraoperative hemodynamic instability (heart rate ≥100 bpm or ≤60 bpm, hypertension (systolic arterial blood pressure ≥20% above baseline), hypotension (systolic arterial blood pressure ≤20% below baseline) and ST-segment changes in the ECG), because it was the main outcome variable in the present study. The researchers utilized SPSS-24 to input and analyze the research data. The evaluation between groups involved Student t tests for independent samples to compare numerical variables.

RESULTS

The mean age of patients in the GA group was 45±10 years, while in the SA group, it was 46±9 years (p=0.55). Both groups were composed entirely of female patients, with no significant differences in ASA classification (40/40/20 in the GA group vs. 42/38/20 in the SA group, p=0.85), BMI (24.5±3.2 kg/m² in GA vs. 25.1±3.5 kg/m² in SA, p=0.43), or preoperative heart rate (78±8 bpm in GA vs. 79±7 bpm in SA, p=0.65). Preoperative systolic and diastolic blood pressures were also similar between the two groups (120±12 mmHg vs. 121±13 mmHg, p=0.79 and 80±10 mmHg vs. 81±9 mmHg, p=0.62, respectively (Table 1). The heart rate data showed a significant difference between the two groups. In the GA group, heart rate increased from 80 bpm at baseline (T0) to 98 bpm at 15 minutes (T1), peaking at 102 bpm at 30 minutes (T2), and gradually returning to 90 bpm by the end of surgery (T5). In contrast, the SA group showed minimal fluctuations, with the heart rate remaining relatively stable throughout the procedure, ranging from 82 bpm at baseline to 85 bpm at the end of surgery (Table 2). The systolic blood pressure (BP) in the GA group showed a marked increase from baseline (120 mmHg) to 140 mmHg at 15 minutes (T1) and peaked at 145 mmHg at 30 minutes (T2). This elevated BP remained relatively high throughout the procedure, gradually decreasing to 130 mmHg by the end of surgery (T5) (Table 3).

Table 1: Demographic and Baseline Characteristics of Participants

Characteristic	GA Group (n=100)	SA Group (n=100)	p-value
Age (years)	45±10	46±9	0.55
Gender (Male/Female)	0/100	0/100	-
ASA Classification (I/II/III)	40/40/20	42/38/20	0.85
BMI (kg/m²)	24.5±3.2	25.1±3.5	0.43
Preoperative Systolic BP (mmHg)	120±12	121±13	0.79
Preoperative Diastolic BP (mmHg)	80±10	81±9	0.62
Heart Rate (bpm)	78±8	79±7	0.65

Table 2: Comparison of Heart Rate (bpm) between General Anesthesia (GA) and Spinal Anesthesia (SA) Groups

Time Point	GA Group (Heart Rate, bpm)	SA Group (Heart Rate, bpm)
T0 (Baseline)	80	82
T1 (15 mins)	98	84
T2 (30 mins)	102	85
T3 (1 hour)	100	84
T4 (2 hours)	92	83
T5 (End of Surgery)	90	85

Table 3: Comparison of Systolic Blood Pressure (mmHg) between General Anesthesia (GA) and Spinal Anesthesia (SA) Groups

Time Point	GA Group (Systolic BP, mmHg)	SA Group (Systolic BP, mmHg)
T0 (Baseline)	120	122
T1 (15 mins)	140	122
T2 (30 mins)	145	125
T3 (1 hour)	142	125
T4 (2 hours)	135	120
T5 (End of Surgery)	130	120

DISCUSSION

The present study showed that spinal anesthesia minimized the changes in the heart rate, blood pressure. The incidence of fluctuations in the hemodynamic variables was higher in group SA compared to group GA. A larger number of patients required hypotension medication support during SA when compared to patients under GA thus these medications often produce hypertension with tachycardic side effects. A previous study on hypotension incidence and myocardial ischemia during fractured hip surgical procedures reported parallel results.[9]

A greater number of hemodynamic variable fluctuations occurred among patients receiving general anesthesia than spinal

anesthesia during transurethral resection of the prostate.[10] It indicates that hypotension risk together with its severity levels both elevated substantially between general anesthesia versus spinal anesthesia.[11] According to documented research small-dose bupivacaine creates successful anesthesia with better stability while the needed ephedrine and fluid levels to deal with hypotension were higher when using general anesthesia rather than spinal anesthesia (these findings connect with results from previous studies.[12-14]

The laryngoscopic examination combined with intubation procedures alongside surgical trauma initiates a stress response that produces elevated heart rate and blood pressure measurements thus raising myocardial oxygen requirements in already oxygen-deprived hearts.[15] The oxygen requirements of the hearts exposed to ischemic damage in high risk patients increase because of the general anesthesia-induced hemodynamic instability which persists throughout 24 postoperative hours.[16,17] Placing a constant flow of anesthesia through the spinal cord yields superior pain control than traditional general anesthesia systems.[4,18] Patients with high ischemic heart disease risk exhibited better stability of sympathy-vagal balance during spinal anesthesia than general anesthesia.[19,20] The research acknowledges two main limitations as its single-center approach combined with its minimal patient numbers.

CONCLUSION

General anesthesia induced minimal changes in hemodynamic variables compared to spinal anesthesia in high risk cardiac patients undergoing elective surgery but spinal anesthesia decreased the requirement for pharmacological support in high risk cardiac patients.

REFERENCES

1. Kisa A, Koruk S, Kocoglu H, Leblebici İM. Comparison of general anesthesia with spinal anesthesia in laparoscopic cholecystectomy operations. Medeni Med J 2019;34(4):346-53.
2. Mavropoulos A, Camann W: Use of a lumbar tattoo to aid spinal anesthesia for cesarean delivery. Int J Obstet Anesth 2009;18(1):98-9.
3. Balki M, Carvalho JC: Intraoperative nausea and vomiting during cesarean section under regional anesthesia. Int J Obstet Anesth 2005; 14(3):230-41.
4. Mishriky BM, Habib AS: Metoclopramide for nausea and vomiting prophylaxis during and after caesarean delivery: A systematic review and meta-analysis. Br J Anaesth 2012;108(3): 374-83.
5. Ge DJ, Qi B, Tang G, Li JY. Intraoperative dexmedetomidine promotes postoperative analgesia and recovery in patients after abdominal hysterectomy: a double-blind, randomized clinical trial. Sci Rep 2016; 23(6): 21514.
6. Raghvendra KP, Thapa D, Mitra S, Ahuja V, Gombar S, Huria A. Postoperative pain relief following hysterectomy: A randomized controlled trial. J Midlife Health 2016; 7(2): 65-58.
7. Masood Z, Haider J, Jawaid M, Alam SN. Preoperative Anxiety in Female Patients: The Issue Needs to Be Addressed. *KUST Med J* 2009;1(2):38-41.
8. Pouriamofrad E, Rajaee M, Madineh H, Sadeghi B. The Effect of General Versus Spinal Anesthesia on Blood Sugar Changes During Surgery. *J Anesth Pain* 2012;2(8):158-64.
9. Vriesendorp TM, Morelis QJ, Devries JH, Legemate DA, Hoekstra JB. Early post-operative glucose levels are an independent risk factor for infection after peripheral vascular surgery: a retrospective study. Eur J Vasc Endovasc Surg 2004;28(5):520-5.
10. Gulec H, Cakan T, Yaman H, Kilinc AS, Basar H. Comparison of hemodynamic and metabolic stress responses caused by endotracheal tube and Proseal laryngeal mask airway in laparoscopic cholecystectomy. *J Res Med Sci* 2012;17(2):148-53.
11. Selvaraj V. Evaluation of clonidine as an adjuvant to bupivacaine in wound infiltration for providing postoperative analgesia after abdominal hysterectomy. Anesth Essays Res 2016; 10(3): 408-13.
12. Amri P, Alijanpour E, Nickbakhsh N, Modarress R, Naghshineh A, Esmaeili M. Effects of gabapentin on postoperative pain following laparoscopic cholecystectomy. J Mazandaran Univ Med Sci 2013; 23(103): 28-31.
13. Goyal M, Taxak S, kshetrapalkk, goel Mk: Continuous spinal anesthesia in high risk elderly patient using epidural set. J Anesthesia Clinpharmacol 2011; 27:139-41.
14. Dobson PM, Caldicottld GS, Cole DS Jr, Channerk S: Changes in hemodynamic variables during transurethral resection of the prostate: comparison of general and spinal anesthesia. br J Anaesth 1994;72:267-71.
15. ErrandoCl, peiró CM, gimeno A, Soriano Jl: Single shot spinal anesthesia with very low hyperbaric bupivacaine dose (3.75 mg) for hip fracture repair surgery in the elderly: a randomized, double blinded study. Rev Esp Anestesiolreanim 2014;61:481-8.
16. Messina A, frassanito l, Colombo d, vergari A, draisci g, della Corte f, et al: Hemodynamic changes associated with spinal and general anesthesia for hip fracture surgery in severe ASA iii elderly population: a pilot trial. Minerva Anaestesiol 2013; 79:1021-9.
17. Saber R, Metainy S. Continuous spinal anesthesia versus single small dose bupivacaine–fentanyl spinal anesthesia in high risk elderly patients: A randomized controlled trial. Egyptian J Anesthesia 2015; 31:233-8.
18. Basques BA, Toy JO, Bohl DD, Golinvaux NS, Grauer JN: General compared with spinal anesthesia for total hip arthroplasty. J bone Joint Surg Am 2015;97:455-61.
19. Sarakatsianou C, Georgopoulou S, Tzovaras G, Perivoliotis K, Papadonta ME, Baloyiannis I. Hemodynamic effects of anesthesia type in patients undergoing laparoscopic transabdominal preperitoneal inguinal hernia repair under spinal vs general anesthesia. Hernia 2019;23(2):287-98.
20. Kahveci K, Doger C, Ornek D, Gokcinar D, Aydemir S, Ozay R. Perioperative outcome and cost-effectiveness of spinal versus general anesthesia for lumbar spine surgery. Neurol Neurochir Pol 2014;48:167-73.

This article may be cited as: Zubair H, Khan MN, Fatima A, Yousaf A, Chaudry SA, Perveen S, Rafiq A, Chaudhry AA: Changes in Haemodynamic Variables during total Abdominal Hystrectomy: Comparison of General and Spinal Anesthesia. Pak J Med Health Sci, 2023; 17(12): 199-201.