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A CLINICAL STUDY OF COMPARISON BETWEEN GENERAL ANAESTHESIA AND SPINAL ANAESTHESIA FOR LOWER ABDOMINAL LAPAROSCOPIC SURGERIES

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ABSTRACT

Background: Laparoscopic surgery is becoming more and more popular since it is less intrusive and has lower morbidity. GA is typically used during laparoscopic surgery because it is considered the best method for achieving excellent muscle relaxation and tolerance to pneumoperitoneum. Laparoscopic surgery under spinal anesthesia is feasible, widely studied, and also avoids the complications of GA. This clinical study was conducted to compare the hemodynamic alterations, surgical conditions and patient acceptance of spinal anaesthesia with general anesthesia.
Materials and Methods: The study included 50 patients ASA I and II scheduled for elective lower abdomen laparoscopic procedures, divided into two groups. General anesthesia was given to Group A and spinal anaesthesia to Group B.
Results: Demographics are comparable in both groups. In comparison to group B, group A mean heart rate, systolic blood pressure and diastolic blood pressure were all greater. The group B demonstrated excellent hemodynamic stability. Seven of the group B cases reported right shoulder pain and discomfort, managed with iv Propofol, although no case was converted to general anesthesia. 8% of the group B, 32% of the group A experienced postoperative nausea and vomiting. In the initial postoperative period, postoperative discomfort was less severe in Group B, and Group A required more rescue analgesia.
Conclusion: Spinal anesthesia for lower abdominal laparoscopic surgery is safe and promising anesthetic technique, with favorable intraoperative surgical circumstances, stable hemodynamics, and postoperative pain management throughout the patient hospital stay.
Keywords: General Anaesthesia, Spinal Anaesthesia, Lower Abdominal Laparoscopic Surgeries.

INTRODUCTION

Laparoscopic surgery, a novel surgical technique made its debut in the 20th century and was quickly accepted by the surgical community and also the patients. Philippe Mouret performed the first laparoscopic cholecystectomy in Lyons in March 1987, which is recognized as the beginning of minimally invasive surgery.[1] Following this, the procedure became widely used and endoscopic procedures were developed for use in other medical disciplines like urology, gynecology and thoracic surgery. Almost every aspect of surgical therapy for a wide range of disorders has been transformed by minimally invasive surgery, helping a larger patient population, due to their advantages in terms of postoperative discomfort, hospital stay, cosmetic reasons and speedy return to daily activities.[2]

New surgical methods however, present new anesthetic problems that necessitate the creation of fresher anesthetic methods. Even though it has several advantages over traditional procedures, laparoscopic surgery which uses carbon dioxide (CO_2) insufflation to generate pneumoperitoneum, nevertheless has the potential to enhance stress hormone responses (cortisol, adrenaline and norepinephrine), leading to increased peripheral vascular resistance, raised serum catecholamine levels and decreased cardiac output, hence result in hemodynamic fluctuations, which would then limit tissue perfusion. Additionally, pneumoperitoneum which lowers functional residual capacity causes ventilatory impairment and diaphragmatic dysfunction after laparoscopic surgery. Laparoscopy has been found to be only slightly intrusive morphologically, but physiologically it is otherwise. This is demonstrated by the elevation of stress hormones, cardiovascular instability and ventilatory impairments occurring during laparoscopy, which are detrimental to high risk patients. Despite the fact that laparoscopic treatments have many benefits, they are also associated with significant life threatening side effects like venous gas embolism, systemic carbon dioxide absorption and the cardiovascular effects of pneumoperitoneum. Numerous investigations have discovered a significant rise in systemic vascular resistance even if the changes in CO and preload are still up for debate (SVR).[3,4] The intraoperative monitoring of these changes in hemodynamic parameters is critical.
In patients undergoing laparoscopic surgery, the objectives of the anesthesiologist include minimizing shoulder tip pain, obtaining a suitable level of sensory block, managing the consequences of pneumoperitoneum, speedy emergence from anaesthesia, giving enough postoperative pain relief to prevent deterioration of respiratory mechanics and allowing ambulation as soon as possible.[5]
It is no longer true that laparoscopic treatments can only be performed under general anesthesia. Growing evidence points to the importance of spinal anesthesia for patients having laparoscopic surgeries, due to sore throat, post-operative discomfort, nausea, vomiting and an elevated stress reaction to endotracheal intubation following general anaesthesia. Avoiding airway manipulation, using fewer sedatives and narcotics, improving muscle relaxation and lowering the surgical stress response are just a few of the key advantages of regional anesthesia. Additionally, it provides the benefits of a patient who can communicate during the procedure, lessen postoperative pain and is economical.
Our study compares the intraoperative surgical circumstances, hemodynamic changes with general anesthesia, the requirement of rescue analgesic in the postoperative period and incidence of PONV to determine the viability of spinal anesthesia in lower abdominal laparoscopic procedure.

Aim and Objectives of the Study

The aim is to study and compare outcomes of spinal anaesthesia and general anaesthesia for lower abdominal elective laparoscopic surgeries in terms of intra operative Hemodynamic stability, Quality of analgesia, adequacy of intraoperative relaxation and surgical comfort, Post-operative Analgesia and Incidence of PONV during spinal anesthesia and general anesthesia.

MATERIAL AND METHODS

This is a prospective comparative analytical study, done over 1 year. Total number of 50 patients were divided into 2 groups. Patients belonging to ASA I &II, aged between 16 to 45 years and patients undergoing elective laparoscopic surgeries e.g. laparoscopic Appendicectomy, tubal ligation, ovarian cystectomy, diagnostic laparoscopy and laparoscopic lymph node biopsy are included in the study. Patients who are ASA grade III and IV, having infection at the site of injection, with coagulopathy or on anti-coagulation treatment, having congenital abnormalities of lower spine and meninges, with active disease of central nervous system, with history of allergy to local anaesthetics are excluded from the study.
Pre-anesthetic assessment was done and documented, and informed consent was obtained. Patients were kept nil by mouth, overnight and all patients were given an oral dose of Tab pantoprazole 40mg and Tab alprazolam 0.25mg the night before surgery. They were randomized to either have general anesthesia (Group A) or a subarachnoid block (Group B). As soon as the patient entered the operating room, monitors were connected and baseline vital signs such heart rate, systemic artery pressure, ECG and peripheral oxygen saturation were recorded. An intravenous cannula of the appropriate sizes was secured. Both groups received 10mlkg-1 of ringer lactate as a preload.
Patients in group A generally went through the same general anesthetic technique. Ondansetron 4 mg, midazolam 0.05 mg/kg, pentazocine 0.5 mg/kg and glycopyrrolate 0.2 mg were administered intravenously as premedication. The dosage of propofol was 2 mg/kg for the patients. Succinylcholine 2 mg/kg was used to assist endotracheal intubation. Recordings of the heart rate and blood pressure SPO_2, $ETCO_2$ were made, with readings taken at 1, 2, and 15 minutes following intubation. Vecuronium bromide 0.05 mg kg-1 and 33% oxygen in nitrous oxide were used to maintain anesthesia, and this process was repeated after 20 minutes. Intermittent positive pressure ventilation was performed and the ventilatory frequency and tidal volume were adjusted, to keep end-tidal carbon dioxide between 32 and 36 mm Hg. CO_2 was insufflated to produce and maintain a pneumoperitoneum at a pressure of 15 mmHg. Neostigmine and glycopyrrolate were administered

intravenously at the appropriate dose at the conclusion of the procedure to reverse any remaining neuromuscular block. After being extubated, the patient was taken to the recovery area.

In Group B patients, Ondansetron 4 mg IV, pantoprazole 40 mg IV and pentazocine 0.2 mg/kg were given to the patients as premedication. Under strict aseptic precautions lumbar puncture done with 23G Quincke needle in left lateral position, at the L3-L4 spinal interspinous space by midline approach and after free flow of cerebrospinal fluid, 3cc of bupivacaine hydrochloride and 25mcg of fentanyl was injected intrathecally and the time was noted. Surgery was started using CO_2 insufflation at a pressure of 15 mm Hg when the level of sensory blockage up to T6 was achieved. All patients received 4 l/min of oxygen supplementation through a face mask. During the surgical procedure, monitoring was done for shoulder pain, neck pain, desaturation or hypoxemia (SpO_2 90%), hypotension, nausea and vomiting.

A reduction in systolic blood pressure (SBP) of more than 20% from the baseline was considered hypotension. An infusion of crystalloids was used to alleviate intraoperative hypotension, and in cases where it persisted, bolus doses of the injectable drug phenylephrine 25-50 mcg intravenously were administered. Any patient whose pulse rate dropped below 60 beats per minute received an intravenous injection of glycopylorrate (0.2 mg).

Heart rate, SpO_2, $EtCO_2$, electrocardiography (ECG) with ST segment analysis, systemic blood pressure, including the systolic and diastolic blood pressure and electrocardiography (ECG) were measured at the following times in both groups Prior to induction or pre-operatively, immediately following pneumoperitoneum, 1, 3 and 5 minutes after endotracheal intubation and then every fifteen minutes after that. The intra-operative circumstances and muscular relaxation were graded on a scale of poor, good and excellent by the surgeon.

All patients were watched for any indications of complications or adverse events in the postanesthetic care unit (PACU). Transient neurological symptoms, headache, sore throat, and nausea and vomiting were all asked about to the patients. A visual analogue scale was used to evaluate the pain at 1, 3 and 12 hours. A 10-point visual analogue scale (VAS) depicting the varied amount of pain from 0 (no pain) to 10 was used to measure the intensity of the discomfort (worst pain). When the VAS was 6 or higher, rescue analgesic diclofenac sodium 75 mg im. was administered. Ondansetron 4 mg intravenously, a rescue antiemetic was administered if any patient felt nausea or vomiting.

The study findings were given in a tabular format. The student t test was used for statistical analysis. Using SPSS for Windows version 17, the chi-square test was run on nonparametric results and a P value of 0.05 was deemed statistically significant.

RESULTS

Demographic characteristics are comparable between the groups. Out of 50 patients in this study, 40% were scheduled for appendicectomies, 16% for laparoscopic ovarian cystectomies 20% for laparoscopic tubal ligations, and 24% for diagnostic laparoscopies. Appendicectomy (40%), laparoscopic ovarian cystectomy (16%), lap tubal ligation (20%) and diagnostic laparoscopy (24%) were performed in group A in a similar manner to those performed in group B with a p valve of 1 that was statistically insignificant.

By comparing the Pulse Rate (PR) between the groups was shown statistically not significant ($P> 0.05$) at different time intervals. No statistically significant difference in the Systolic Blood Pressure and disaolic blood pressure, seen between the groups at different time intervals. In this study the association between SPO2 among study groups was not statistically significant with P valve of 0.58. The incidence of post-operative nausea and vomiting was 32% in Group A and 8 % in Group B which was statistically significant with p valve of 0.03. In this study, at time periods 1, 3, 6, 12 hrs. VAS scoring was statistically significant with < 0.05 p value. [Table 4]

Table 1: Surgical procedures

	General Anesthesia		Spinal Anesthesia		Total	
	N	%	N	%	N	%
Appendicitis	10	40%	10	40%	20	40%
Lap ovarian cystectomy	4	16%	4	16%	8	16%
Lap. Tubal ligation	5	20%	5	20%	10	20%
PI- Diagnostic lap	6	24%	6	24%	12	24%
Total	25	100%	25	100%	50	100%
Chi square test= 0, p=1, Not statistically significant						

Table 2: Pulse rate

	General Anesthesia		Spinal Anesthesia		P value
	Mean	SD	Mean	SD	
pre-op	82.72	10.48	81.24	8.18	0.58
1st min	96.36	14.94	87.40	13.39	0.03
2min	100.52	12.71	96.80	10.98	0.27

3min	92.52	12.33	94.12	10.77	0.63
4min	87.36	7.75	87.00	10.74	0.89
5min	83.44	8.43	83.76	10.98	0.91
at pneumo	83.08	8.99	84.60	10.72	0.59
15min	90.12	10.28	84.36	10.00	0.05
30min	83.76	8.61	82.32	9.30	0.57
45min	79.64	7.31	77.96	5.45	0.37
60min	77.96	7.75	78.29	6.19	0.87

Table 3: SBP comparison

	General Anesthesia		Spinal Anesthesia		P value
	Mean	SD	Mean	SD	
pre-op	116.80	9.09	118.56	8.11	0.47
1st min	137.60	9.68	109.28	7.68	0.00
2min	121.44	10.79	102.16	9.61	0.00
3min	153.20	199.39	107.56	8.66	0.26
4min	114.56	8.05	113.04	8.83	0.53
5min	113.76	4.70	112.76	7.40	0.57
at pneumo	121.84	12.91	114.92	5.73	0.02
15min	135.32	10.02	111.84	8.26	0.00
30min	124.24	9.84	114.00	6.89	0.00
45min	116.24	7.51	114.63	5.81	0.41
60min	114.84	5.51	116.33	5.64	0.35

Table 4: DBP comparison

	General Anesthesia		Spinal Anesthesia		P value
	Mean	SD	Mean	SD	
pre-op	76.48	10.38	77.16	5.80	0.78
1st min	88.88	7.66	71.36	6.90	0.00
2min	81.84	11.22	66.96	6.51	0.00
3min	79.44	8.52	69.96	8.02	0.00
4min	74.64	7.61	76.60	7.65	0.37
5min	75.12	7.19	79.20	6.56	0.04
at pneumo	79.80	9.67	78.48	5.58	0.56
15min	88.80	8.52	77.60	4.64	0.00
30min	81.28	11.28	75.33	5.33	0.02
45min	77.76	7.92	75.46	5.20	0.24
60min	75.12	6.51	75.60	4.83	0.77

Table 5: VAS scoring

	General Anesthesia		Spinal Anesthesia		P value
	Mean	SD	Mean	SD	
1 HR	7.92	0.76	0.04	0.20	0.00
3 HR	6.84	1.25	2.40	0.76	0.00
6 HR	6.80	1.08	5.04	1.02	0.00
9 HR	7.32	1.22	7.36	1.32	0.91
12 HR	7.16	1.03	6.44	1.36	0.04

DISCUSSION

Because pneumoperitoneum causes a variety of physiological changes, laparoscopic surgeries provide extra difficulties to the anesthesiologists. General anesthesia provides total analgesia throughout the surgery while keeping the patient entirely unconscious and oblivious of what is happening, however, it has drawbacks like decreasing functional residual capacity and total lung capacity, causing basal atelectasis, raising airway pressures, building CO2 and rising PETCO2, postoperative course of patients with a higher incidence of pain, PONV and prolonged hospital stay leading to higher hospital costs, which raises the question of whether the widely accepted anesthesia modality, general anesthesia, is actually beneficial. Over the years, several additional techniques have been studied as a result of the necessity for an alternative technique of anesthesia. Spinal anesthesia is one of the most well studied and successfully applied alternatives.

Numerous studies have shown that it is a good substitute for GA and in some circumstances is even superior to GA. These studies looked at factors like patient comfort during and after the procedure, recovery from anesthesia, the frequency of postoperative complications, ambulation, hospital stay and cost-effectiveness.[6,7]

. In the SA group, the levels of the hormones adrenaline, noradrenaline and all other catecholamines drastically dropped during surgery. While variations in noradrenaline levels indicate activity in the sympathetic nervous system, variations in circulating adrenaline levels indicate action in the adrenal medulla. Therefore, a decrease in both catecholamines may result from total blockage of the adrenal medulla innervation via the

T6-L2 spinal neurons51 and complete blockage of the thoracolumbar sympathetic nervous system caused by severe spinal anesthesia.[8]

The SAB counteracts the vasomotor constriction of the leg muscles and splanchnic organs as well as the elevated sympathetic tone brought on by pneumoperitoneum. It explains why none of the patients had intraoperative hypertension. Hypotension was a common finding that was managed with liberal intravenous fluid therapy a low IAP, little tilt in the operating table and no cardiovascular illness in the patients. In a study, Calvo Soto et al,[9] shown that whereas epidural anesthesia was unable to do so, SA alone was able to prevent the rise in cortisol levels.

In our study, preoperatively, the mean heart rate was statistically insignificant the mean heart rate was greater at various intraoperative time points in spinal anaesthesia group but statistically insignificant at all times. In a study by Pamela et al,[10] who came to the conclusion that SAB offered good intra- operative conditions and muscle relaxation that was comparable to GA. Contrary to GA patients, SAB patients displayed reduced tachycardia during surgery. Bradycardia was discovered in 2 patients (8%) receiving spinal anesthesia, and they were successfully treated with a 0.2 mg intravenous infusion of glycopyrrolate similar to our study.

In their research, Purvi J. Mehta et al,[11] and Gautam B,[12] found no evidence of bradycardia, demonstrating that bradycardia poses little danger. In group GA, no patients had hypotension, while hypotension (defined as a fall in blood pressure of more than 20%) was recorded in 5 (20%) cases treated with mephentermine 6 mg bolus in only 2 cases, while the remaining patients received intravenous fluids as similarly managed in our study.

In 18.21% of the patients, Sinha et al,[13] and Purvi J Mehta et al,[11] reported hypotension and in 30% of the cases. This demonstrates unequivocally that using SAB during open surgery or laparoscopic surgery has no effect on the incidence of hypotension. Hypertension tends to occur more frequently towards the onset of insufflations, when the increasing intra-abdominal pressure which is still below 10 mm Hg increases the venous return by reducing the blood volume in the splanchnic vasculature.[14] Thus showing that compared to GA, spinal anesthesia offers a better overall hemodynamic picture. The reduced surgical bed oozing brought on by hypotension, bradycardia and increased venous drainage brought on by SAB has been mentioned as an additional cardiovascular benefit.[15]

Numerous studies have been conducted on the detrimental effects of the pneumoperitoneum with CO_2 on respiratory performance. Due to its high water solubility and great capacity for exchange in the lungs, CO_2 is typically employed for safety. By using capnography and ventilation, it is simple to monitor and regulate the CO_2 concentration.[16] These effects are especially prominent in patients who have had forced head down positioning, lengthy endoscopy procedures and pulmonary and cardiac dysfunction. In this context as a general over view, it can be stated that spontaneous physiological respiration during SA would always be better than an assisted respiration, as in GA1. Throughout the surgery, SpO_2 and $PETCO_2$ were within normal ranges, demonstrating that spinal anesthesia is safe even without tracheal intubation.

The condition of respiratory parameters throughout the 2 anesthetic modes for laparoscopic surgery appears to be the main topic of debate. Overall, it can be said that in this situation, spontaneous physiological respiration (SA) would always be preferable than aided respiration (GA). When compared to SAB, GA has a higher risk of intubation and ventilation- related issues, including an increase in mechanical ventilation to reach an adequate ventilation pressure.[17] In addition, after laparoscopic surgery with GA, pulmonary function takes 24 hours to restore to normal. Contradictory reports of respiratory parameter changes while patients are under regional and GA are present and the observations are not all consistent.

When the patient was under GA as opposed to when the patient was breathing on their own, Nishio et al,[18] researches from 1980 showed a larger increase in $PaCo_2$ after CO_2 pneumoperitoneum. On the other hand, under epidural anesthesia Chiu et al,[19] , documented considerable arterial blood gas abnormalities. Epidural anesthesia for laparoscopy does not result in ventilatory depression, according to Circolo et al.[20]

During the surgery, neither CO_2 retention nor hypoxemia were seen in the spinal anesthetic group. While some surgeons maintain lower pressures (< 10 mmHg, others prefer high pressures (14 mmHg). To lessen diaphragmatic discomfort, we selected a low pressure of up to 8 mmHg. Because of the good muscular relaxation brought on by the high level of sensory and motor block, O_2 saturation and PET CO_2 were normal during the SA group, showing the safety of the approach even without tracheal intubation. Pneumoperitoneum had to be raised above 9 mmHg in the GA group.[21] With the exception of lowering peritoneal pressure to 8 mmHg to prevent vagal reflexes and bradycardia, spinal anesthesia may not result in any changes to surgical technique.

Although awake patients seem to tolerate laparoscopy well, shoulder tip pain may be a serious intraoperative issue.[22] The lower surface of the diaphragm is irritated by CO_2 during the pneumoperitoneum, causing shoulder tip pain, sometimes, severe enough to warrant switching the anesthetic method. We discovered that 5 (or 20%) of the patients in our SAB group had shoulder tip pain, which was treated with an intravenous propofol 1 mg/kg bolus. While on sedation, one patient experienced apnea, which was treated with mask ventilation until the patient resumed spontaneous breathing. GA was not converted for any patients. Our study finding that 20% of patients experienced intraoperative shoulder pain is consistent with the findings of van Zundert AAJ et al,[23] who reported a 25% prevalence of shoulder-tip pain during LC under SAB. We think that 2% 10-ml lidocaine irrigation on the right hemidiaphragm can help to lower the frequency of shoulder pain in spinal method.[24]

In a study by Yuksek et al,[25] 16 patients (55.2%) complained intraoperative right shoulder discomfort recorded, necessitating the administration of fentanyl or requiring anesthetic conversion. Three patients required anesthetic conversion due to the severity of the pain, while five others required further 2% lidocaine solution spraying on the diaphragm to relieve the discomfort. According to Tzovaras et al65 right shoulder pain occurs in 13% of cases and requires intravenous fentanyl in 20% of cases.

In the current study, pain scores at 2, 4, 6, 8 and 12 hrs after surgery were significantly lower in the SA group than in the GA group. This difference is attributable to the local anesthetic continued analgesic effects in the subarachnoid space as well as a reduction in discomfort from the lack of a tracheal tube and its complications with avoiding GA.[26] After SAB, there was no postoperative restlessness that is typically observed after GA and the patient is always receptive and more compliant towards instructions. It appears that SA has the ability to reduce the need for postoperative analgesia. When GA was utilized, the injectable analgesic was typically needed soon after extubation in the postoperative phase and it can be difficult to effectively manage immediate postoperative pain.

In the first 4-6 postoperative hours following lower elective abdominal surgery, this study found that SA with hyperbaric bupivacaine 0.5% is superior than GA for reducing pain intensity, the need for further analgesia and the frequency of opioid requests. Mean variations in heart rate and blood pressure were statistically lower during the surgery and the first six postoperative hours, which may indicate less pain during that time. But after that period until 24 h there were no statistically significant differences between the two groups regarding postoperative pain scores. In a recent study, Kessous et al. found that postoperative meperidine requirements in the first 24 hours were considerably higher in the GA than SAB.

The surgeon was questioned about the surgical circumstances and muscular relaxation following each procedure and asked to rate them as bad, good or extraordinary. The surgeons claim of good abdominal muscle relaxation in comparison to general anesthesia may be explained by the high amount of sensory, motor and sympathetic block in both spinal methods. Similar assessments of the surgical circumstances were made by Pamela et al10, who came to the conclusion that SAB offered good intra- operative conditions and muscle relaxation that was comparable to GA.

Early on after surgery (up until six hours), the SAB group experienced less discomfort than the GA group. After this time, no discernible change was observed. In our SAB group, postural headaches, one of the side effects of spinal anesthesia, were not observed. After GA, there is frequently a significant morbidity due to complications such sore throat, muscle soreness from muscle relaxants, lightheadedness and postoperative nausea and vomiting (PONV). However, after GA PONV is at its maximum, particularly when nitrous, opiates or reversal medications are used. The percentage can range from 60% to 70% when they are present. Antiemetics may be necessary in as many as 50% of patients with PONV and in 7% of patients, they may cause a delay in hospital discharge89. Even with more modern drugs like Propofol and Isoflurane, the incidence can reach 30%, which significantly raises anesthesia expenses.[27] In comparison to SA patients, our GA patients had a 20% incidence of PONV, which was significantly greater. 16% of the GA group reported having a sore throat. Our initial reports with laparoscopic spinal anesthetic surgery are encouraging.

CONCLUSION

Laparoscopy surgery presents challenges for both the anesthesiologists and the operating surgeon. In this randomized, prospective trial, we found that spinal anesthesia effectively maintained hemodynamic stability in patients undergoing lower abdomen laparoscopic surgery with reduced postoperative pain and PONV. SAB has limits, including pruritis and shoulder-tip pain (which can be treated with, additional sedatives and analgesics, or conscious sedation). In view of stable hemodynamics, favorable surgical conditions, a pain- free post-operative time and low post-operative problems, we conclude that spinal anesthesia is a sensible, safe, and efficient substitute for general anesthesia.

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