

## **Spinal Anaesthesia for Laparoscopic Abdominal Surgeries: A Comparison with General Anaesthesia Regarding Haemodynamic and Respiratory Stability**

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### **Abstract**

**Introduction:** Laparoscopic surgery has remarkably shown advancement in recent years, due to which there are reduced morbidity and shorter hospital stays when compared with open surgeries. Presently, most laparoscopic operations are usually performed under general anaesthesia, except for patients who have some contraindication for general anaesthesia. Given the advantages of spinal anaesthesia, we conducted a study to see the feasibility of spinal anaesthesia concerning cardiovascular and respiratory stability and postoperative outcomes.

**Materials and Methods:** 120 patients of ASA Grades I or II undergoing various abdominal surgeries were randomly divided into 2 groups with 60 patients in each group. Group A underwent the procedure under GA as

per the preset protocol. Group B underwent the procedure under spinal anaesthesia (SA). In both the groups BP, Heart rate and ECG were recorded. Patients were enquired about nausea, vomiting, headache, sore throat, transient neurological symptoms, and pain in the post-operative area.

**Statistical Analysis:** Student t-test and Chi-square tests were applied to calculate statistical significance.

**Results:** Group B, receiving spinal anaesthesia, was more hemodynamically stable than Group A.

Post-operative analgesia was better in Group B for a duration of 6-h, after which there was not much difference in both groups.

**Conclusion:** SA is a feasible, safe and effective alternative to GA, furnishing stable hemodynamics, lower neuroendocrine stress response, good surgical

conditions, pain-free post-operative period and minimal post-operative effect

**Keywords:** Laparoscopic abdominal surgery, Spinal anaesthesia, General anaesthesia

### **Introduction**

Anaesthesia began as an improvisation and innovation during the early period. There has been a gradual revolution similar to our civilization which has graduated to a fully-fledged science with multiple subspecialties. [1] Laparoscopic surgery procedures performed with the use of pneumoperitoneum on severely sick patients are still a challenging approach for both the anaesthetist as well as the surgeon. Occasionally, neuraxial anaesthesia has been used in major abdominal surgery and oncology, including breasts. Neuraxial anaesthesia was initially used to operate on patients who, due to cardiorespiratory problems, could not undergo GA. Given the good results obtained, the method was also applied to patients in good conditions [2]. Strengthened by the experience gained in traditional open surgery with neuraxial anaesthesia, in laparoscopic surgery the applications have started directly in ASA I-II patients, with appendectomy, cholecystectomy and hysterectomy, then with case comparisons between GA and SA[2]. Many articles/review articles in which an attempt is made to summarize current evidence on regional anaesthesia for laparoscopic surgery. Because most accessible data come from retrospective and large rigorous prospective clinical trials comparing regional vs. general anaesthesia, it is needed to evaluate the true value of regional anaesthesia in laparoscopic surgery. [3] Laparoscopy is the surgical technique of inspecting the abdominal cavity through an endoscope, where Carbon dioxide is universally used to insufflate into the abdominal cavity. Several pathophysiological changes occur after carbon dioxide insufflation such as pneumoperitoneum as well as

extremes of patient positioning. A thorough understanding of these pathophysiological changes is fundamental for optimal anaesthetic care. Because expertise and equipment have improved, laparoscopy has become one of the most common surgical procedures performed on an outpatient basis and to severely ill patients, rendering anaesthesia for laparoscopy is technically challenging. Careful choice of the anaesthetic technique must be done to the type of surgery.[4] This study was carried out to see the feasibility of spinal anaesthesia concerning cardiovascular and respiratory stability and post-operative outcome.

### **Aim**

To compare the quality of Spinal anaesthesia vs General anaesthesia for laparoscopic surgeries.

### **Objective**

- To Compare Intraoperative and Post-Operative anaesthesia and analgesia in patients undergoing laparoscopic surgery under General anaesthesia and Spinal Anesthesia
- To Compare Patient's Hemodynamic Stability Undergoing Laparoscopic Surgery Under General Anesthesia and Spinal Anesthesia
- To Compare Post-Operative Side Effects in patients undergoing Laparoscopic Surgery Under General Anesthesia and Spinal Anesthesia

### **Inclusion Criteria**

- Patient Willing to Give Consent for The Study
- Patient Undergoing Laparoscopic Surgery in Pravara Rural Hospital Loni
- Patient Under ASA 1 & 2
- Patient Both Genders
- Patient Within Age 18-65 Years

### **Exclusion Criteria**

- The patient Not Willing to give consent

- Patient with Age More Than 65 Years Old
- Patients with ASA grades 3 and 4
- Patients who Are pregnant, have a thyroid disorder, neurological diseases, psychiatry medication, and lactating mother.

### **Sample Size**

The sample size was calculated using Open Epi, version 3, open source calculator with a power of 0.8 from article [14] by considering post-operative analgesic requirement. The minimum calculated sample size was 18. But a sample size of 120 was deemed sufficient for a large size effect.

### **Materials and Methods**

After approval from the institutional ethical committee Dr. Balasaheb Vikhe Patil Rural Medical College, Loni and written informed consent of patients, this study was carried out in patients' age groups ranging from 18-65 years, body mass index < 30 kg/m<sup>2</sup> and ASA physical status I/II who were posted for laparoscopic surgery at Rural Medical College, Loni. Preoperative evaluation and preparation was standardized, The Following Data Was Recorded: Name, Age, Sex, Address, Diagnosis, General and Clinical Examination and Vital Parameters were monitored and recorded. Before the surgical procedures, both anaesthetic techniques either general anaesthesia or spinal anaesthesia were informed to all patients. After valid informed consent patients were divided into two groups. either General (Group A) or Spinal anaesthesia (Group B). The patient was kept NBM 6 hours before the procedure.

In both groups patients were premedicated with institutional standardised protocol and pre-loaded with IV Ringer's lactate 15ml/kg body weight.

### **General Anesthesia**

Was induced with IV Propofol 1.5mg/kg, fentanyl 1 µg/kg and succinyl chloride 1.5 mg/kg, and intubated

with a suitable-sized cuffed endotracheal tube. Anaesthesia was maintained using 2-3% sevoflurane and 50% nitrous oxide in Oxygen and atracurium (0.5 mg/kg) for neuromuscular blocking. Ventilation was controlled with a tidal volume of 6-8 ml/kg, and the ventilatory rate was adjusted to maintain a PaCO<sub>2</sub> value of 35-40 mmHg. Noninvasive arterial blood pressure, electrocardiography, pulse oximetry and end-tidal carbon dioxide (ETCO<sub>2</sub>) were monitored continuously and recorded. Ringers lactate solution (3-6ml/kg/h) was infused throughout the surgery. No additional intravenous opioids were to be injected. At the end of the surgery, the residual neuromuscular block was reversed by neostigmine 0.05m/kg and glycopyrrolate 0.01 mg/kg intravenously and the patient was extubated.

### **Regional Anaesthesia**

Under all aseptic techniques, Spinal anaesthesia was given at the level of L3-4 lumbar interspace vertebrae in the midline approach, lumbar puncture performed using a 25-gauge spinal needle, once flow of clear CSF 3.8 ml hyperbaric bupivacaine with 25 µg fentanyl in a total volume 4.0 ml injected intrathecally, then the patient was asked to lie in a supine position and the level of anaesthesia was checked to a sensory blockade up to T4. The sensory block level was assessed by the pinprick test using a 25-gauge hypodermic needle, while the motor block level was assessed by the modified Bromagescale. Ringers lactate solution (3-6 ml/kg/h) was infused throughout surgery, Oxygen supplementation was given to all the patients at 3l/min through the nasal cannula. Non-invasive arterial blood pressure, electrocardiography, and pulse oximetry was monitored continuously. Just before creating pneumoperitoneum local anaesthesia with Bupivacaine 0.25% 20 ml was sprayed intraperitoneally and fentanyl 2 mcg/kg was given intravenously.

Intraoperative incidents (e.g., right shoulder pain, headache, abdominal discomfort, hypotension, nausea, and/or vomiting) were documented. Intraoperative hypotension of more than 20% of the basal measure was managed by intravenous Mephentermine. At the end of the surgery, patients were transferred to PACU. All the patients were monitored in the PACU for 24 hours. Postoperative analgesia was achieved by fentanyl, tramadol and diclofenac depending on the post-operative VAS score of the patient.

**Statistical Analysis**

Data was tabulated in Microsoft Excel and analysed using MedCalc software version 22.026. Continuous variables are presented as mean ± SD, Student t-test was applied for the calculation of statistical significance whenever the data was normally distributed. Nominal categorical data between the groups are compared using the Chi-square test. p-value <0.05 is taken to indicate a statistically significant difference.

**Result**

Table 1: Demography

Parameter	Ga (Group A)	Sa (Group B)	P Value
Age	42.90±13.2	43.57± 11.5	0.7683
Male / Female	19/41	23/37	-
Height (Cm)	168.54± 9.87	165.33± 8.35	0.0569
Weight (Kg)	75.34± 10.94	73.94± 9.47	0.4551
Bmi (Kg/M2)	26.5± 4.32	27.0± 3.98	0.5110
Duration of Surgery (Minutes)	126.79± 20.91	121.89± 19.73	0.1893

Table 2: Type of Surgery

Type of Surgery	Number of Cases
Appendectomy	25
Umbilical Hernia	9
Inguinal Hernia	10
Total Laparoscopic Hysterectomy	54
Ovarian Cyst Excision	5
Cholecystectomy	17

Graph 1

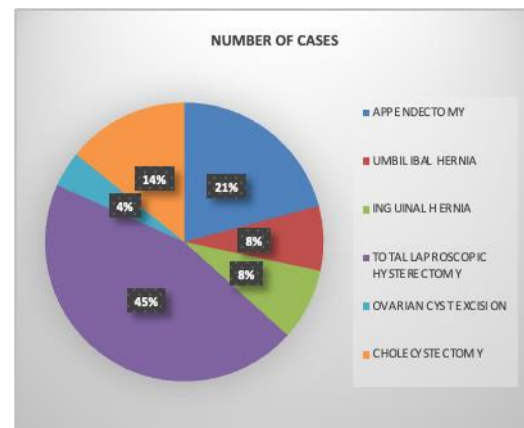


Table 3: Hemodynamics

Time	Heart rate		P value	MAP		P value
	Group (A)	Group (B)		Group (A)	Group (B)	
Basal	86 ± 1.77	83 ± 2.57	<0.001	100.23 ± 1.25	100.11 ± 2.08	0.826
After induction	92 ± 1.05	76 ± 1.75	<0.001	93.42 ± 2.87	84.7 ± 3.61	<0.001
Intra op 15mins	99 ± 2.47	80 ± 3.17	<0.001	92.22 ± 2.95	86.9 ± 3.69	<0.001
Intra op 30mins	97 ± 2.83	84 ± 1.19	<0.001	91.04 ± 3.45	85.52 ± 4.14	<0.001
Intra op 45mins	92 ± 2.05	85 ± 2.55	<0.001	91.86 ± 4.17	86.21 ± 5.86	0.002
Intra op 60mins	91 ± 1.27	78 ± 2.07	<0.001	107.76 ± 2.37	92.3 ± 2.8	<0.001
Intra op 120mins	93 ± 3.77	85 ± 1.58	<0.001	109.65 ± 2.88	94.01 ± 3.31	<0.001

Graph 2

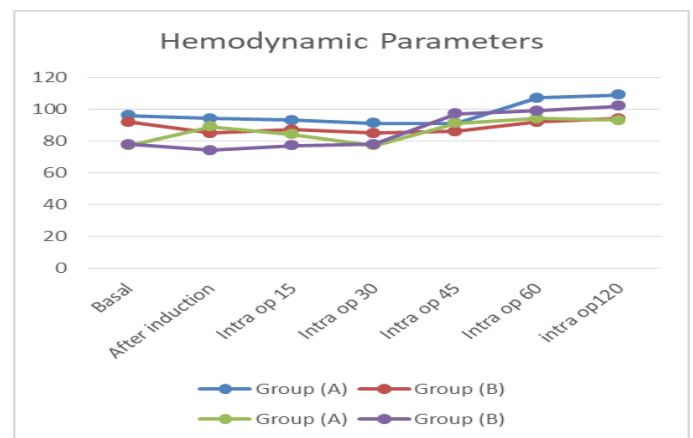


Table 4: Complications

(4.1)

Intraoperative Events	GA	SA
Abdominal Discomfort	-	-
Referred Shoulder Pain	-	2
Hypotension	-	4
Nausea/Vomiting	-	1
Anxiety	-	4
Hypertension	3	-

(4.2)

Post Op Events	GA	SA
Abdominal Discomfort	1	3
Referred Shoulder Pain	-	4
Hypertension	2	-
Hypotension	1	1
Nausea/Vomiting	2	-
Anxiety	-	2
Urinary Retention	-	-
Headache	-	-
Sore Throat	2	-

Table 5: Vas Score

Post Op Pain Score (Vas)

Time	GA	SA
0 Hours	2/10	0/10
03 Hours	4/10	2/10
06 Hours	6/10	4/10
09 Hours	5/10	4/10
12 Hours	4/10	4/10
15 Hours	3/10	3/10
18 Hours	3/10	3/10
21 Hours	2/10	2/10
24 Hours	0/10	0/10

Table 6: Total Analgesic Consumption in the First 24 Hours.

Analgesic Consumption	Group A (Ga)	Group B (Sa)
Fentanyl (Mcg)	6754	6157
Tramadol (Mg)	12300	11200
Diclofenac (Mg)	225	75

**Discussion**

Spinal anaesthesia for laparoscopic surgery can be used safely with better post-operative pain control in some conditions, whether it is the anaesthesia procedure of choice is still a debatable topic and further studies are required. There are multiple instances that we have come up with our study that may have raised the absolute indication of spinal anaesthesia for laparoscopic surgery. It is seen in our study that pneumoperitoneum which is done for viewing the abdominal cavity induces a rise in intra-abdominal pressure. This causes regurgitation of gastric content thus necessitating the use of endotracheal intubation to prevent aspiration in such an eventuality and for regional anaesthesia putting a ryle’s tube was done. The increased intra-abdominal pressure during pneumoperitoneum, as well as the head-up tilt used in upper abdominal laparoscopies, leads to decreased venous return to the heart. [5]

Spinal anaesthesia causes sympathetic blockade with peripheral vasodilatation. In laparoscopic procedure done under spinal anaesthesia may result in hypotension. Indeed, the effects of CO<sub>2</sub> pneumoperitoneum on intra-operative hemodynamics under regional anaesthesia need further studies. In our study, we noticed that pre-anaesthetic fluid loading of around 500 ml before induction can prevent the occurrence of hypotension. Sinha *et al.*[6] noted an incidence of hypotension at 20.5% in their series. While we did have hypotension in 5 cases out of 60 cases of spinal anaesthesia and 1 case

under general anaesthesia out of 60 general anaesthesia cases. In spinal anaesthesia cases, hypotension was corrected with saline infusion and selective alpha-blocker agent (Inj Mephenataramine). We also had an incidence of hypertension in 5 out of 60 general anaesthesia cases. In our series, the SpO<sub>2</sub> changes of much are not noticed in the patients undergoing laparoscopic surgery under regional anaesthesia. Retention of CO<sub>2</sub> and hypoxemia was observed in the spinal anaesthesia group with a non-invasive EtCO<sub>2</sub> sample line, the value that was approximate but not as accurate as in the General Anaesthesia group. Tiwari *et al*, [7] noted much like in the experience of other authors where the incidence of conversion from SA to GA was noted to range from nil to 2.8%. In our study, however, none out of the 120 cases of Laparoscopic surgery under spinal anaesthesia were converted to General Anaesthesia.

Incidence of referred pain to the right shoulder, while doing Laparoscopic surgery under regional anaesthesia, has been described as ranging from 25%-43%.[5] In our study 2 out of 60 cases complained of shoulder pain intraoperatively and 4 out of 60 postoperatively. Referred pain to right shoulder pain is due to the irritation of the subdiaphragmatic surface when CO<sub>2</sub> pneumoperitoneum is made.[5] These side effects were managed with fentanyl post-operatively and spraying of Local anaesthetic subdiaphragmatically intraoperatively. In our study we tried to use low-pressure pneumoperitoneum (10-12 mmHg) during the surgical procedure, to minimize the incidence of right shoulder pain.

Generally, Laparoscopic surgery in comparison to a pneumoperitoneum at 12-16 mmHg and pneumoperitoneum pressure below 10 mmHg is associated with lesser abdominal/shoulder pain.[6] In our study, such incidences were low due to the preemptive

spraying of local anaesthetics before creating pneumoperitoneum.

In addition, on 2 different occasions, it was necessary to interrupt the procedure when the patient complained of discomfort, the anaesthesiologist had to intervene with additional medication. This explains the fact that the pneumoperitoneum time and similarly the surgery time was more in the SA group, that's why in our study group we tried to achieve a spinal level around T4. In Tiwari *et al*, [7] it has been found that there was a difficulty faced by the surgeon when operating in a limited field permitted by low-pressure pneumoperitoneum, it was not encountered in our study. The advantage of this technique is in terms of reduced post-operative pain, so the use of analgesics requirement also decreases, preservation of pulmonary function, and thus reduces hospital stay. The post-operative recovery was mostly uneventful in all patients of both groups. It is described that, when compared to GA, SA is associated with a lower frequency of serious peri-operative morbidities and an improved outcome concerning postoperative sore throat, which is comparatively less in our study, but in different studies this complication is often seen in patients undergoing endotracheal intubation.[9] In our series, the incidence of post-operative events which required intervention was 2 out of 60 cases in the GA group, who had postoperative sore throat compared to 4 out of 60 cases in the SA group who had right shoulder pain. But only on this basis, it is not justified to compare the two groups. While in one group the events were unique to GA, in the other they were unique to SA. Postoperative nausea and vomiting were noticed in 1 out of 60 patients who underwent GA for laparoscopic event and in SA no such things were noticed. Bessa *et al*.,[10] in a similar study, confirmed that Laparoscopic surgery done under SA results in significantly less early post-

operative pain, compared to that performed under general anaesthesia. GA may be considered "day care" anaesthesia with the patient being discharged to home the same day while SA would require an overnight stay. Ellakany, in his study of 40 patients receiving either general or segmental thoracic spinal anaesthesia, found comparable surgical conditions with better post-operative analgesia and significantly good satisfaction scores among patients in the spinal anaesthesia group. He also found a 40% incidence of considerable hypotension and 25% incidence of abdominal discomfort, which were managed easily. He found no patients with nausea and vomiting in the spinal anaesthesia group.<sup>[11]</sup> However, the use of newer, long-acting anti-emetics like palonosetron reduces the incidence of PONV to a significant extent.<sup>[12]</sup> Mehta *et al.*, in their study of 60 patients, also found superior post-operative analgesia with SA in comparison to GA for LC. They found no noteworthy difference between the groups regarding intraoperative complications, recovery and degree of satisfaction. There were no incidences of nausea and vomiting in the patients who have received spinal anaesthesia.<sup>[13]</sup>

This study confirms the feasibility and safety of spinal anaesthesia for elective laparoscopic surgery. The patient outcomes are similar to those observed if the surgery is done under general anaesthesia. No significant respiratory or hemodynamic changes were observed in either groups. This study did not include a cost analysis, nor the geriatric population or any patient who was under ASA III or IV, but other studies indicate that laparoscopic surgeries under SA are more cost-effective than under GA. This makes SA a better and a more feasible option as the anaesthesia of choice especially in developing countries.

### Limitation

In our study, ABG interpretation intraoperatively is not done. EtCO<sub>2</sub> in the spinal anaesthesia group gave an approximate value, not accurate.

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