

# Laparoscopic Surgery Using Spinal Anesthesia

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## ABSTRACT

**Background:** Laparoscopic abdominal surgery is conventionally done under general anesthesia. Spinal anesthesia is usually preferred in patients where general anesthesia is contraindicated. We present our experience using spinal anesthesia as the first choice for laparoscopic surgery for over 11 years with the contention that it is a good alternative to anesthesia.

**Methods:** Spinal anesthesia was used in 4645 patients over the last 11 years. Laparoscopic cholecystectomy was performed in 2992, and the remaining patients underwent other laparoscopic surgeries. There was no modification in the technique, and the intraabdominal pressure was kept at 8mm Hg to 10mm Hg. Sedation was given if required, and conversion to general anesthesia was done in patients not responding to sedation or with failure of spinal anesthesia. Results were compared with those of 421 patients undergoing laparoscopic surgery while under general anesthesia.

**Results:** Twenty-four (0.01%) patients required conversion to general anesthesia. Hypotension requiring support was recorded in 846 (18.21%) patients, and 571 (12.29%) experienced neck or shoulder pain, or both. Postoperatively, 2.09% (97) of patients had vomiting compared to 29.22% (123 patients) of patients who were administered general anesthesia. Injectable diclofenac was required in 35.59% (1672) for abdominal pain within 2 hours postoperatively, and oral analgesic was required in 2936 (63.21%) patients within the first 24 hours. However, 90.02% of patients operated on while under general anesthesia required injectable analgesics in the immediate postoperative period. Postural headache persisting for an average of 2.6 days was seen in 255 (5.4%) patients post-

operatively. Average time to discharge was 2.3 days. Karnofsky Performance Status Scale showed a 98.6% satisfaction level in patients.

**Conclusions:** Laparoscopic surgery done with the patient under spinal anesthesia has several advantages over laparoscopic surgery done with the patient under general anesthesia.

**Key Words:** Laparoscopic surgery, Spinal anesthesia.

## INTRODUCTION

Conventionally, general anesthesia (GA) remains the choice for the majority of open abdominal surgical procedures, and regional anesthesia is preferred only for patients who are at high risk while under general anesthesia. For 27 years, we have been doing almost all our open abdominal surgeries, including surgery of the upper abdominal organs like the stomach and hepatobiliary system, with the patient under spinal anesthesia (SA). The advantages of a uniform total muscle relaxation, a conscious patient, and relatively uneventful recovery after spinal anesthesia on the one hand and the protection from potential complications of general anesthesia on the other, were the main reasons for selecting spinal anesthesia as the first choice. It was thus a logical extension that we shifted to spinal anesthesia for all our abdominal and retroperitoneal laparoscopic surgeries after operating on the first few laparoscopic cholecystectomy patients (LC) under general anesthesia. The world literature until about 5 years ago suggested only GA as the anesthetic option for abdominal laparoscopic surgery, and it is only recently that reports of laparoscopic surgery being performed with select patients under spinal or epidural anesthesia have started to appear.<sup>1-5</sup> This was a retrospective study of patients having laparoscopic surgery while under spinal anesthesia since 1995 at our center.

## METHODS

All patients undergoing laparoscopic abdominal procedures were offered SA as the first choice. Since 1995, 4645 consecutive patients have undergone abdominal laparo-

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scopic surgery while under SA. Patients who preferred GA or had contraindications for SA, like children less than 10 years of age, patients with clotting disease, spinal deformity, and skin pathology overlying the SA site, were operated on while under GA and kept as controls.

Laparoscopic cholecystectomy (LC) was done in 2992 patients. Of these patients, 560 had acute cholecystitis, 2292 underwent elective cholecystectomy, and 140 had additional laparoscopic or open abdominal surgeries in the same sitting along with LC (**Table 1**). Other abdominal or retroperitoneal laparoscopic surgeries were performed in 1653 patients who were under SA (**Table 2**).

Preloading with 1000 mL of 5% Dextrose in normal saline was done, and patients were premedicated 45 minutes before surgery with glycopyrrolate 0.2 mg IM + Diazepam 10 mg (or midazolam 5 mg) IM + Diclofenac Na 3 mL (25 mg/mL) IM.

SA was administered using a 24FG or 25FG lumbar puncture needle in L1-L2 intervertebral space. Five percent Xylocaine 1.6 mL to 1.8 mL (2 mg/kg) or in those patients where surgical time was contemplated as likely to be more than 30 minutes, 3 mL to 5 mL of Sensorcaine (Bupivacaine HCl 5mg +sod.chl. 8mg/mL) was used. Head down tilt 10degrees to 20 degrees was kept for 5 minutes. The segmental level achieved was T4-T5 to enable introduction of the epigastric port. The patient was monitored for blood pressure, SpO<sub>2</sub>, SpCO<sub>2</sub>, heart rate and patient anxiety. Patient anxiety was defined as anxiety that resulted in inability to complete the procedure under SA and requiring conversion to GA. During surgery, oxygen supplementation was optional and administered through a Ventimask, at the rate of 5 L/minutes, only in patients with SpO<sub>2</sub> below 95%. In patients complaining of neck pain, shoulder pain, or both, Tramadol 25 mg or Fortwin 15 mg was administered as slow IV or in drip. In patients who still

**Table 1.**

Laparoscopic Cholecystectomy (n = 2992)

	Spinal Anaesthesia	General Anaesthesia Conversion
Emergency	558	2
Elective	2280	12
With an additional surgery*	140	

\*Additional surgeries: abdominal hysterectomy, right renal stone, ovarian cyst, tubectomy, appendectomy.

**Table 2.**

Other Laparoscopic Procedure (n = 1653)

Operation	No.
TEP repair U/L	92
TEP B/L	21
Lap ovarian cyst	32
Lap appendectomy	614
Lap transperitoneal nephrectomy	2
Lap assisted hemicolectomy	41
Blunt injury abdomen	39
Lap duodenal perforation repair	91
Lap small bowel perforation repair	25
Lap orchidectomy for abdominal testes	1
Lap lumbar sympathectomy	21
Lap uretrolithotomy + nephrolithotomy	192
Lap hydatid pericystectomy	81
Diagnostic laparoscopy	401

had persistence of pain, Ketamine 25 mg administered as slow IV was used. If the patient was still anxious, conversion to GA was done. Bradycardia below 50/minute was managed by 0.3 mg 0.6mg atropine IV or 0.2mg glycopyrrolate. Hypotension, defined as a fall in BP of greater than 20% of original BP at any time after SA during or after surgery, was managed by 3 mg to 6 mg mephentermine IV intermittently up to a maximum of 15mg and subsequent persisting hypotension was managed by dopamine 4 µg to 6 µg/kg/minute during the operative period, or in the postoperative period, or during both, until stabilization of blood pressure occurred.

The laparoscopic procedures were carried out in the standard fashion with 3 ports to 5 ports without any modifications. The intraperitoneal pressure was kept between 8 mm Hg to 10 mm Hg.

The postoperative parameters evaluated included operative site pain, assessed by a verbal numeric pain scale as, no pain and mild bearable pain, neither requiring any medication and moderate pain and severe pain, both requiring medication. The other parameters included urinary retention, headache, and overall patient satisfaction as graded by Karnofsky Performance Status at the time of first follow-up at 10 days postoperatively. The incidence of postoperative vomiting and pain was compared with corresponding parameters of 421 patients undergoing LC while under GA in the same unit.

The patients were routinely followed up for 1 month after surgery.

**RESULTS**

This retrospective study included 4645 patients who underwent abdominal laparoscopic surgery while under SA and 421 patients who underwent laparoscopic cholecystectomy while under GA between June 1995 and May 2006. The data were obtained by chart review. In the SA group, 2944 patients were females, and the average age was 42.7 years. Laparoscopic cholecystectomy was performed in 2992 patients, 560 of whom had acute cholecystitis (Table 1). The other laparoscopic surgery group included a wide range of surgical procedures both elective and under emergency settings. Elective surgery included laparoscopic appendectomies in 614 patients, TEP repair in 113 patients, ureterolithotomy in 192 patients, while emergency surgery included among others duodenal perforation repair in 91 patients (Table 2).

Hypotension requiring support was recorded in 846 (18.21%) patients. Of these patients, only 41 required additional use of dopamine, and 571 (12.29%) experienced neck or shoulder pain, or both. Intravenous Tramadol or Fortwin was required in 2996 patients (64.5%), while Ketamine had to be given to 567 (12.21%) patients. Ten (0.21%) patients required conversion because of anxiety,

despite sedation. Conversion to GA was also required in 4 patients with failure of SA effect (Table 3).

LC required an average of 15.6 minutes and 19.1 minutes, respectively, in elective and emergency settings. The time for other laparoscopic surgeries varied from 12 minutes to 85 minutes.

Postoperatively, significantly fewer patients experienced one or more vomiting episodes compared with those under GA [97 (2.09%) patients versus 123 (29.22%) patients]. The incidence of postoperative urinary retention requiring catheterization was however seen significantly more in patients after SA (Table 3). Injectable diclofenac was necessary in 35.59% (1672) of patients for their abdominal pain within 2 hours postoperatively and an oral analgesic was required in 2936 (63.21%) patients within the first 24 hours postoperatively compared with 379 (90.02%) patients requiring injectable analgesia in the GA group of patients (Table 3). Thus, significantly more patients required injectable analgesics after GA. Port-site infection was seen in 12 (0.26%) patients. Postural headache persisting for an average 2.6 days was seen in 255 (5.4%) patients and responded to patients being in a lying posture and increased intake of fluids and salt. Average time to discharge was 2.3 days. Karnofsky Performance Status showed a 98.6% satisfaction level in patients.

**Table 3.**  
Spinal Anaesthesia Related Complications

	Spinal Anaesthesia (n = 4645)	General Anaesthesia (n = 421)	P Value*
Perioperative			
Neck/shoulder pain	571 (12.29%)		
Hypotension (<20% fall)	846 (18.21%)		
Anxiety	10 (0.21%)		
Stomach distension requiring Ryle's tube aspiration	-	30 (0.07%)	
Conversion to GA	24 pts	-	
Postoperative			
Vomiting	97 (2.09%)	123 (29.22%)	<0.001
Abdominal pain treated with injectable analgesic	1672 (35.59%)	379 (90.02%)	<0.001
Abdominal pain treated with oral analgesic	2936 (63.21%)		
Urinary retention	19 (0.41%)	4 (0.01%)	<0.001
Headache	255 (5.49%)		
Port site infection	12 (0.26%)	1 (0.24%)	NS

\*P value was used to denote significance by Student *t* test; values <0.05 are considered to be significant.

## DISCUSSION

Regional anesthesia is seldom used in abdominal laparoscopic surgeries except for diagnostic laparoscopies. The prime indication for using regional anesthesia in therapeutic laparoscopy is still limited to patients unfit for GA, and the preferred type of regional anesthesia is epidural anesthesia. Thus, reports of laparoscopic surgery being done with patients under spinal anesthesia are even scarcer than those of patients under epidural anesthesia.<sup>3-5</sup> We have been performing the majority of our open abdominal surgeries primarily with patients under spinal anesthesia (SA) for the last 27 years. Rarely in upper abdominal surgeries, especially those of the cardioesophageal junction or liver, supplemental sedation or conversion to GA is required. It was thus logical that after performing the initial few laparoscopic surgeries using GA in 1994 we shifted to SA as the anesthesia of choice for all our abdominal laparoscopic procedures. The optimal anterior abdominal wall relaxation and the conscious and receptive patient under SA together spurred us to try out SA for all our laparoscopic surgery patients. Another reason for preferring SA was preventing the potential problems of GA. The initial concern was never the subcostal level of anesthesia (T4-T5) for the epigastric and subcostal ports because we had been successfully making upper abdominal incisions in open abdominal surgeries without discomfort to the patient. The pneumoperitoneum-induced rise in intraabdominal pressure including pressure on the diaphragm and carbon dioxide-induced peritoneal irritation were factors to be considered. Initially when we started, we had no clue as to how the conscious patient would respond to these. Initially, we started LC using SA and then shifted other laparoscopic abdominal surgeries also to SA. Changes in methodology of port-site placement and using nitrous oxide, which is less irritating for the peritoneum compared with carbon dioxide, and maintaining a low intraperitoneal pressure of 8mm Hg when using SA have all been reported to reduce the discomfort and chances of neck and shoulder pain.<sup>3</sup> We have always been operating at an average pressure of 8mm of carbon dioxide, and no changes have been necessary in port placement in SA compared with GA patients. This agrees with a recent report by Tzovaras.<sup>5</sup> Surprisingly, neck pain and shoulder pain have never been a major problem in our patients. They occurred in only 12.29% of patients, none of whom required conversion to GA. Pursnani et al<sup>1</sup> noted that shoulder and neck pain occurred in 2 of their 6 patients operated on while under epidural anesthesia, and it was easily managed. On the other hand, in the series of Hamad et al,<sup>3</sup> 10 LC were done with patients under SA, and

one patient had to be given GA because of intolerable shoulder pain. Chiu et al<sup>6</sup> also noted shoulder pain in 1 of 11 patients of B/L spermatic varices operated on while under epidural anaesthesia. The other notable perioperative problem encountered was discomfort and anxiety seen in 0.21% of our patients. This was easily managed by sedation except in 10 patients where conversion to GA was necessary. The other reasons for conversion in our series were either an incomplete effect of SA or prolongation of surgical time to beyond the effective time of SA, as was seen in 14 patients. Conversion to GA because of abdominal distension discomfort during epidural anesthesia was reported in 1 of 11 patients in the study of Chiu et al.<sup>6</sup> One of 6 patients in the Ciofolo et al<sup>4</sup> study required conversion to an open procedure because of uncontrolled movements under epidural anesthesia.

In addition to SA-related hypotension, the pneumoperitoneum-induced rise in intraabdominal pressure could be another cause for the persistence of hypotension. When we compared our hypotension figures recorded in 846 (18.21%) patients with figures in patients undergoing open surgery with SA, we found a comparable picture. Thus while Bernd<sup>7</sup> reported hypotension in 5.4% of their SA patients, Palachewa<sup>8</sup> had an incidence of 15.7%, Throngnumchai<sup>9</sup> 20.2%, and Hyderally<sup>10</sup> reported a 10% to 40% incidence. This then conclusively proves that the incidence of hypotension is no different whether laparoscopic surgery or open surgery is being done with SA and that an intraperitoneal pressure of between 8 mm Hg to 10 mm Hg does not add to the problem of decreased venous return and persistence of hypotension. Although Chui<sup>11</sup> have mentioned that a high SA block of up to T2-T4 may cause myocardial depression and reduction in venous return, this was never substantiated in our series. An added cardiovascular advantage cited has been the decrease in surgical bed oozing because of hypotension, bradycardia, and improved venous drainage associated with SA.<sup>12</sup>

GA patients unlike SA patients frequently have an additional problem of stomach inflation as a result of mask ventilation. This often requires Ryle's tube intubation, which amounts to unnecessary intervention in a body cavity.

The main debatable point however seems to be the status of respiratory parameters among the 2 modes of anesthesia during laparoscopic surgery. 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 GA. The potentiality of intu-

bation and ventilation-related problems including an increase in mechanical ventilation to achieve an adequate ventilation pressure exists during GA compared with SA.<sup>1</sup> In addition, pulmonary function takes 24 hours to return to normal after laparoscopic surgery performed using GA.<sup>13</sup> However, the observations are not uniform, and conflicting reports of respiratory parameter alterations while patients are under regional and general anesthesia are present. Nishio et al<sup>14</sup> documented a greater increase in PaCO<sub>2</sub> after CO<sub>2</sub> pneumoperitoneum when the patient was under GA compared with when the patient was breathing spontaneously. Similarly Rademaker et al<sup>15</sup> showed greater forced ventilatory capacity during GA. On the other hand, Chiu et al<sup>6</sup> reported significant arterial blood gas alterations during epidural anesthesia. Ciofolo et al<sup>16</sup> concluded that epidural anesthesia for laparoscopy does not cause ventilatory depression. Even in our series, none of the patients had any significant variation in PaO<sub>2</sub> or PaCO<sub>2</sub> during the surgery with SA.

The surgical time for LC was 12 minutes to 48 minutes (avg, 15.6), and the operative time for other surgeries was an average of 48.9 minutes. For multiple surgeries including laparoscopic cholecystectomy, operative time was 42.7 minutes, which compares with operative time for our GA patients. Thus, there was no difference in the operating time while using SA. Instead, the time from application of total anesthesia to wheeling the patient out of the operating room actually decreases appreciably when the patient is being operated on while under SA, because the intubation and extubation time of GA is saved.

Perioperative shoulder pain never persisted in the postoperative period. In the postoperative period after SA, there was no restlessness as is commonly seen after GA, and the patient is always receptive and more compliant to suggestions. A specific advantage of SA seems to be the decrease in the requirement of postoperative analgesia. Injectable diclofenac was required by 35.59% of our SA patients for their abdominal pain compared with a significantly greater number of our GA patients (90.02%) requiring injectable analgesics within 2 hours after extubation. The injectable analgesic was usually required between 2 hours to 6 hours after surgery versus within 2 hours after extubation when GA was used. The benefit of prolonged analgesia after SA has also been noted in other studies.<sup>1-3</sup> Postural headache was seen in 5.49% of patients, persisted for an average of 2.6 days, and responded to the patient lying down and an increased intake of fluids and salt. This complaint, which is not usually seen with GA, was in fact the only patient complaint in the postoperative period. The incidence of spinal headache has been variously

quoted as 3.3%,<sup>8</sup> 7.7%,<sup>9</sup> and 14%<sup>10</sup> after SA in open surgery. This again is no different from our figures of 5.49%. Catheterization was required postoperatively in 19 (0.41%) of our patients compared with 11.7% in a study of 420 patients operated on while under SA.<sup>8</sup> The corresponding figure for patients operated on while under GA was 4(0.01%). This significantly lower incidence of urinary retention in patients operated on while under GA is explainable by the prolongation of muscle paralysis with SA.

Complications like sore throat, relaxant-induced muscle pain, dizziness, and postoperative nausea and vomiting (PONV) often create high morbidity after GA.<sup>12</sup> In this context, PONV is particularly troublesome, and antiemetics may be required in as many as 50% of patients<sup>17</sup> and can delay discharge from the hospital in 7% of patients.<sup>18</sup> The problem with PONV was seen in 2.09% of our SA patients, but has been reported as high as 8.1% in another study of SA.<sup>8</sup> But PONV is highest after GA, especially when nitrous, opiate, or reversal agents are used. In their presence, the rate can vary up to 60% to 70%.<sup>19,20</sup> Even with the newer agents like Propofol and Isoflurane, the incidence is as high as 30% and substantially increases the cost of anesthesia.<sup>21</sup> Our GA patients had an incidence of 29.22% of PONV, which was significantly higher compared with that in SA patients.

Another important advantage of SA is that other complications specific to GA, including cardiac, myogenic, and possible cerebral complications, do not occur with SA. Mobilization and ambulation in both SA and GA patients was achievable within 6 hours to 8 hours after surgery. Average time to discharge was 2.3 days. Port-site infection was seen in 12 patients, which was similar to that in GA patients. Karnofsky performance status showed a 95% to 100% satisfaction level in 98% of patients. This means that the patient was happy and would probably recommend this approach to friends. This is actually true because a sizeable number of our patients now actually demand that they be operated on while under SA.

## CONCLUSION

There is no risk of intubation-related airway obstruction, little risk of unrecognized hypoglycemia in a diabetic patient, excellent muscle relaxation, decreased surgical bed oozing, and a more rapid return of gut function when laparoscopic surgery is done using SA compared with GA. This is in addition to the obvious advantages in an old patient or those with COPD or other systemic diseases like hepatic and renal disease and diabetes.

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