

## Laparoscopic cholecystectomy under spinal anaesthesia: a prospective study

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### ABSTRACT:

Laparoscopic cholecystectomy under general anaesthesia is the present gold standard in treatment of symptomatic gall bladder disease. This study was conducted to determine the efficacy and safety of laparoscopic cholecystectomy under spinal anaesthesia which could be more cost effective. A prospective study was conducted over a fourteen month period at a teaching hospital to evaluate efficacy, safety and cost benefit of conducting laparoscopic cholecystectomy under spinal anaesthesia (SA). Patients meeting inclusion criteria were taken up for laparoscopic cholecystectomy under spinal anaesthesia by standardized techniques. They underwent standard four port laparoscopic cholecystectomy. Mean anaesthesia time, pneumoperitoneum time and surgery time defined primary outcome measures. Intraoperative events and post operative pain score were the secondary outcomes measured. All patients underwent laparoscopic cholecystectomy without any major complications. None had to be converted to general anaesthesia in this series. The operation had to be converted to open incision in 3 patients. Commonest complaint was pain in right shoulder and anxiety at the beginning of operation/pneumoperitoneum. All patients were highly or well satisfied during follow up. Laparoscopic cholecystectomy done under spinal anaesthesia as a routine anaesthesia of choice is feasible and safe. In this study spinal anaesthesia for laparoscopic cholecystectomy was found to be safe even in patients with respiratory problems, cost-effective, with minimal postoperative pain and smooth recovery; the disadvantage being occasional right shoulder pain following pneumo-peritoneum (40%). Spinal anaesthesia can be recommended to be the anaesthesia technique of choice for conducting laparoscopic cholecystectomy in hospital setups where cost is a major factor; provided proper backup is present.

**Keywords:** Laparoscopic cholecystectomy, spinal anaesthesia, gall stone disease, surgery expense.

### INTRODUCTION

Spinal anaesthesia provides a much cheaper and feasible method of Laparoscopic Cholecystectomy without requiring intubation, providing longer post operative pain relief.<sup>1</sup> It has been used as an supplement in low doses to provide post operative pain relief.<sup>2</sup> Previous studies have demonstrated the feasibility of laparoscopic cholecystectomy under spinal anaesthesia with lower postoperative morbidity, reduced postoperative nausea and vomiting than that is associated with general anaesthesia.<sup>3</sup> Some used nitrous dioxide for insufflation to reduce pain.<sup>4</sup> General anaesthesia has been the technique of choice but has the disadvantage of being expensive, with possibly long term neurological effects.<sup>5,6</sup>

### MATERIALS AND METHODS:

The study was conducted in a semi urban teaching hospital and during the time period January 2013 to March 2014. Permission was taken from the institutional ethics committee and received. The study consisted of 116 patients presenting with gall bladder stone disease and worked up for Laparoscopic Cholecystectomy during the study period.

### PATIENT SELECTION

Consecutive newly diagnosed cases of symptomatic cholelithiasis who presented for surgical consultation for surgery and who met the following criteria were enrolled in the study:

- American Society of Anaesthesiologist's (ASA) physical status I, II or III.<sup>7</sup>
- Age between 18 and 80 years of age.

Exclusion criteria were as follows:

- Acute Inflammatory process (pancreatitis or cholangitis)
- Bleeding diathesis or deranged Liver function test.
- Local spinal deformity which precluded safe spinal anaesthesia.
- Suspected/confirmed common bile duct stones

There was no cut off criteria for body mass index (BMI) per se as an exclusion criterion but few of the patients presenting were obese. Similarly, history of previous open upper abdominal surgery too was not taken as a criterion for exclusion.

Patients with grade IV ASA score, and those specifically requesting for GA (I would like to be completely unconscious during my operation, not just pain free) and those preferring open cholecystectomy from the outset were excluded from the study. Patients having suspected or confirmed CBD Stones or deranged liver function tests were also excluded. As such, no attempt was made to exclude difficult gall stone disease and patients with acute disease were included. All patients and their attendants were informed about the proposed surgery, the possible complications; the types of anaesthesia available along with the attendant risks, cost implications; the advantages and disadvantages and subsequently written consent was taken.

The participants were admitted on the day of surgery or the day before in the evening if they were from far off. They were kept fasting for at least 4 hours prior to surgery. They were advised earlier to take 2 tablets of Sodium Picosulfate (Dulcolax) laxative at bed time so as to reduce colonic load at the time of surgery.

In the operation theatre the patients were connected to non-invasive monitors and baseline levels of Pre-anaesthetic values of heart rate, mean arterial pressure, respiratory rate, and pulse oximetry were recorded. IV access was established and pre-operative antibiotic and Ondansetron 8 mg was given along with preload of 500 ml of ringer's lactate.<sup>8</sup>

3.5-4 ml of 0.5% Bupivacaine heavy was injected using 25 or 27 gauge spinal needle at the level of Lumbar 2 and 3 interspinous space, after observing for free flow of spinal fluid, with the patient either in sitting or right lateral position. The patient was then laid supine at 10-15 degree Trendelenburg's position with pillow support under the shoulders for 5-6 minutes so as to allow fixation. The upper extent of the anaesthesia was checked by pin prick or temperature method and was intended to extend up to the thoracic 4 level.

The patients were to be converted to general anaesthesia with intubation in case of (i) excessively anxious patient/agitation which might compromise surgical movement. (ii) Uncontrolled pain not relieved by medication. (iii) Episode of severe hypotension or desaturation. (iv) Any other circumstance the anaesthetist deemed necessary for conversion to GA including surgical difficulties or loss of anaesthesia effect.

Pneumoperitoneum was created by inserting a Veres needle in 1cm incision in the supraumbilical area; insufflation is started at the rate of 0.5 liters per minute up to 1.5 liters of intraperitoneal carbon dioxide (CO<sub>2</sub>) and subsequently the flow rate was increased as this has shown to reduce the incidence of right shoulder pain.<sup>9</sup> The upper limit for intraabdominal pressure was kept at 10mm Hg after the first trocar insertion at 12mm Hg of

**Table 1:** Summary of Laparoscopic cholecystectomy under spinal anaesthesia.

Total number of patients	115	
Completed under spinal anaesthesia	115	3 patients converted to open surgery.
Incidence of shoulder pain	46	
Intraoperative Hypotension	14	
Bradycardia	1	
Post operative nausea or vomiting.	10	
Time taken in minutes	Mean =41.42 (21-89min)	
Injuries attributed to anaesthesia	None	
Patients with medical illness		
Chronic obstructive pulmonary disease	5	
Diabetes mellitus	6	
Asthma	2	
Right bundle branch block in ECG	2	
Hypertension	15	
Age in Years	Mean =40.15(range 19 to 73)	
Body Mass Index (BMI)	Mean=22.80 (Range 19.6 to 27.2)	

pressure so as to avoid inadvertent visceral injury.<sup>9,10,11</sup> In case of discomfort intravenous Pentazocine 30 mg was given along with massage of right shoulder, if desired by the patient, which was found to be very helpful. Subsequently 10mm port was introduced and standard four ports were inserted depending on the anatomy- the extent of liver and the gall bladder. The fundus of the gallbladder was retracted so as to stretch the gall bladder and separate the structures at the Calot's triangle. The cystic duct and artery was isolated after mainly using posterior dissection. They were double clipped after tracing and ensuring the anatomy and then cut. The gallbladder was removed from the liver bed mainly by using the hook coagulation. The gall bladder was delivered via the epigastric port and in cases where it was extra turgid or oedematous it was taken out via the umbilical port. Sub hepatic drain was inserted on a case by case basis; in case of difficult dissection or difficulty in removing from liver bed. Ports were closed using 2-0 Vicryl(polyglactin) and dressed.

Intraoperative episodes of hypotension were managed by giving IV fluids, or by administration of Mephentermine or Ephedrine as required, so as to keep systolic blood pressure above 90 mmHg or a mean arterial pressure (MAP) fall of less than 30% of the baseline level. Oxygen supplementation was provided via nasal prongs using oxygen concentrator or moist Oxygen at the rate of 4 Litres/min keeping oxygen concentration above 95% spo<sub>2</sub>.

The participants were shifted to ward with continued IV fluid and intramuscular administration of injection Diclofenac supplemented with slow intravenous injection of Tramadol 50 mg or in drip if needed. Postoperatively, all patients were given intravenous Ringer's Lactate solution + dextrose 5% 1 Litre each for 24 hours or until the patient were taking orally. Postoperative pain was assessed using a visual analog scale at hours 4, 6, and 12 after completion of the procedure. Other postoperative events potentially related to either the surgical or anesthetic procedure, i.e., discomfort, nausea and vomiting, shoulder pain, urinary retention, pruritus, headache, or other neurologic sequelae, were also recorded. The patients were fed by mouth/ orally from 8 hours after the end of the procedure or as desired by the patients and were discharged 24 hours after the procedure if no complications occurred. All patients were followed up by telephone or in outdoor patient department for 1 week postoperatively, and asked to assess their degree of satisfaction (high, fair, or not at all) with the procedure.

## RESULTS

During the study period a total of 116 cases of Cholelithiasis patients were operated under subarachnoid block.

It was possible to induce spinal anaesthesia in all patients up to the desired level. This was done on the second attempt in 14 patients.

Among the participants, 46 patients complained of pain or discomfort in the right shoulder area mainly during the initial 10 minutes of surgery. This was managed by giving inj. Pentazocine and massaging the shoulder area which provided relief to most of the patients. Three patients were quite uncomfortable due to shoulder pain later in the operation and had to be administered with Ketamine 50mg which tided over the period of gall bladder dissection from the liver bed. None of the patients had to be converted to GA in our series due to anaesthesia problems.

Three patients had to be converted to open cholecystectomy which was done by subcostal incision by joining the epigastric and sub costal port and continued under spinal anaesthesia. The conversion was due to very difficult dissection around the Calot's area and Mirizzi type (ii) in one case.

In the study, 14 patients had episode of low blood pressure which was managed by intravenous (iv) fluid bolus or inj. Mephentermine to keep MAP(Mean Arterial Pressure) of not less than 30% of preoperative Mean Arterial Pressure.

One patient had episode of bradycardia while pneumoperitoneum was being created following which the gas was evacuated and atropine was administered. Subsequently the operation was completed under spinal without any further problems.

Three patients developed headache in the postoperative period. The features did not match classical of post-dural puncture headache. This was treated by giving more fluids orally and tab Paracetamol 500mg orally the patients were fine within three days.

One of the patients who had to be converted to open surgery had bilious discharge for 5 days which resolved on its own, just as ERCP (Endoscopic Retrograde Cholangiopancreatography) was being planned.

Patients were not routinely catheterized and 17 patients needed single catheterization, while one patient had recurrent retention for which in dwelling catheterization was required.

Among the participants, Five patients had Chronic Obstructive Pulmonary Disease (COPD) but none of them experienced any intraoperative respiratory difficulty and were smoothly managed on supplemental oxygen only.

Out of the 15 hypertensive patients, 4 patients had mildly

raised blood pressure in preoperative period which was reduced by inj. Midazolam.

In the study, 10 patients experienced post-operative nausea and vomiting who were treated symptomatically.

In this study, 84 patients were discharged within 48 hours in satisfactory condition, 12 patients had continued pain which they themselves deemed severe enough to stay admitted and 10 patients were from far off and preferred staying in the hospital for 5 days just as to guard against "what if something happens."

We successfully performed the operations in 116 patients without any complication associated with the use of spinal anaesthesia for the purpose of laparoscopic cholecystectomy. One patient was excluded as he didn't want to be aware during surgery. In this study none of the patients under spinal anaesthesia had to be converted to general anaesthesia owing to shoulder pain or discomfort or any other reason. The operation had to be converted to open cholecystectomy in three patients due to difficult dissection. In the study the mean age of patients was 40.15 years (range 73-19 years), mean BMI was 22.81 (range 19.42-27.2), the mean duration of operation was 41.42 minutes (range 21- 86 min), the mean O<sub>2</sub> saturation was 97.6% and the mean peak respiratory rate was 20.4 (range 14-36). Among the participants, 40 % (46) complained of right shoulder pain and most of them were managed using Pentazocine (30 mg) during initial phase of operation combined with shoulder massage. All the patients were satisfied on follow up and had no complaints regarding intraoperative or immediate postoperative pain.

## DISCUSSION:

Regional anaesthesia has been shown to be a safe and feasible method with better analgesia in immediate post-operative period along with a possible reduced incidence of post operative nausea and vomiting (PONV) and all this at a much cheaper cost which is quite important in India.<sup>9,12,19</sup> Laparoscopic cholecystectomy under spinal anaesthesia has also been shown to be quite possible on a day care surgery basis.<sup>13</sup>

The deliberate induction of carbon dioxide pneumoperitoneum during laparoscopic surgery could be a possible source of cardiovascular collapse. CO<sub>2</sub> pneumoperitoneum significantly increased central venous pressure, mean arterial pressure, mean pulmonary artery pressure, pulmonary vascular resistance index and stroke index for the range of PEEP levels. Systemic vascular resistance is elevated significantly in parallel with the change in cardiac output.<sup>14,15</sup> An intra abdominal pressure of 8 to 10 mm Hg was maintained and there

was no associated rise in blood pressure or episode of hypertension among the participants. The initial intra abdominal pressure was kept above 10mmHg to preclude injuries associated with blind Veres insertion or the first port. As the later ports are inserted under vision the intra-abdominal pressure was reduced, if vision was adequate, to 8 mm Hg.<sup>9,10,11</sup> Change in posture and the raised intra-abdominal pressure caused by intraabdominal CO<sub>2</sub> may cause hypotension which was observed in number of patients. This is counteracted by preoperative loading with saline and supportive measures during the episode. Retention of CO<sub>2</sub>(Carbon dioxide) and hypoxemia were not observed in this group during the procedure. This experience was similar to that noted by other series.<sup>9</sup> Right shoulder pain occurring as a result of pneumoperitoneum is one of the drawbacks of laparoscopic surgery under spinal anaesthesia and can be reduced by slow induction of pneumoperitoneum. Studies have shown that the incidence is lower in case pneumoperitoneum is created using N<sub>2</sub>O(Nitrous Oxide) instead of Carbon dioxide.<sup>4</sup> Others have used irrigation with Lignocaine and Saline or Bupivacaine just after pneumoperitoneum is achieved and subsequent to gall bladder removal to reduce the incidence.<sup>15</sup> In this study we managed to tide over using massage, Pentazocine or Ketamine as deemed necessary.

Intraoperative hypotension is one of the consequences of spinal anaesthesia and this was seen in 14 (12%) of the patients in this study. Furthermore, the extreme positions required for comfortable completion of laparoscopic cholecystectomy and CO<sub>2</sub> pneumoperitoneum caused increased mean CVP(Central Venous Pressure) as well as increased mean systemic and mean pulmonary arterial pressures which required corrective rehydration.<sup>16</sup> Our cases were managed by volume preload and Mephentermine iv if needed. Some studies have advocated using low dose spinal anaesthesia using reduced dose of hyperbaric Bupivacaine and Fentanyl 20 microgram at thoracic 10-11 level to avoid the complication of intraoperative hypotension.<sup>17</sup>

Single puncture subarachnoid block is a simpler and cheaper technique compared to general anaesthesia with an excellent safety profile. The preoperative preparation time is more than offset by post-operative ease of management, better pain relief during the immediate post operative period and less incidence of postoperative nausea and vomiting. We were also able to include five patients with Chronic Obstructive Pulmonary Disease without any difficulty although this might have been troublesome under general anaesthesia.

In our series we did not exclude any difficult cholecystectomy deliberately though a few cases turned

out to be more difficult than was expected on preoperative examination and investigations. Such cases could be tackled without much difficulty or change in plan. As stated three cases had to be converted to open surgery due to surgical reasons and the rest could be completed laparoscopically. The analgesic effect remained for an average of two and half hours which is more than adequate for doing a laparoscopic cholecystectomy. This duration may be increased by using intrathecal Clonidine or Fentanyl as shown in arthroscopy patients.<sup>18</sup>

Patients were not catheterized but were asked to void just before surgery and were able to void by themselves in the post-operative period. In cases where the patient had not voided 6 hours post-procedure, a single clean catheterization was needed. One patient had urinary retention for which Foley's catheter had to be inserted. This Study found that laparoscopic cholecystectomy under spinal anaesthesia was feasible, safe, gave adequate analgesia with low pressure CO<sub>2</sub> pneumoperitoneum and provides adequate postoperative analgesia as well. The patients and surgeons were satisfied with Laparoscopic cholecystectomy under spinal anaesthesia. Therefore, Laparoscopic cholecystectomy under spinal anaesthesia may be an appropriate treatment choice to increase the number of patients eligible for outpatient surgery.

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