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Original Article

Major laparoscopic surgery under regional anesthesia: A prospective feasibility study



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ABSTRACT

Background: Laparoscopic surgeries have attained the status of a gold standard for most of the abdominal pathology; we therefore performed this study to assess feasibility and safety of major laparoscopic surgeries like laparoscopic cholecystectomy (LC) and laparoscopic assisted vaginal hysterectomy (LAVH)/total laparoscopic hysterectomy (TLH) under regional anesthesia that is combined spinal epidural anesthesia (CSE) with normal pressure pneumoperitoneum using intrathecal fentanyl with bupivacain.

Methods: In a zonal government hospital, 50 patients were selected prospectively for LC and LAVH/TLH, under normal pressure (12 mmHg) pneumoperitoneum and under CSE over a span of fifteen months. Injection bupivacaine (0.5%) and 20 µg of fentanyl were used for spinal anesthesia. Plain bupivacaine (0.5%) was used for epidural anesthesia.

Results: We successfully performed the operations in 48 patients without major complications. CSE was converted to general anesthesia in two patients due to distressing shoulder tip pain. Age varied between 25 and 70 years. Duration of operation time (skin to skin) was between 50 and 170 min. Five patients had urinary retention and one developed localized pruritis. There was no incidence of respiratory depression, aspiration or headache.

Conclusion: Laparoscopic surgeries with normal pressure CO₂ pneumoperitoneum are feasible and safe under CSE. Incidence of postoperative shoulder pain was minimal due to use of intrathecal fentanyl and complications were less and easily manageable.

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Introduction

The development of laparoscopic surgery has revolutionized surgical procedures and thus has influenced the practice and

techniques of anesthesia. Laparoscopic surgery has reduced postoperative morbidity, pain, and pulmonary complications, shortened hospital stay, moved many procedures into the outpatient arena, and perhaps reduced overall costs.^{1–3} However, laparoscopic surgery has also introduced new

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challenges for anesthesiologists due to the effects of pneumoperitoneum on circulation and respiratory function, the risk of venous gas embolism, and the pathophysiologic changes caused by extraperitoneal gas insufflation and extremes of patient positioning.^{4,5} Thus the surgeries which were performed under regional anesthesia traditionally went under the domain of general anesthesia thereby negating some advantages of minimal access surgery as general anesthesia have some disadvantages linked to it. Laparoscopic surgeries are normally performed under general anesthesia with endotracheal intubation to prevent aspiration and respiratory embarrassment secondary to induction of pneumoperitoneum and also to prevent discomfort and shoulder pain due to stretching of the diaphragm in patients who are awake during the procedure. Consequently, the use of regional anesthesia (RA) in laparoscopic surgery has been limited to patients at high risk for GA due to severe coexisting pulmonary, cardiac, or other disease.^{5,8,9,11} Regional anesthesia has also been used for laparoscopy in fit patients in combination with general anesthesia for the pain-free postoperative period. There is no doubt that regional anesthesia has been successfully used for LC in patients unfit for general anesthesia, but surprisingly, has not been tried in fit patients. Recent evidence suggests that regional anesthesia has a significant role in the care of patients undergoing laparoscopy.⁶ There are many published reports of LC and inguinal hernia repair under spinal anesthesia and epidural anesthesia.^{7-10,33-43} Herewith we present a case series of LC and LAVH/TLH in 50 healthy patients performed under CSE.

Methods

After the approval of Institutional Ethical Committee and written informed consent, 50 American Society of Anesthesiologists (ASA) Grade I and II patients underwent either elective LC or LAVH/TLH under CSE. Exclusion criteria included those with the presence of any condition contraindicating elective surgery or spinal anesthesia.

The patients were explained during the preoperative visit by the anesthesiologist that any anxiety, pain, or discomfort occurring during surgery would be dealt with intravenous medications or if required, conversion to general anesthesia. During and after the procedure, the patients were encouraged to report any discomfort, abdominal or shoulder pain, nausea and vomiting. All patients received oral diazepam 05 mg (wt < 50 kg) or 10 mg (wt > 50 kg) on the night prior to surgery. In the operative room an IV line secured and all patients received adequate preloading with 1000 ml of Ringer's lactate solution over 15 min and intravenous Ondansetron 8 mg. All routine monitors namely, non-invasive blood pressure, pulse-oximetry (SpO₂) and electrocardiogram, were attached and baseline values of vital signs were recorded.

The patients were positioned in left lateral position, and the L2-L3 (for LC)/L3-L4 (for LAVH/TLH) space was palpated. Under strict aseptic precautions a single puncture spinal and epidural block was given using CSE set. Using an 18G Touhy needle and loss of resistance technique epidural space was located. 27G pencil point spinal needle was then advanced through epidural needle to determine the subarachnoid space.

Spinal anesthesia was then performed with 3 ml (15 mg) of 0.5% heavy bupivacaine with 20 µg of inj. fentanyl injected into L2-L3/L3-L4 subarachnoid space after free flow of cerebrospinal fluid. After removing spinal needle 10 ml of plain 0.5% bupivacaine was injected into epidural space. The patients were then turned to the supine position and a 10° Trendelenburg tilt, in case of LC, was given to achieve the required level of block, as assessed by pinprick method.

Heart rate, ECG, EtCO₂ and SpO₂ were recorded and blood pressure was recorded every 02 min for the duration of surgery. Once the block was considered adequate (minimum block T4, as assessed by pinprick), surgery was commenced using carbon dioxide (CO₂) insufflation at a maximum pressure limit of 12 mmHg.

Anxiety was treated with IV midazolam 2 mg in divided doses and if required, IV infusion of IV dexmedetomidine was started at 1 µg/kg loading dose over 10 min and then 0.2-0.7 µg/kg/min of maintenance infusion titrated to level of sedation and also heart rate and blood pressure. Patients having hypotension or bradycardia were not given loading dose.

Hypotension was treated with fluids or if required then IV Mephenteramine 6 mg as IV bolus and 3 mg was repeated as and when required during the intraoperative period.

The surgical procedure of LC and LAVH/TLH was carried out according to standard protocol with no modification. Operative time as well as any intraoperative event was recorded. All patients were given IV Paracetamol 1 gm and Diclofenac Sodium 100 mg rectal suppository for post-operative pain relief. In post period they were treated with IV Paracetamol 1 gm eight hourly and IV Diclofenac Sodium 75 mg IM SOS for 24 h and then SOS.

Results

50 patients were taken up for laparoscopic surgery during March 2013 and May 2014. Out of these 42 were LC and 8 were LAVH/TLH. 43 patients were female and 07 were male. Age range was between 09 and 70 years (mean age-41.88 years). However, only one 09 years old male child was operated for cholecystectomy, other patients were in the age range of 25 and 70 years (Table 1).

All 50 surgeries were completed laparoscopically. Two (4%) of the 50 patients had distressing shoulder tip pain so were converted to general anesthesia. Other patients responded well and surgery was accomplished without any pain. Surgery took an average of 98 min (range 50-170 min).

Intraoperative vital parameters including blood pressure, heart rate, oxygen saturation, and respiratory rate and end tidal CO₂ levels were all within baseline values. Five patient required pharmacological intervention for bradycardia. Five

Table 1 – Patient characteristics and outcome indicators.

Age (Yrs)	41.8 (9-70)
Sex Ratio M:F (N)	7:43
Type Of Surgery LC:LAVH/TLH	42:8
Duration Of Surgery (Min)	98 (50-170)

Table 2 – Perioperative side effects.

Shoulder tip pain (N)	2
Bradycardia (N)	5
Hypotension (N)	5
Urinary retention (N)	5
Pruritis (N)	1
Ponv (N)	1
Headache (N)	0
Respiratory depression (N)	0

patients (10%) required one time support with Mephenataramine bolus dose of 6 mg. No patient developed any postoperative hypotension or bradycardia (Table 2).

Five patient (10%) developed urinary retention which required one time catheter assisted voiding of urine. However there was no delay in discharge or any long term morbidity.

One patient (2%) developed mild localized pruritis on the chest region. It was mild and did not require any treatment and the symptoms subsided spontaneously.

There was no case of post dural puncture headache.

One patient (2%) developed postoperative nausea and vomiting which subsided with antiemetics. There was no case of intraoperative respiratory insufficiency or respiratory depression in the postop period.

Postoperatively patients had minimal pain and there was no requirement of any analgesic in the initial 5–6 h. Patients were mobilized and started on liquid diet same evening. There was no long term complication and no patient required any readmission.

Discussion

Laparoscopic surgery is fast becoming the gold standard for treatment of uncomplicated symptomatic abdominal pathologies.^{1–3,28} Regional anesthesia was not regarded as suitable anesthesia for laparoscopic surgery in most of the cases till now because of the risk of aspiration, increased load of CO₂ and also shoulder tip pain. However General anesthesia as the only suitable technique for laparoscopic procedures is a concept of the past as it does not facilitate postoperative analgesia superior to regional anesthesia or an emesis free recovery, two important problems associated with laparoscopic surgeries. Also there are various complications associated with airway instrumentation. In addition there is sympathetic stimulation due to stress response during intubation in GA which adds on to the sympathetic over activity due to pneumoperitoneum resulting in hypertensive episodes in patients. Also there is always a danger of unanticipated difficult airway and aspiration of gastric contents which can be catastrophic. Regional anesthesia per se is considered superior to General Anesthesia in terms of safety and post-op morbidity and pain scores. Hence if it is possible to do these surgeries under RA without compromising on patient safety and operating conditions for the surgeon, it would be much better for the patients.

The goal of anesthetic management in these patients includes management of pneumoperitoneum, achieving adequate level of sensory blockade, management of shoulder

tip pain, provision of postoperative pain relief adequate to prevent deterioration of respiratory mechanics, and ambulation as early as possible. CSE fulfills all the above criteria and aids in the quick and uneventful postoperative recovery and thus has been suggested to be a suitable alternative anesthetic method for laparoscopic surgeries.¹²

This case series provides an indication regarding safety and adequacy of lumbar CSE in patients undergoing LC and LAVH/TLH, the most commonly performed major laparoscopic surgeries.

One of the concerns of performing laparoscopic surgery under regional anesthesia is lack of adequate abdominal relaxation for surgeon to view abdominal contents and perform surgery. In fact many authors have listed this problem in their studies.¹⁴ In contrast, abdominal relaxation was sufficient in all of our 50 patients. The combination of subarachnoid block and extradural block leads to widespread and dense block because of the cephalad spread of intrathecal drug caused by epidural drug volume.

Another major concern was the consequence of paralyzing the primary expiratory muscles, those of the anterior abdominal wall. No patient in our study experienced breathing difficulty during abdominal insufflations. Under regional anesthesia the respiratory mechanism remains intact, and diaphragm the main respiratory muscle is unaffected allowing the patient to adjust minute ventilation without any significant changes in ventilatory parameters or CO₂ levels.⁷ In a study conducted by Ciofalo et al,¹³ the ventilatory measurements and arterial blood gases were maintained within normal limits at different stages during laparoscopy under epidural anesthesia. Data from healthier women undergoing laparoscopic surgery with CO₂ insufflation under RA suggest that PaCO₂ does not rise during surgery because awake women increase respiratory rate and minute ventilation.^{13,15–17} In our study we did not monitor arterial blood gases but monitored SpO₂, ETCO₂ and respiratory rate which remained within baseline value.

Cardiovascular changes were also minimal commensurate with CSE for open abdominal surgeries. The patients remained conscious, thus avoiding significant central depression of circulation along with adequate IV fluids prevented any significant cardiovascular changes. Five patients (10%) required one time support with Mephenataramine bolus dose of 3 mg. Sinha et al noted an incidence of hypotension as 20.5% in their series.¹⁹ An added cardiovascular advantage had been the decrease in surgical bed oozing because of hypotension, bradycardia, and improved venous drainage associated with SA.²⁶

Shoulder tip pain is a very common and quite troublesome problem during laparoscopic surgery under RA. This is a referred pain due to the stretching of diaphragm by insufflating CO₂ as diaphragm is supplied by cervical roots which are spared during regional anesthesia. Overall, reported rate of conversion from RA to GA due to intolerable shoulder pain has been 0–37.1% for LC.^{7–9,18–21,33} However in our study, it occurred in only 2 (4%) of our patients which was acceptable. In our opinion Intrathecal fentanyl helped in better management of shoulder tip pain. Also the conversion to GA was in initial cases when the technique was in refinement stage. As our experience grew there was no problem of shoulder tip

pain and no conversion was required. Other studies have used various measures aimed at reducing shoulder pain include positioning changes, abdominal massage, passive drainage and suprahepatic suction of residual gas, spraying bupivacaine on the peritoneum over the diaphragm, and “painting” the diaphragm with a gauze soaked in bupivacaine.^{22–24,34} Also use of low-pressure pneumoperitoneum (<10 mmHg) decreases shoulder pain incidence and severity²⁵ but it adds to the difficulty level for surgeon. However in our study except intrathecal fentanyl no other technique was used for management of shoulder tip pain. So in our opinion this was an easier and better method for shoulder tip pain management. However a larger and better randomized study will be required to establish its advantage.

Urinary retention and the need for urinary catheterization could be a serious disadvantage of RA in healthy patients. In our study one time catheterization was required for 05 patients (10%) which were comparable to some other studies.²⁹ However no long term catheterization was required in any patient. The corresponding figure for GA is very less but this complication can be easily managed and does not result in any morbidity for patient. In our study also it did not result in delay in discharge of any patient.

Another concern is Post Dural Puncture Headache (PDPH) in patients operated under combined spinal epidural anesthesia. However in our study there was no case of PDPH. This can be explained by use of Whitacre point needle and also the drug given in the epidural space which reduces pressure gradient between subarachnoid space and epidural space, thereby reducing/preventing CSF leak and thus headache.

Another concern is the adverse effects associated with intrathecal fentanyl like respiratory depression and itching. It is believed that lipophilic opioids (e.g. fentanyl) bind rapidly and avidly with the opioid receptors in spinal cord and do not tend to spread rostrally in CSF as compared to the hydrophilic opioids (e.g. morphine). This is thought to explain the more rapid onset of analgesic action with fentanyl than morphine and lesser incidence of respiratory depression. Respiratory depression from fentanyl occurs within minutes and rate is much lower as compared to morphine. In our study there was no case of respiratory depression. Itching is one of the most common and distressing side effects of opioid administration. With fentanyl incidence rate is around 47%.^{31,32} In our study there was one case of localized pruritus over chest but it did not require any intervention and subsided on its own. This was probably because of much lower dose (20 µg) used by us.

Another advantage of regional anesthesia was reduced incidence of intra-op and postop nausea vomiting (PONV). Adequate hydration, reduced systemic opioid use and pre-op prophylaxis by Ondansetron resulted in reduced incidence. Also intrathecal fentanyl results in reduced incidence of nausea and vomiting.³⁰ Cooper et al. also reported a statistically significant reduction in intraoperative nausea with the addition of intrathecal fentanyl (25 µg) to a standardized spinal anesthetic for cesarean delivery. Only one patient (2%) developed nausea and vomiting in postop period requiring antiemetics. PONV is particularly troublesome after GA because of the use of opioids, nitrous oxide and also reversal agents. Antiemetics may be required in as many as 50% of

patients²⁷ and can delay discharge from the hospital in 7% of patients.¹⁸

Also in the postoperative period after RA, there was no restlessness as is commonly seen after GA and the patient is always receptive and more compliant to suggestions. Epidural analgesia and intrathecal fentanyl resulted in prolonged postop analgesia which resulted in smooth and uneventful recovery of patient. Also complications like sore throat, relaxant-induced muscle pain and dizziness were absent in patients with regional anesthesia which are encountered in GA. Overall there was good patient satisfaction and very few complications making regional anesthesia a good and viable option for conducting laparoscopic surgeries. However further studies and large RCTs are required to establish its benefit over GA.

This study confirms the feasibility and safety of regional anesthesia as the sole anesthesia technique for conduct of major elective laparoscopic surgeries. This study did not include a cost analysis, but other studies²⁵ indicate that laparoscopic surgeries under regional anesthesia are more cost effective than under GA. This makes regional anesthesia an attractive option as the anesthesia of choice especially in developing countries.

Conclusion

Regional Anesthesia is safer and much more advantageous to the patient as compared to General Anesthesia. Laparoscopic surgeries have really revolutionized the abdominal surgeries and have drastically reduced the morbidity and mortality. Unfortunately it also took these surgeries out of the realm of regional anesthesia and put them back in the ambit of General Anesthesia. This negated some of the advantages of laparoscopic surgeries. We attempted this study to assess the feasibility of doing these surgeries under regional anesthesia safely without any modification of the surgical techniques. Our study has confirmed the feasibility of performing elective laparoscopic surgeries without any change in standard surgical technique under combined spinal and epidural anesthesia. Additionally, it appears that regional anesthesia provides minimal intraoperative hemodynamic perturbations and is valuable in postoperative pain control and patient satisfaction. However, this approach requires a co-operative patient, an experienced surgeon and an enthusiastic anesthesiologist ever prepared to supplement it with intravenous adjuncts and if needed with general anesthesia. From these we conclude that with proper application and with suitable improvements, regional anesthesia has got the potential to emerge as the novel gold standard anesthetic technique for elective laparoscopic surgeries like LC and LAVH/TLH. However further larger randomized controlled trials are required to compare regional anesthesia and general anesthesia in terms of cost, benefits and risks while conducting elective laparoscopic surgeries.

Conflicts of interest

All authors have none to declare.

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