

Spinal Anaesthesia for Laparoscopic Appendectomy - Single Center Pilot Study

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Abstract

Background: Appendectomy is commonly performed by laparoscopic method now-a-days because of its promising benefits over open method. The most commonly used and preferred mode of anaesthesia for laparoscopic abdominal surgeries is general anaesthesia with intubation and positive pressure ventilation. Studies regarding use of regional anaesthesia for laparoscopic abdominal surgeries are very limited. Therefore, this study was designed to conduct laparoscopic appendectomy with spinal anaesthesia as the first choice with contention that it can be better alternative to general anaesthesia. **Subjects and Method:** This was a single center pilot study conducted with permission and approval of institutional ethical committee. 100 patients with ASA grade I and II belonging to age group 18 to 60 years diagnosed with acute appendicitis undergoing laparoscopic appendectomy were enrolled. Standard spinal anaesthesia procedure was carried out using 0.5% hyperbaric injection bupivacaine intrathecally. Injection ketamine 0.25 mg/kg injected intravenously just before pneumoperitoneum in view of management of shoulder pain. Conversion of procedure to general anaesthesia and open surgical method, relief of shoulder pain, hemodynamic changes, postoperative complications, postoperative pain and postdural puncture headache were recorded and analysed. **Result:** The appendectomy procedure was completed laparoscopically in 94 patients while only 6 patients required conversion to open method due to surgical factors. None of the patients had any cardiopulmonary complication except bradyarrhythmia in 4 and transient hypotension in 10 patients which were managed successfully. No one needed conversion to general anaesthesia. 5 patients complained about mild right shoulder pain. None of the patients complained about postdural puncture headache, postoperative nausea and vomiting. Only 3 patients required rescue analgesia postoperatively within 2 hours. **Conclusion:** Spinal anaesthesia using 0.5% hyperbaric bupivacaine and injection ketamine 0.25 mg /kg intravenously provided effective anaesthesia for laparoscopic appendectomy. It can be considered as a better alternative for general anaesthesia with minimal complications.

Keywords: Laparoscopic Appendectomy, Spinal Anaesthesia, General Anaesthesia, Ketamine, Appendicitis

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Received: 04 December 2020

Revised: 13 January 2021

Accepted: 20 January 2021

Published: 30 March 2021

Introduction

One of the most common causes of acute abdomen is acute appendicitis.^[1,2] The standard treatment for acute appendicitis was open appendectomy. But nowadays it has been gradually replaced by laparoscopic method after Semm introduced it in 1983.^[3,4] The development of laparoscopic surgery has revolutionised surgical branch. It is being considered as gold standard due to certain benefits like reduced bleeding, decreased infectious complication, less postoperative surgical and pulmonary complications, earlier recovery, shortened length of hospital stay.^[5] Laparoscopic surgeries are traditionally performed under general anaesthesia with endotracheal intubation to take care of possibility of aspiration and respiratory embar-

rassment due to induction of pneumoperitoneum.^[6,7]

Recent evidences suggest that regional anaesthesia can play a significant role in the care of patients undergoing laparoscopic surgeries.^[8] Spinal anaesthesia is minimally invasive anaesthetic technique that has significantly lower morbidity and mortality rates. Spinal anaesthesia has many advantages over general anaesthesia as the patient is conscious and responsive at the end of the surgery, better level of analgesia due to effect of neuraxial block, no polypharmacy and total muscle relaxation with good operative condition. Patient tend to ambulate earlier.^[9,10] It also protects against side effects and potential complications of general anaesthesia along with uneventful postoperative recovery.^[7]

Despite of these advantages, majority of surgeons still prefer general anaesthesia for laparoscopic appendectomy. Most of the textbooks and publications cite “general anaesthesia is the only anaesthetic option” for laparoscopic abdominal surgeries. There are some studies and reports of laparoscopic surgeries being performed successfully under regional anaesthesia in selected patients in recent times.^[8–10] So our primary objective is to design a pilot study considering spinal anaesthesia as a preferred mode for laparoscopic appendectomy.

Subjects and Methods

This single center study was conducted in tertiary care center, Government Medical College Miraj. Institutional ethical committee approved this as a pilot study. We enrolled 100 patients with American Society of Anaesthesiologists grade I and II diagnosed with acute appendicitis undergoing laparoscopic appendectomy. Age group selected was 18 to 60 years of either sex. The exclusion criteria for the study were as follow: patients having contraindication to spinal anaesthesia like any skin infection at injection site, bleeding disorders or history of any drug consumption causing it, refusal for spinal anaesthesia procedure, history of any allergy or hypersensitivity to local anaesthetics, severe back pain or any spinal deformity.

All the patients were informed about the possibility of conversion to general anaesthesia technique intraoperatively at any point of time depending upon conditions like discomfort or persistent pain despite of adequate analgesia and sedation. Detailed written informed consent was taken during pre-anaesthetic evaluation and spinal anaesthesia procedure was explained.

On the day of the surgery, consent was checked. Routine monitors like pulse oximetry, electrocardiograph monitor, non-invasive blood pressure cuff, end tidal carbon dioxide were attached and all the baseline vital parameters recorded. Ringer lactate crystalloid fluid started via peripheral vein with 18 gauge intravenous catheter. Premedication like Injection ondansetron 0.1mg/kg as an antiemetic, injection midazolam 0.02mg/kg, injection pentazocine 0.3 mg/kg as anxiolytics, injection glycopyrolate 4 mcg/kg as antisialagogue given intravenously.

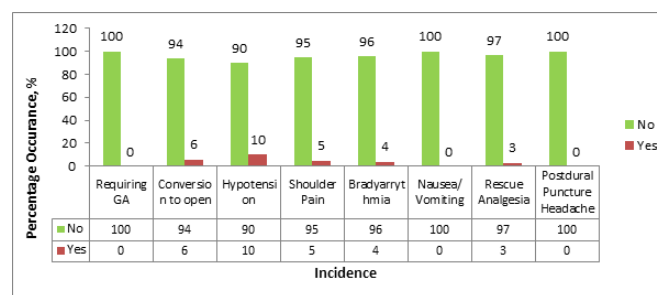
After taking all aseptic precautions standard spinal anaesthesia procedure was carried out with 25 gauge Quincke spinal needle, with patient in right lateral position with midline approach in L3-L4 interspace. After successful aspiration of clear cerebrospinal fluid 0.5% hyperbaric injection bupivacaine was injected intrathecally. The intrathecal dosage was determined considering patients’ height, weight, age and target sensory level of anaesthesia (T4). The patient was turned to supine position after 20 seconds. The sensory block level

was tested by pinprick using 24 gauge blunt hypodermic needle and Bromage scale (0 = no motor blockade, 1 = unable to raise extended legs, 2 = unable to flex knees, 3 = unable to flex ankle) was used to assess motor blockade in consideration of our target sensory level of anaesthesia (T4) and complete abdominal muscle relaxation. Injection ketamine 0.25 mg/kg was given intravenously just before the start of pneumoperitoneum for right shoulder pain. Surgeons were requested to apply minimum possible intra-abdominal pressure for CO₂ pneumoperitoneum. If any patient experienced discomfort or pain, additional dose of injection ketamine was repeated.

Hypotension was considered when there was >20% fall in systolic blood pressure compared to preanaesthetic level or systolic blood pressure < 90 mm Hg. It was treated with bolus IV fluids 100-200 ml and injection Mephentermine. Bradycardia was treated when heart rate was less than 50 with 0.6 mg of injection atropine. Side effects and complaints of all patients were recorded (e.g. hypotension, nausea, vomiting, referred right shoulder pain, abdominal discomfort). Pain score was assessed for 2 hours postoperatively as after particular time spinal anaesthesia wear off. Visual analogue scale (0 = no pain, 10 = worst pain) was used for pain scoring. Injection diclofenac was used as rescue analgesia if required.

Result

Statistical analysis: Statistical software MS Excel was used to analyse data. MS Excel and MS word was used to obtain graphical representation of data such as bar diagram.



The neuroaxial anaesthesia procedure was successfully performed in all patients included in study. No patient experienced any problem while injecting anaesthetic drug intrathecally. An effective sensory blockade upto T4 level were obtained in all patients with excellent surgical condition. Laparoscopic procedure for appendectomy was performed successfully in all except 6 patients under spinal anaesthesia with no one requiring conversion to general anaesthesia. Because of surgical factors 6 patients out of 100 required conversion to open appendectomy procedure under spinal anaesthesia only.

Hemodynamic changes were minimal and insignificant. Hypotension was seen in 10 patients who were successfully managed with bolus intravenous fluid and injection Mephen-termine 0.6 mg bolus doses. Bradycardia was seen in 4 patients who were managed by injection atropine. During study only 5 patients complained about shoulder tip pain, managed effectively with repeat dose of injection ketamine 0.25 mg/kg according to VAS pain score with maximum dose upto 1 mg/kg.

None of the patients complained about postoperative nausea-vomiting. Only 3 patients were required rescue analgesia, injection diclofenac 75 mg intramuscularly within 2 hours postoperatively. No one complained about postdural puncture headache.

Discussion

During laparoscopic surgeries, pneumoperitoneum is created with insufflation of carbon dioxide and trendelenburg position is given for better visualization of operative field. This may cause upward displacement of diaphragm and respiratory embarrassment. Stretching of peritoneum and collection of blood or fluid under diaphragm cause diaphragmatic irritation and discomfort. As the diaphragm is supplied by phrenic nerve, pain is referred to shoulder due to common root value C3, C4, and C5. [6-10]

General anaesthesia, as the only suitable and preferred mode of anaesthesia for laparoscopic procedures, was concept of the past. [6] General anaesthesia has its own disadvantages such as sore throat, pressor response to intubation, stress hormone release, postoperative nausea and vomiting, inadequate postoperative analgesia. [4-7] Regional anaesthesia was not considered as suitable anaesthetic technique for laparoscopic surgeries until now because of risk of aspiration, respiratory embarrassment due to CO₂ pneumoperitoneum and shoulder tip pain. [11-14] Some reports and studies of regional anaesthesia being used for laparoscopic surgeries are documented. There are studies supporting growing evidences that patients of ASA grade I and II without any pre-existing respiratory disease can tolerate laparoscopic procedures very well without any complications under regional anaesthesia. [15-19]

The major goals of anaesthetic management in laparoscopic surgeries should be adequate analgesia and muscle relaxation, management of pneumoperitoneum and shoulder pain, provision of better postoperative analgesia to avoid deterioration of respiratory mechanics and early ambulation. Spinal anaesthesia fulfils all above criteria and thus it can be considered as suitable alternative to general anaesthesia for laparoscopic surgeries with specific considerations. [20-22]

Major concerns with spinal anaesthesia are possible respiratory embarrassment because of paralysis of the primary expiratory muscles, proper management of shoulder

pain and discomfort because of carbon dioxide pneumoperitoneum along with hemodynamic stability. The respiratory mechanism remains intact under regional anaesthesia. The main inspiratory muscle diaphragm remains unaffected which allows patients to adjust minute ventilation without any significant changes in ventilatory parameters or CO₂ level. [8] Pneumoperitoneum-induced shoulder pain is the most distressing and one of the leading cause of conversion of regional anaesthesia to general anaesthesia. [17,18] Several studies have been conducted for relief of distressing shoulder pain associated with laparoscopic surgery under spinal anaesthesia. [23-26].

This study was designed as a pilot study, which would provide indications regarding safety and efficacy of spinal anaesthesia with 0.5% hyperbaric injection bupivacaine in patients undergoing laparoscopic appendectomy. [6-8].

The spinal anaesthesia procedure was carried out in right lateral position in L3-L4 interspace to avoid accidental injury to the spinal cord. To obtain adequate sensory level (T4), spinal hyperbaric drug was spreaded to affect most of cord segments responsible for sympathetic outflow. As ASA I and II grade patients were included in the study, hemodynamics were well maintained without any circulatory or respiratory depression. [9-12]

Most common problem in laparoscopic surgeries, shoulder tip pain occurred in 5 out of 100 patients. It was managed with injection ketamine 0.25 mg /kg (maximum upto 1 mg/kg) just before the start of pneumoperitoneum. [13-15] Avoidance of extreme trendelenburg position and tilt, so blood and irritant fluids won't run to irritate diaphragm, low intra-abdominal carbon dioxide pressure during pneumoperitoneum are the reasons for lower incidence.

None of the patients required general anaesthesia at any time during study. 6 out of 100 patients required conversion to open surgical method because of surgical factors. None of the patients complained about postoperative nausea-vomiting. Only 3 instead of 4 patients required rescue analgesia, managed with injection diclofenac 75 mg intramuscularly. Patients were monitored for postdural puncture headache postoperatively with proper post spinal anaesthesia care. None complaint was recorded.

Conclusion

Our pilot study concluded that spinal anaesthesia can be considered as safe and better alternative to general anaesthesia for laparoscopic appendectomy. Spinal anaesthesia technique provide adequate level of sensory blockade with good muscle relaxation, adequate postoperative analgesia; prevent deterioration of respiratory mechanics and allow early ambulation. Distressing event of shoulder tip pain, which was taken care of by injection ketamine, was feasible for relief during

laparoscopic appendectomy under spinal anaesthesia. Hemodynamic stability was well maintained by careful monitoring. This study had several limitations. This observational study was done in very small population. There was no control group or placebo for comparison.

Acknowledgment

I take this opportunity to express my heartiest gratitude and reverence towards **Dr. Pradnya Bhalerao**, MD, Professor and Head Of The Department Of Anaesthesiology and **Dr. Prakash Dhumal**, MD, Assistant Professor Department Of Anaesthesiology, Government Medical College Miraj for their guidance and constant encouragement throughout, without which this work would not have been completed.

I owe my special thanks to **Dr. Subodh Ugane**, MS, Associate Professor and Unit Head, Department of Surgery Government Medical College Miraj and team for their Support. I am very thankful to OT staff and patients included in this study.

I wish to thank my family for their undivided support.

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How to cite this article: Almaji BS, Dhumal PR, Bhalerao PM. Spinal Anaesthesia for Laparoscopic Appendectomy - Single Center Pilot Study. *Acad. Anesthesiol. Int.* 2021;6(1):27-31.

DOI: dx.doi.org/10.21276/aan.2021.6.1.6

Source of Support: Nil, **Conflict of Interest:** None declared.