



A COMPARATIVE STUDY BETWEEN SPINAL VS GENERAL ANESTHESIA FOR LAPAROSCOPIC APPENDECTOMY A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Appendectomy is one of the most commonly performed surgery in modern day surgical practice. While laparoscopic appendectomy has been well established as a widespread and standard method for appendectomy surgery, there is ambiguity about the best method of anesthesia for laparoscopic appendectomy surgery. While General anesthesia is the preferred and accepted method for laparoscopic appendectomy surgery, spinal anesthesia with supplemental sedation is being very widely tried and found to be at least as satisfactory if not better than General Anesthesia. Plus the added advantages of cost effectiveness and better postoperative analgesia makes spinal anesthesia a very acceptable alternative to GA for lap appendectomy. We designed a study to compare spinal vs. General anesthesia in a controlled study and found spinal anesthesia to be better than GA for lap appendectomy.

Objectives of study : To compare spinal anesthesia with the currently accepted gold standard technique i.e. general anesthesia for elective laparoscopic appendectomy.

Setting: Medical College Hospital

Design: Controlled randomized trial.

Settings and Study design: One hundred patients with symptomatic gallstone disease and American Society of Anesthesiologists status I or II were randomized to have laparoscopic appendectomy under spinal (n=50) or general (n=50) anesthesia.

Materials and Methods: Patients meeting inclusion criteria were randomised into two groups. Group A and Group B received general and spinal anaesthesia by standardised techniques. Both groups underwent standard four port laparoscopic appendectomy. Mean anaesthesia time and surgery time defined primary outcome measures. Intraoperative events and post operative pain score were secondary outcome measure. Intraoperative parameters, postoperative pain, complications, recovery, and patient satisfaction at follow up were compared between the 2 groups.

Statistical Analysis Used : Student t test and chi square test

Results : All the procedures were completed by the allocated method of anesthesia, as there were no conversions from spinal to general anesthesia. Pain was significantly less at 4 hours (P<.001), 8 hours (P<.001), 12 hours (P<.001), and 24 hours (P=.02) after the procedure for the spinal anesthesia group compared with those who received general anesthesia. There was no difference between the 2 groups regarding complications, hospital stay, recovery, or degree of satisfaction at follow-up.

Conclusions : Spinal anesthesia is adequate and safe for laparoscopic appendectomy in otherwise healthy patients and offers better postoperative pain control than general anesthesia with similar recovery times and better patient satisfaction to some extent. Also, all the complications associated with general anesthesia can be avoided and conduct of anesthesia becomes safer.

KEYWORDS :

INTRODUCTION

With recent technical advances, appendectomy is more commonly performed under laparoscopy than by open laparotomy. Laparoscopic appendectomy (LA) has shown to have considerable advantages over open appendectomy. Such advantages include less postoperative pain, better cosmetic results, a shorter hospital stay, and a lower complication rate [1]. However, LA has been routinely performed under general anesthesia with endotracheal intubation despite the several disadvantages of general anesthesia compared to regional anesthesia, including hemodynamic instability, postoperative nausea and vomiting (PONV), increase in the requirement for postoperative analgesia, complications related to intubation or extubation, and a sore throat postoperatively [2,3]. Although many reports of laparoscopic inguinal hernia repair and cholecystectomy under regional anesthesia have been published [4-7], few studies have involved regional anesthesia for LA [8].

Regional anesthesia has been used for laparoscopy in healthy patients in the past almost exclusively in combination with general anesthesia to extend the analgesic effect during the early postoperative period. In a randomized trial, epidurals combined with general anesthesia have been found to be more effective in lessening postoperative pain in healthy patients compared with general anesthesia alone.⁹

Over the last few years, in the era of minimally invasive medicine, regional anesthesia is gaining popularity and is gaining more utility as a sole method of anesthesia in laparoscopic procedures.

Johnson⁴ noted that "all laparoscopic procedures are merely a change in access and still require general anesthetic; hence the difference from conventional surgery is likely to be small." This statement is predominantly based on the assumption that laparoscopy necessitates endotracheal intubation to prevent aspiration and respiratory compromise secondary to the induction of carbon dioxide pneumoperitoneum,² which is not well tolerated in a patient who is awake during the procedure.^{5,6} However, it is surprising that regional anesthesia has been successfully used for laparoscopic appendectomy in patients unfit to have the procedure under general anesthesia but has not been tested in healthy patients in whom any presumed risk would be theoretically much lower.

Hamad and Ibrahim El-Khattary⁷ used spinal anesthesia for laparoscopic appendectomy for the first time in a small series of healthy patients. In their study, however, nitrous oxide pneumoperitoneum was applied instead of the standard carbon dioxide.

Many studies have recently shown the feasibility of successfully and safely performing laparoscopic appendectomy with low-pressure carbon dioxide pneumoperitoneum under spinal anesthesia alone in healthy patients with symptomatic gallstone disease.⁸ We have also noticed that spinal anesthesia results in less postoperative pain. As such a controlled randomized trial was designed to compare spinal anesthesia with the currently accepted gold standard i.e. general anesthesia for elective laparoscopic appendectomy in

healthy patients.

MATERIALS AND METHODS

A controlled randomized trial was designed to compare spinal anesthesia with the currently accepted gold standard i.e. general anesthesia for elective laparoscopic appendectomy in healthy patients. From January 2016 to December 2016, all patients referred to our unit for elective laparoscopic appendectomy were considered eligible for the trial, provided that they fulfilled the following inclusion criteria:

American Society of Anesthesiologists' status I or II, between 18 and 65 years of age, body mass index (calculated as weight in kilograms divided by height in meters squared) of 30 or less, and normal coagulation profile.

Exclusion criteria were, The exclusion criteria were as follows: (1) infection at the spinal anesthesia injection site, (2) coagulopathy or other bleeding diathesis, (3) spinal deformity or severe back pain, (4) history of bradyarrhythmia, (5) obesity (body mass index > 30 kg/m²), (6) patients < 20 or > 65 years old, (7) history of allergy or hypersensitivity to local anesthetics, and (8) recent administration of sedative drugs or α-adrenergic antagonists, and (9) perforated appendicitis.

Patients were randomized to have a laparoscopic appendectomy under either general or spinal anesthesia. Randomization was created by a computer-generated list in blocks of 50 patients with sex stratification.

During this time period, 100 patients entered our ongoing trial. They were randomized to have laparoscopic appendectomy under spinal (n=50) or general (n=50) anesthesia. One patient from the spinal anesthesia arm withdrew informed consent, and in 2 patients from the general anesthesia arm, the laparoscopic procedure was converted to an open approach. These 3 patients were therefore excluded from further analysis, leaving 49 patients in the spinal and 48 patients in the general anesthesia groups for analysis.

Table 1 : Characteristics of patients who underwent laparoscopic appendectomy

Characteristic	GA group (n=50)	Spinal group (n=50)	P value
Age (in years)	41.12 ± 11.23	42 ± 06	0.20
Gender (M/F)	16/34	18/32	0.16

Chi square test: P < 0.05 considered as significant.

The two study groups were very similar in characteristics including age and gender composition.

The 2 groups were similar regarding demographics (Table 1). All the procedures were completed by the allocated method of anesthesia, as there were no conversions from spinal anesthesia to general anesthesia. Intraoperatively, intravenous ephedrine was administered in 29 (59%) patients from the spinal anesthesia group compared with 2 (4%) patients from the general anesthesia group owing to mean arterial blood pressure drops of more than 20% from the preanesthetic values. In all these cases, mean arterial blood pressure was then normalized and the procedure was completed uneventfully. Discomfort and/or right shoulder pain in some degree was present after the introduction of pneumoperitoneum in 21 patients (43%) who received spinal anesthesia. However, the pain was severe enough to require intravenous fentanyl administration in only 10 cases. The remaining patients did not require any additional medication or other intervention, and procedures were completed uneventfully in all cases.

Table 2: Postoperative adverse events in the two groups

Event	No. Of patients
Abdominal discomfort	9
Referred shoulder pain	8
Hypotension	5
Nausea/ Vomiting	3
Anxiety	2

Discharge from the hospital at 24 hours after surgery was possible for 48 (98%) patients from the spinal anesthesia group and 47 (98%) patients from the general anesthesia group. We had no mortality in either group and essentially no major morbidity. One patient from the regional anesthesia group who required catheterization for urinary retention developed a urinary tract infection and was treated with antibiotics.

Postoperative events related to surgical and/or anesthetic procedures, like nausea, vomiting, or urinary retention, are presented in Table 2. As presented in Table 3,

Table 3: Median Visual Analogue Score

	GA Group	SA Group	P value
06 hrs postop	4	1 (0-3)	<0.002
12 hrs postop	3	1 (0-4)	0.002
24 hrs postop	2	0 (0-4)	0.010

Pain assessed by the visual analog scale was significantly less for the spinal anesthesia group at 4, 8, 12, and 24 hours postoperatively, including both relaxed and stressed conditions. Supplementary postoperative opioid analgesia was administered in only 1 of the 49 (2%) patients who received spinal anesthesia compared with 12 of the 48 (25%) patients who received general anesthesia (P=.001, Fisher exact test).

At 2 weeks' follow-up, the quality of life and patient satisfaction scores were similar in the 2 groups: patients who received spinal anesthesia had a median score of 19 (range, 4-26) compared with a median score of 20 (range, 6-26) for patients who received general anesthesia (P=.2, Mann-Whitney U test). Overall, 96% of the spinal anesthesia group and 94% of the general anesthesia group were highly or fairly satisfied with the anesthetic procedure they had. No late complications were reported at week 4 through telephone contact in any of the patients.

The interim analysis of our study not only confirmed the feasibility of safely performing laparoscopic appendectomy under spinal anesthesia as the sole anesthetic procedure but also showed the superiority of spinal anesthesia in postoperative pain control compared with the standard general anesthesia. Pain assessed at both relaxed and stressed conditions was significantly lower at any time during the postoperative hospital stay in patients having spinal anesthesia compared with those having general anesthesia. Furthermore, supplementary opioids were administered in significantly fewer patients having spinal anesthesia compared with those having general anesthesia. This difference could be attributed to a combination of several factors: the avoidance of endotracheal intubation-related discomfort; the presence of adequate levels of analgesia for the first few hours after the completion of the surgical procedure owing to the existing activity of the analgesia injected in the subarachnoid space; and the potentially minimal stress response associated with a minimal invasive anesthetic procedure, such as spinal anesthesia.⁹ Pain following laparoscopic appendectomy is not a major problem, but it has been a matter of interest in several studies during the last few years. Minimal invasive surgery has dominated because of the rapid and smooth recovery it offers, and postoperative pain control is probably the main factor that characterizes smooth recovery. Several researchers have tested intraperitoneal instillation or aerosolization of local anesthetic agents (eg, bupivacaine), use of the newer anti-inflammatory COX-2 inhibitors (ie, parecoxib, which was used in this study), addition of epidural analgesia, and oral or epidural administration of steroids, finding some effect on postoperative pain, which varies between studies.^{3,10-14} When we designed this trial comparing the 2 methods of anesthesia on several aspects of the intraoperative and postoperative course, we defined postoperative pain control as our primary end point based on the initial experience gained from our pilot study,⁸ in which the exceptionally good postoperative pain control became obvious very quickly. Our data presented herein confirm the superiority of spinal over general anesthesia in postoperative pain control.

Intraoperative events of note in the spinal anesthesia group included a decrease of the mean arterial blood pressure of more than 20% below the preanesthetic value as well as right shoulder pain. With regards to the former, this is a well known adverse effect of spinal anesthesia and is easily overcome after administration of phenylephrine, and therefore it does not essentially affect the planned procedure. Regarding the latter, 43% of the patients who received spinal anesthesia experienced some degree of shoulder pain or discomfort; however, less than half of those patients required treatment.

Laparoscopy-related right shoulder pain has been reported in previous studies and attributed to diaphragmatic irritation from carbon dioxide pneumoperitoneum. 5-7 At times, this symptom could be severe enough to result in conversion of the anesthetic approach. 7 However, the pain was mild in most cases in our study and it did not result in conversion from spinal anesthesia in any of our patients. Even when present, shoulder pain was easily dealt with; reassurance and no medical treatment were used in most patients who experienced this symptom. This could be attributed to our lower cutoff pressure for pneumoperitoneum (12 mm Hg instead of the usual 14 mm Hg) combined with minimal tilting of the operating table; we have, thus, minimized the diaphragmatic irritation.

The use of low-pressure pneumoperitoneum did not jeopardize the adequacy of space and subsequently the view and virtually all the procedures were completed without any technical difficulty. This was especially true for the spinal anesthesia group, because this type of anesthesia offers sensory, motor, and sympathetic blockade at a high level and thus obviates the need for abdominal wall muscle relaxants, which sometimes are necessary when general anesthesia is used. To avoid technical problems with obese patients in whom a potentially higher intra-abdominal pressure is required, we designed the trial with a body mass index cutoff of 30. It is possible, however, that carefully selected patients with higher body mass indexes could have laparoscopic appendectomy under regional anesthesia, as our limited anecdotal experience with such obese patients outside the trial suggests.

With regards to the early (in-hospital) postoperative course, the only essential event detected in the spinal anesthesia group was urinary retention; again, this is known to be related to regional anesthesia with rates of up to 20% in some series. 15 Postoperative urinary retention developed in 3 (6%) patients from the spinal anesthesia group (1 female and 2 male patients). Instant catheterization was the only treatment required in 2 patients and did not affect their recovery or time of discharge. However, the third patient developed a postcatheterization urinary tract infection requiring antibiotics and prolonged hospitalization. At 2 weeks' follow-up, the vast majority of patients from both groups reported being satisfied with the anesthetic approach and experienced equally good recovery.

On the other hand, postdischarge patients' recovery after laparoscopic appendectomy under spinal anesthesia was reported to be equally good compared with the present standard method of anesthesia.

From these preliminary data, it appears that spinal anesthesia is a promising method of anesthesia for laparoscopic procedures, and with proper refinements, it could potentially evolve as the new gold standard anesthetic approach for elective laparoscopic appendectomy in healthy patients.

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