



Laparoscopic cholecystectomy under spinal anesthesia with nitrous oxide pneumoperitoneum: A feasibility study

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Abstract

Background: Spinal anesthesia has been successfully used to perform various laparoscopic procedures. However, laparoscopic cholecystectomy under spinal anesthesia has not been reported. Is this feasible?

Methods: Ten successive laparoscopic cholecystectomies were performed under spinal anesthesia. The surgical technique was modified using nitrous oxide insufflation, lower levels of intraabdominal pressure, modified trocar sites, and minimal surgical manipulation. We used spinal anesthesia by intrathecal hyperbaric 10–12 mg bupivacaine with 10 µg fentanyl to give an anesthetic level at T8–T6.

Results: The mean age was 39.3 years and there were four females. Only one patient was converted to general anesthesia due to intolerable shoulder pain. One patient vomited intraoperatively. Nine patients considered the procedure well tolerated under spinal anesthesia. The mean operative time was 47.4 min. Postoperatively, there were minimal pain and no vomiting.

Conclusions: Laparoscopic cholecystectomy can be performed successfully under spinal anesthesia and is well tolerated.

Key words: Laparoscopy — Cholecystectomy — Spinal anesthesia

Laparoscopic cholecystectomy is considered the gold standard for therapy of symptomatic cholelithiasis [17]. General anesthesia is routinely used for this operation. To our knowledge, spinal anesthesia has not been reported in the medical literature as an anesthetic method for laparoscopic cholecystectomy. On the other hand, for open cholecystectomy, although general anesthesia is often used, spinal anesthesia has been infrequently reported as the anesthetic procedure of choice [2]. Generally, spinal anesthesia was found to be associated with

less postoperative mortality and other serious complications than general anesthesia [14, 15, 19].

In some minor laparoscopic procedures, spinal anesthesia has been found to be associated with less emesis, less postoperative pain, shorter postoperative stay, better patient satisfaction, and improved overall safety [3]. Spinal anesthesia has been used with laparoscopic procedures such as diagnostic laparoscopy, infertility procedures, and tubal sterilization [3, 12, 20]. Both laparoscopic inguinal hernia repair [11, 18] and laparoscopic appendectomy [8] have also been performed under spinal anesthesia.

However, for laparoscopic cholecystectomy, spinal anesthesia has not been reported as the sole anaesthetic technique, but only as a adjunct to general anesthesia to increase the postoperative analgesic effect [6, 10].

In reviewing laparoscopic surgery, Johnson [9] 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.” Such a critical point of view, in our opinion, was one of the important factors that pushed many authors to try to prove that some laparoscopic procedures could be performed under regional anesthesia [3, 8, 11, 12, 18, 20]. Because it has fewer postoperative complications than general anesthesia, spinal anesthesia seems more matching to the minimally invasive laparoscopic technique.

We hoped to determine whether or not laparoscopic cholecystectomy could be performed under spinal anesthesia.

Materials and methods

Ten patients for whom laparoscopic cholecystectomy was indicated were prospectively and nonselectively allocated for operation under spinal anesthesia. Informed consent was obtained from each patient. Patients were offered the possibility of conversion to general anesthesia if they were unsatisfied with spinal anesthesia at any time during the procedure. The ethics committee of the Assiut Faculty of Medicine approved the study protocol.

Anesthetic technique

All patients were given spinal anesthesia in the L2–L3 or L3–L4 intervertebral space using 25-gauge spinal needle. Five percent hyperbaric bupivacaine (10–12 mg) in addition to 10 µg fentanyl were injected intrathecally. Surgery was commenced when the level of anesthesia reached T8. Intraoperative monitoring of blood pressure, electrocardiograph, SaO₂, shoulder pain, patient discomfort, and vomiting was performed.

If any patient experienced discomfort or pain to the extent that he or she asked for general anesthesia, the patient was converted to general endotracheal intubation anesthesia after induction with thiopental followed by 1 µg/kg fentanyl. Intubation was facilitated by atracurium, which when further needed was given in incremental doses.

Surgical technique

Laparoscopic cholecystectomy was performed by a surgeon experienced in laparoscopic surgery, with the following modifications of the surgical technique:

- Use of nitrous oxide as the insufflating gas instead of carbon dioxide.
- The intraabdominal pressure was set at a maximum of 11 mmHg instead of the usual 14 mmHg.
- All trocars were sited below the level of the umbilicus.
- Gentle surgical manipulation was employed, especially near the diaphragm and the pylorus to minimize shoulder pain and vomiting, respectively.

Operative time was recorded. Conversion, either surgical from laparoscopic to open technique or anesthetic from spinal to general anesthesia, was recorded. The patients were followed postoperatively regarding pain or discomfort, vomiting, oral feeding, and postoperative stay. Each patient was asked at the time of discharge to rank his or her satisfaction with the procedure on a score from 0 to 10.

Results

A total of 10 patients (6 males and 4 females) underwent laparoscopic cholecystectomy under spinal anesthesia. The mean age was 39.3 years (range, 24–56 years). In 9 patients, the operations were completed successfully under spinal anesthesia. The actual anesthetic level ranged from T8 to T6 in all patients. One patient experienced pain in the right shoulder and nape severe enough that the patient was converted from spinal to general anesthesia. In this patient, there were extensive adhesions between the anterosuperior surface of the liver and the diaphragm, which made the superior retraction of the liver very difficult and increased the manipulation at the right copula. This was the only patient who experienced vomiting caused by handling of the pylorus, which was near the surgical field due to failure to retract the liver. Four other patients experienced mild temporary discomfort, especially when the copula was manipulated, but they did not ask for conversion and needed only psychological support.

There was no conversion from the laparoscopic to open approach. Nine patients showed adhesions between the gallbladder and omentum, intestine, or abdominal wall. One patient had extensive adhesions between the liver and the diaphragm. The operative time ranged from 24 to 115 min, with a mean of 47.4 min. Postoperatively, all patients experienced mild pain after fading of the analgesic effect of the spinal anesthesia and

were given only nonnarcotic analgesics. None of them suffered from vomiting or nausea postoperatively. Oral feeding was resumed on the day of operation for all patients. The hospital stay ranged from 11 to 26 h, with a mean of 18.8 h, and three patients were discharged on the day of the operation.

One patient was cirrhotic and positive for hepatitis C, with elevated liver transaminases. The postoperative liver functions showed no deterioration. Another patient was lactating, and she was able to resume lactation immediately after surgery.

Nine patients considered the operation under spinal anesthesia as highly satisfactory, with scores ranging from 8 to 10. However, the patient who needed anesthetic conversion considered spinal anesthesia as unsatisfactory.

Discussion

Laparoscopic cholecystectomy, which is considered a minimally invasive procedure, is performed under general anesthesia. It was found that spinal anesthesia, by causing neuraxial blockade, is associated with not only less postoperative mortality but also fewer other serious complications, such as deep venous thrombosis, pulmonary embolism, pneumonia, respiratory depression, myocardial infarction, and renal failure, if the results were compared to those of general anesthesia [15]. Other authors have concluded that spinal anesthesia can reduce the incidence of postoperative central dysfunction and bronchopneumonia, especially in geriatric patients [14]. Moreover, in another series, spinal anesthesia was associated with lower incidence of postoperative complaints and treatments and a shorter surveillance time compared to general anesthesia [19]. Consequently, spinal anesthesia seems better matched to laparoscopic cholecystectomy than general anesthesia.

To our knowledge, this is the first trial to test the feasibility of performing laparoscopic cholecystectomy under spinal anesthesia. We avoided CO₂ insufflation, because it causes severe irritation to the parietal peritoneum that is perceived by the patient as severe abdominal pain and discomfort if not under general anesthesia [4, 16]. Instead, we used nitrous oxide, which was found to be more comfortable for institution of pneumoperitoneum under local anesthesia [16]. Nitrous oxide was repeatedly used for insufflation with different types of laparoscopic surgery including cholecystectomy without any explosive accidents [1, 4, 18]. Moreover, the risk of explosion of nitrous oxide with laparoscopy was proven to be nonexistent on sound experimental basis by Hunter et al. [7] because of the improbability of using the percentages of gaseous mixture needed to support combustion.

We sited the trocars just below the level of the umbilicus to be covered by the spinal anesthesia. The intraabdominal pressure was maintained lower than 11 mmHg to avoid interference with respiratory movement and to decrease pain referred to the shoulders. The method of spinal anesthesia was intrathecal injection of bupivacain with fentanyl—a combination that was

proved effective with a short-duration laparoscopic procedure [20].

Of the 10 patients, laparoscopic cholecystectomy was performed successfully under spinal anesthesia in 9. However, 1 patient experienced pain severe enough to indicate conversion to general anesthesia. Nine patients considered the procedure under spinal anesthesia highly satisfactory. It might be possible to discharge patients on the same day of the operation, as was the case with 3 of our patients.

We had no acute cholecystitis cases in our series. Acute cases might need more vigorous tissue manipulation, which may initiate discomfort to the patient. On the other hand, the rate of conversion to open surgery is relatively high and may force the anesthetist to convert to general anesthesia. Further studies are needed to elucidate this issue.

We could not find other similar reports with which to compare our results. However, epidural anesthesia with laparoscopic cholecystectomy has been reported twice. In one series, 6 patients with coexisting pulmonary disease were operated on under epidural anesthesia [13]. In another series, 29 patients with chronic obstructive pulmonary disease successfully underwent laparoscopic cholecystectomy under epidural anesthesia [5].

It is safe to conclude that with some surgical modifications, laparoscopic cholecystectomy can be performed satisfactorily under spinal anesthesia, which might be a possible alternative to general anesthesia. However, further comparative studies are necessary before the relative advantages and disadvantages of both anesthetic techniques can be defined.

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