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Review Article

Alternatives to General Anesthesia for Cholecystectomy: A Review

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Abstract

Background: Reports of cholecystectomy under local or regional anesthesia are rare. Nevertheless, it can be a useful tool in selected patients with high risk or unwillingness for general anesthesia. An updated review of the cases published in the medical literature was conducted.

Method: The Medline/PubMed database and the Medical Subject Headings (MeSH) vocabulary were used to search original articles regarding cholecystectomy under local or regional anesthesia. The main terms used for the literature review were: "local anesthesia", "spinal anesthesia", "epidural anesthesia", "nerve block" and "cholecystectomy".

Findings: In regard to local anesthesia, four studies were found with a total of 125 patients in which an open cholecystectomy was performed under local anesthesia plus sedation through a small abdominal incision. Operative duration varies from 40 to 101 minutes. Regarding regional anesthesia 14 studies, all using a laparoscopic approach, were included in our review. The most common complications of this approach were severe shoulder pain (6-55% of patients) and hypotension (5-59% of patients). An inconvenience of all these procedures is the occasional need for conversion into general anesthesia (up to 37%). When reported, patient satisfaction is 100%.

Conclusion: Cholecystectomy under local or regional anesthesia plus sedation can be a safe and feasible procedure in selected patients, when there is a high risk or unwillingness for general anesthesia.

Core Tip

Cholecystectomy is rarely practiced under local or regional anesthesia. However, this practice can be safe and feasible in selected patients with high risk or unwillingness for general anesthesia. An updated review of the medical literature is presented. Regarding local anesthesia, four studies were found totalizing 125 patients operated on through a small open laparotomy. Regarding regional anesthesia, 14 studies, all using a laparoscopic approach, were reviewed, being the most common complications of this approach severe shoulder pain (6-55%) and hypotension (5-59%). An inconvenience of all these procedures is the occasional need for conversion into general anesthesia (up to 37%).

Introduction

Cholecystectomy is a common operation in hospitals worldwide. Surgical options include the current standard Laparoscopic Cholecystectomy (LC) and the older more invasive procedure, the open cholecystectomy. A variant of the latter is the Mini-Open Cholecystectomy (MC), which uses a small incision in order to reach a minimally invasive approach.

Cholecystectomy is usually performed under General Anesthesia (GA). However, it is likely that in suitable patients or in those who are unwilling to have GA or have severe contraindications to narcosis, the gallbladder can be excised under local (LA) or Regional Anesthesia (RA) through a small incision in the first case or using either a MC or a laparoscopic approach in the second. The aim of our study is to present a review of the alternatives to GA for cholecystectomy and to determine its usefulness and feasibility.

Method

The Medline/PubMed database and the Medical Subject Headings (MeSH) vocabulary were used to search original articles regarding cholecystectomy under LA or RA. The main terms for the literature review were: "local anesthesia", "spinal anesthesia", "epidural anesthesia", "nerve block" and "cholecystectomy", all restricted to main MeSH major topic. We also introduced two additional filters: language and article type. We included clinical trials, journal articles, comparative and multicentre studies published in English, Spanish, German and French. The purpose of our review is to provide detailed information about the above-mentioned topic so we did not filter the search results by publication date. We excluded publications regarding the systemic effects of local spinal and epidural administration of local anesthetics or opioids. We also excluded other less invasive

Table 1: Cholecystectomy under local anesthesia.

AUTHOR, DATE OF PUBLICATION	NUMBER OF PATIENTS	ASA SCORE	COMPLICATIONS	CONVERSION TO GENERAL ANESTHESIA	OPERATIVE TIME (minutes)	HOSPITAL STAY	PATIENT SATISFACTION (%)
Largiader F, 1991	8	Not mentioned	Not mentioned	No	Not mentioned	Not mentioned	Not mentioned
Séfiani T, 2004	35	Not mentioned	Not mentioned	13 (37%)	101	Not mentioned	Not mentioned
Tangjaroen & Watanapa, 2007	42	Not mentioned	No	2 (5%)	40	5 days	Not mentioned
Grau Talens EJ et al. 2010	35	Not mentioned	Wound infection (1 patient), wound seroma (2 patients), nausea (3 patients)	13 (37%)	51,1	< 1day (except for 3 patients)	100%

ASA score, conversion rate, complications, duration, hospital stay and patient satisfaction are summarized.

procedures for the management of gallstones such as cholecystostomy, endoscopic and radiological procedures or lithotripsy.

The aim of this review is to present recent achievements and scientific reports about local and regional anesthesia and to summarize the benefits and side effects of this type of anesthesia for cholecystectomy, whereas case reports are isolated cases of particular patients that do not cover overall situation in this field. This is the reason why we did not consider publications of case reports.

Results

Cholecystectomy under local anesthesia

Out of the 26 papers that satisfied our search criteria, we included four studies with a total of 125 patients in this review. From the remaining 22 articles, 20 described wound or peritoneal infiltration with local anesthetics or nerve blocks, one is about analgesia with ketamine and the last one about interpleural catheter technique.

The four papers reviewed describe an open approach using a MC technique through a 4-5 cm incision. Conventional open surgical instruments were used. In one of the studies a cylindrical retractor is used in order to improve visualization. Most patients included in these studies had not had evidence of acute cholecystitis, previous episodes of pancreatitis, obesity or other upper abdominal surgery; there is no mention of patients' ASA score in any of the reviewed articles (Table 1). MC was performed under combination of LA and sedation mainly with fentanile of midazolam.

As shown in table 1, a relatively common trouble of this procedure is the need for conversion to GA. The conversion rate is detailed in table 1 for all the articles included in the review. The complications rate of cholecystectomy under LA is not always described (Table 1).

As reported by Tangjaroen et al. [1], as well as by Grau Talens et al. [2], open MC under LA was a relatively short procedure of 40 and 51.1 minutes respectively with shorter duration than LC, while Séfiani et al. [3], report an average surgical time of 101 minutes (Table 1). Similarly, satisfactory results are reported in regard to hospital length of stay: less than one day (Grau Talens et al. [2],). In the study of Tangjaroen et al. [1], hospital length of stay was longer due to special characteristics of the operated population (Table 1). Patient satisfaction was evaluated only in the study of Grau Talens et al. [2], reporting full patient's satisfaction (Table 1).

Cholecystectomy under spinal anesthesia

Fifteen articles satisfied our initial search criteria. Two studies considering, as a main topic, vector cardiography and factors influencing mortality in gallbladder surgery under spinal anesthesia, were excluded from the review. Similarly, another two articles

Table 2: Cholecystectomy under spinal anesthesia.

AUTHOR, DATE OF PUBLICATION	NUMBER OF PATIENTS	ASA SCORE	COMPLICATIONS/ SIDE EFFECTS	CONVERSION TO GENERAL ANESTHESIA	MEAN OPERATIVE TIME (minutes)	HOSPITAL STAY	PATIENT SATISFACTION (%)
Hamad MA et al, 2003	10	Not mentioned	**Intraoperative**: severe right shoulder and nape pain (1 patient, 10%), vomiting (1 patient, 10%), mild discomfort (4 patients, 40%). No **postoperative** complications	1 case	47	24 hours	High (80%), moderate (13%), dissatisfied (7%)
Tzovaras G. et al, 2006	15	I and II	**Intraoperative**: Severe shoulder pain (2 cases, 13%), nausea (1 case, 7%), mild shoulder pain (1 case, 7%), abdominal discomfort (1 case, 7%). **Postoperative:** urinary retention (1 case, 7%), nausea and vomiting (4 cases, 27%)	0 cases	47,4	18,8 hours (mean)	High (90%), low (10%)
Van Zundert AAJ et al, 2007 NOTE: Combined spinal-epidural anesthesia	20	I and II	**Intraoperative**: hypotension (2 patients, 10%), shoulder pain (5 patients, 25%), abdominal discomfort (1 patient, 5%), anxiety (2 patients, 10%) **Postoperative:** shoulder pain (2 patients, 10%)	0 cases	60	<24hours (17patients), >24hours (3 patients)	High (100%)
Yunus NY et al, 2008	29	I and II	**Intraoperative**: hypotension (17 patients, 59%), severe shoulder pain (16 patients, 55%). No **postoperative** complications	3 cases	46	24 hours	High (100%)

Tzovaras G et al, 2008	50	I and II	**Intraoperative**: hypotension (29 patients, 58%), severe shoulder pain (10 patients, 20%), mild or moderate shoulder pain (11 patients, 22%). **Postoperative:** urinary retention (3 cases, 6%), urinary tract infection (1 case, 2%), nausea and vomiting (7 cases, 14%), pruritus (1 case, 2%)	0 cases	45	at 24hours (48 patients), >24hours (1 patient)	"the vast majority of patients reported being satisfied"
Sinha R et al, 2009[1]	3492	Not mentioned	**Intraoperative**: hypotension (700 patients, 20%), shoulder or neck pain (429 patients, 12%). **Postoperative:** nausea and vomiting (80 cases, 2%), postural headache (206 cases, 6%)	18 cases	Not mentioned	Not mentioned	98.6% satisfaction level, (Kernofsky's performance status)
Gautam B, 2009[2]	20	I and II	**Intraoperative**: shoulder pain (2 patients, 10%), anxiety (2 patients, 10%) hypotension (1 patient, 5%) **Postoperative:** vomiting (1 patient, 5%), headache (1 patient, 5%) urinary retention (1 patient, 5%)	1 case	Not mentioned	≤ 48 hours (11 patients)	Very good
Imbelloni LE et al, 2010	34	I and II	**Intraoperative**: hypotension (14 patients, 41%) shoulder pain (16 patients, 47%), nausea and vomiting (1 patient, 3%) **Postoperative:** nausea and vomiting (1 patient, 3%), shoulder pain (2 patients, 6%)	1 case (excluded from the analysis)	62,9	24 hours	Great satisfaction (100%)
Bessa SS et al, 2010[3]	60	Not mentioned	Not mentioned	0 cases	Not mentioned	Not mentioned	93.3% considered the technique "very well"
Bessa SS et al, 2012	86	I and II	**Intraoperative**: severe shoulder pain (20 patients, 23%), mild shoulder pain (8 patients, 9%) hypotension (29 patients, 34%). **Postoperative:** nausea and vomiting (6 patients, 7%), headache (3 patients, 3%), urine retention (1 patient, 1%), wound sepsis (4 patients, 5%)	4 cases (excluded from the analysis)	35	<24hours (86 patients)	High (100%)
Manoranjan K et al, 2011[4]	291	Not mentioned	**Intraoperative:** right shoulder pain (90%) hypotension (36 patients, 12%), **Postoperative:** headache (5 patients, 2%), low back pain (no number mentioned), wound exudate (12 patients, 4%)	2 cases	39,6	72 hours	Satisfied (100%)

ASA score, complications (severe shoulder pain was the main reason for conversion to general anesthesia), operation time, hospital stay and patient satisfaction are summarized.

regarding cholecystectomy with combined spinal/general anesthesia also were excluded. Finally, 11 studies with a total number of 4107 patients were included in the present review.

Most of these reports included patients ASA score. All patients were in ASA I or ASA II groups (Table 2). With this anesthetic technique, severe shoulder pain was the main reason for conversion to GA, reported in 7 out of 11 studies with a total number of 30 patients (Table 2). The most common complications of cholecystectomy under spinal anesthesia were severe shoulder pain (6-55% of patients) and hypotension (5-59% of patients; Table 2). Less common complications were nausea and vomiting, urinary retention, headache, anxiety and wound infection (Table 2).Variables like operation time and hospital stay, assessed in most studies are summarized in table 2. In general, patient satisfaction from the anesthetic and surgical procedure was high, reaching 100% in some studies (Table 2).

Cholecystectomy under epidural anesthesia

Out of five studies, that satisfied our search criteria, two studies were discarded due to administration of combined epidural/general anesthesia. Data about patient physical status and complications/side effects are summarized in table 3. Here, the most frequent side effect was again shoulder pain (23-48% of patients). Length of operation, time of discharge and patient satisfaction are detailed in table 3.

In both, epidural and spinal groups, the surgical technique was a conventional LC using CO2 pneumoperitoneum. The majority of patients included in all these studies (LA and RA) had not had evidence of acute cholecystitis, previous episodes of pancreatitis or other upper abdominal surgery. No data about obesity or other comorbidities were reported.

Table 3: Cholecystectomy under epidural anesthesia.

AUTHOR, DATE OF PUBLICATION	NUMBER OF PATIENTS	ASA SCORE	COMPLICATIONS/ SIDE EFFECTS	CONVERSION TO GENERAL ANESTHESIA	MEAN OPERATIVE TIME (minutes)	HOSPITAL STAY	PATIENT SATISFACTION (%)
Hamad MA et al, 2003	10	Not mentioned	**Intraoperative**: severe right shoulder and nape pain (1 patient, 10%), vomiting (1 patient, 10%), mild discomfort (4 patients, 40%). No **postoperative** complications	1 case	47	24 hours	High (80%), moderate (13%), dissatisfied (7%)
Tzovaras G. et al, 2006	15	I and II	**Intraoperative**: Severe shoulder pain (2 cases, 13%), nausea (1 case, 7%), mild shoulder pain (1 case, 7%), abdominal discomfort (1 case, 7%). **Postoperative:** urinary retention (1 case, 7%), nausea and vomiting (4 cases, 27%)	0 cases	47,4	18,8 hours (mean)	High (90%), low (10%)
Van Zundert AAJ et al, 2007 NOTE: Combined spinal-epidural anesthesia	20	I and II	**Intraoperative**: hypotension (2 patients, 10%), shoulder pain (5 patients, 25%), abdominal discomfort (1 patient, 5%), anxiety (2 patients, 10%) **Postoperative:** shoulder pain (2 patients, 10%)	0 cases	60	<24hours (17patients), >24hours (3 patients)	High (100%)
Yunus NY et al, 2008	29	I and II	**Intraoperative**: hypotension (17 patients, 59%), severe shoulder pain (16 patients, 55%). No **postoperative** complications	3 cases	46	24 hours	High (100%)
Tzovaras G et al, 2008	50	I and II	**Intraoperative**: hypotension (29 patients, 58%), severe shoulder pain (10 patients, 20%), mild or moderate shoulder pain (11 patients, 22%). **Postoperative:** urinary retention (3 cases, 6%), urinary tract infection (1 case, 2%), nausea and vomiting (7 cases, 14%), pruritus (1 case, 2%)	0 cases	45	at 24hours (48 patients), >24hours (1 patient)	"the vast majority of patients reported being satisfied"
Sinha R et al, 2009[1]	3492	Not mentioned	**Intraoperative**: hypotension (700 patients, 20%), shoulder or neck pain (429 patients, 12%). **Postoperative:** nausea and vomiting (80 cases, 2%), postural headache (206 cases, 6%)	18 cases	Not mentioned	Not mentioned	98.6% satisfaction level, (Kernofsky's performance status)
Gautam B, 2009[2]	20	I and II	**Intraoperative**: shoulder pain (2 patients, 10%), anxiety (2 patients, 10%) hypotension (1 patient, 5%) **Postoperative:** vomiting (1 patient, 5%), headache (1 patient, 5%) urinary retention (1 patient, 5%)	1 case	Not mentioned	≤ 48 hours (11 patients)	Very good
Imbelloni LE et al, 2010	34	I and II	**Intraoperative**: hypotension (14 patients, 41%) shoulder pain (16 patients, 47%), nausea and vomiting (1 patient, 3%) **Postoperative:** nausea and vomiting (1 patient, 3%), shoulder pain (2 patients, 6%)	1 case (excluded from the analysis)	62,9	24 hours	Great satisfaction (100%)
Bessa SS et al, 2010[3]	60	Not mentioned	Not mentioned	0 cases	Not mentioned	Not mentioned	93.3% considered the technique "very well"
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Manoranjan K et al, 2011[4]	291	Not mentioned	**Intraoperative:** right shoulder pain (90%) hypotension (36 patients, 12%), **Postoperative:** headache (5 patients, 2%), low back pain (no number mentioned), wound exudate (12 patients, 4%)	2 cases	39,6	72 hours	Satisfied (100%)

ASA score, complications, operation time, hospital stay and patient satisfaction are summarized.

Discussion

Surgical options for gallbladder removal include the standard laparoscopic procedure and the open cholecystectomy. A variant of the latter is MC, which was first described more than three decades ago by Dubois et al. [4] and since then it has proved favorable results [5-7]. It uses a small incision of 4-5 cm in order to reach a minimally invasive approach and it can be performed using local anesthetics.

More than 2,000 cases of MC have been reported worldwide without any deaths or major common bile duct injuries since the first report in 1982 [8-11]. Although three randomized controlled trials showed better results for LC than MC with gallbladders that were not acutely inflamed, in terms of shorter hospital length of stay, reduced postoperative analgesic requirements or earlier return to normal activities, a more recent study from Majeed et al., [9] showed that LC took longer to be performed than MC and did not have significantly better recovery. It is therefore reasonable to conclude that the two procedures have been accepted as effective minimally invasive surgical procedures for non acute gallbladder disease. However, none of these reports involved surgery under LA.

The studies analyzed in this reviewed report good surgical results, with low rate of complications [10-14]. However, conversion to GA can be required when LA or RA does not allow completion of surgery; therefore patients must be well informed about this possibility. Most patients included in the studies were selected and had low anesthetic risk. Most of them had not had cholecystitis, pancreatitis or obesity. Patients with these complications were excluded to minimize the possibility of conversion to GA. The different authors agree that a careful preoperative patient selection is essential to obtain benefits from these alternatives anesthetic techniques.

From our review, it can be inferred that the main utility of these alternative anesthetic techniques is to satisfy the patient's preference when there is unwillingness of GA. Furthermore, in some cases, LA or RA may be advantageous for the management of high anesthetic risk patients to avoid some of the drawbacks of GA. In this regard, it should be emphasized that the practice of cholecystectomy under a type of anesthesia different than GA, should always respond to a joint decision between anesthesiologist and surgeon, with the patients agreement and consent. Even in those cases of patients operated on under LA, the participation of the anesthesiologist is essential for i) sedation ii) vital signs monitoring and maintenance of the patient, and iii) to anticipate the ever-present possibility of conversion to GA.

LC has traditionally been performed under GA. However, owing in part to the advancement of surgical and anesthetic techniques, quite a few laparoscopic cholecystectomies have been successfully performed under a loco-regional anesthetic technique. No report of LC performed under LA has been found in our review. RA for LC may be considered to have some advantages as compared to GA. Patients are awake and oriented at the end of the surgery and have less postoperative pain, nausea and vomiting. Problems related to GA, such as oral and teeth injury during laryngoscopy, as well as sore throat and gastric distention, as a result of mask ventilation, might be avoided with RA [13]. However, there are some specific drawbacks that can occur when using these techniques.

At operation, the blood pressure may draw below the normal limits. This is a well-known adverse effect of spinal and epidural anesthesia covering the thoracic dermatome level, and is easily controlled with ephedrine administration. Similarly, referred shoulder pain due to diaphragmatic irritation from carbon dioxide pneumoperitoneum has also been described in the studies as a significant intraoperative event that occasionally has required conversion to GA [14-17]. Some authors consider that the absence of a nasogastric tube may favor the appearance of shoulder pain. As suggested in previous studies, using nitrous oxide [13], gentle surgical manipulation [17], nasogastric tube insertion for gastric decompression [18], irrigation of the right diaphragm with 2% lidocaine solution [19], phrenic nerve block and NSAID administration [20,21] may help to prevent shoulder pain.

One important problem of LC under RA is inadequate relaxation of wall abdominal muscles [19]. This problem may result in great difficulties for completing the operation depending on surgeon's abilities. Moreover, in relation to this, patient respiratory difficulty may appear. In our review, there is a relation of respiratory insufficiency with increased intra-abdominal pressure. Concerning the status of respiratory function parameters during LC under RA, there is no agreement among different authors and conflicting results are reported. A study reported a significant arterial blood gas alteration during epidural anesthesia [13], while in another study PaCO2 was maintained within the normal range by increasing the ventilation rate without causing respiratory depression [22]. Ventilation had to be increased by an average of 30% during cholecystectomy with spontaneous breathing under epidural anesthesia. Intermittent positive pressure ventilation for maintenance of normocarbia is important to prevent arrhythmias [23]. While practicing a cholecystectomy under LA or RA, it is essential to keep in mind that respiratory problems can occur.

Common complications after GA, like postoperative nausea and vomiting, are less common using local or regional anesthetic procedures [17]. However, postoperative urinary retention is known to be related to RA with rates of up to 20% in some series [24]. All the studies included in our review have important limitations, particularly in regard to patient selection. In some studies, only favorable patients with low ASA score were included [26]. Others include patients with severe accompanying diseases, claiming that these patients may benefit from regional anesthetic techniques [13]. Although the American Society of Anaesthesiologists' (ASA) classification of physical health is a widely used grading system for preoperative health of the surgical patients and one of the strongest predictors of intra- and postoperative complications, there is no reference to patients' ASA score in any of the LA revised articles. Similarly, cholecystectomy under LA is claimed by authors to be an operation with fewer complications than its GA counterpart, although the complications rate is not always described (Table 1).

All studies conclude that LA or RA is feasible and may benefit patients who are unwilling to have GA or who have a contraindication to narcosis [28-34]. Therefore, in suiTable patients who do not desire to have GA or present a high anesthetic risk, the gallbladder can be safely excised by a LC under RA or even, under LA, through a very small abdominal incision. Minimally invasive surgery combines patient satisfaction with cost-saving policies. In this sense, good results in terms of hospital length of stay can be expected according to some reports.

Conclusion

Cholecystectomy under local and loco-regional anesthesia can be an effective, safe and feasible surgical procedure for selected patients, when there is a high risk or unwillingness for GA.

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