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Laparoscopic ventral hernia repair in obese patients under spinal anesthesia

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ABSTRACT

Purpose: The aim of the present study was to evaluate the feasibility and efficacy of laparoscopic ventral hernia repair under spinal anesthesia in obese patients (BMI > 30 kg/m^2).
Methods: From January 2007 to February 2010, 23 obese patients had their elective laparoscopic ventral hernia repair under spinal anesthesia. We looked primarily for intra-operative incidences as well as immediate postoperative complications. Long term results and especially recurrences were also to be evaluated.
Results: Median operative time was 55 min (range 20–100). Intraoperatively, six patients (26%) complained of shoulder pain, three patients (13%) developed bradycardia and two (8.7%) hypotension. Postoperatively, nausea and/or vomiting were recorded in four patients (17.4%), four patients (17.4%) experienced urinary retention and one patient developed wound infection. Median pain score at 4th, 8th and 24th postoperative hour was 0.5 (0–5), 1.5 (0–6), and 1.5 (0–5) respectively. The median length of hospital stay was one day (1–2). At a median follow up of 39 months, one patient was diagnosed with a recurrence.
Conclusion: Spinal anesthesia for LVHR in obese patients (BMI > 30 kg/m^2) proved an efficient and safe alternative to general anesthesia in the given patient sample.

1. Introduction

Ventral hernia, both primary and incisional, represents a frequent clinical problem with both open and laparoscopic techniques being used for its repair. Traditionally, the open repair is considered, and not unfairly, as a rather challenging procedure associated with significant morbidity.[1,2] On top of that, studies raise the incidence of recurrence after "simple" repair up to 49%, a figure that however seems to be limited (under 10%) when a prosthetic mesh is used.[3,4] Laparoscopic ventral hernia repair (LVHR) aimed to offer the advantages of minimally invasive surgery in a patient population by definition prone to postoperative complications.[5,6]

Traditionally, obesity has been considered a risk factor for the formation and the repair failure as well rendering obese ventral hernia patients, a rather "explosive" combination, poor candidates for repair. The associated co-morbidities and the increased risk of postoperative wound infection observed in this patient population virtually diminish the possibilities of an uneventful post-repair recovery.[1] Although general is the anesthetic of choice for laparoscopic procedures, the safety and efficacy of performing certain operative procedures such as cholecystectomy, transabdominal preperitoneal inguinal hernia repair (TAPP) and ventral hernia repair laparoscopicaly under spinal anesthesia has already been tested and reported by our team.[7–9]

However, at the fear of technical difficulties with the establishment of the pneumoperitoneum in an alert patient, the cut-off BMI point of 30 or 35 – depending on the trial – was used. Having in mind that ventral hernias occur commonly in overweight patients we deduced that a significant proportion of ventral hernia patients were finally not offered the option of having their ventral repaired laparoscopicaly under spinal anesthesia simply due to the concomitant obesity. Thus, in the present study we tried to expand the use of spinal anesthesia for LVHR in patients with BMI >30 kg/m^2 as well and practically test its efficacy and efficiency. The theoretical basis of this concept was to transmit the benefits of the combination of a minimally invasive surgical procedure (laparoscopic repair) with its anesthetic counterpart (spinal anesthesia) in

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patients at higher risk to develop complications after the "standard" approach (open repair under general anesthesia) i.e. obese patients (BMI > 30 kg/m^2).

2. Methods

Internal board approval and ethics committee permission was obtained prior to the initiation of this prospective study. From January 2007, all ASA I-III class I (BMI > 30 kg/m^2), class II (BMI 30–35 kg/m^2) and class III (BMI > 35 kg/m^2) obese patients, undergoing elective LVHR at the University Hospital of Larissa were offered the option of having their operation performed under spinal anesthesia irrespective of the patients' demographics or the characteristics of the hernia. Table 1. Patients were encouraged to adopt a voluntary low-calorie intake diet combined with regular exercise in the preoperative setting but however, none of the patients was enrolled into a formal intensive preoperative weight loss program. In addition, when appropriate, the option of a definite obesity surgery was discussed. Nevertheless, none of the eligible patients opted for a simultaneous weight loss operation.

Written informed consent was obtained from every patient after the preoperative anesthetic evaluation. Prospectively collected patient's data included age, gender, BMI, ASA status, associated co-morbidities, type of hernia and previous operations. All procedures were performed under the same surgical and anesthetic principles by the same relevant teams and techniques previously described.[9] Regarding spinal anesthesia, with the patient in the right lateral decubitus position, a 25-gauge pencil-point spinal needle was introduced into the subarachnoid space at the L2–L3 intervertebral space, under aseptic conditions. After free flow of cerebrospinal fluid was obtained, 3 ml of hyperbaric bupivacaine 0.5%, 0.25 mg of morphine, and 20 μg of fentanyl were injected intrathecally. Dosages were fixed and common in all cases. Subsequently, the degree and extent of nerve block was assessed with sequential neurological response tests. Table manipulations i.e. Trendelenburgh and reverse Trendelenburgh were used appropriately to achieve the desired extend/height of the anesthesia. Patients were continuously monitored during the operation both clinically and hemodynamically. The experience in regional anesthetic techniques of the anaesthesiologists' involved in the study practically rendered the use of auxiliary equipment for the completion of the block such as ultrasound unnecessary. All spinal anesthetic procedures were performed in the operating room.

After the induction of the analgesic and anesthetic effect of spinal anesthesia, usually within 5–10 min after the completion of the anesthetic procedure, a CO2 pneumoperitoneum of a maximum pressure of 10 mm Hg was established by the introduction of a 15 cm Veress needle. The type and the characteristics of the hernia determined the site of the needle insertion. We used the left upper quadrant laparoscopic needle entry instead of the standard umbilicus approach in those cases with suspected peri-umbilical adhesions or when the umbilicus was obliviously involved in the hernia. Then, an 11-mm optical trocar was introduced at the umbilical level, usually on the left side (depending on the site and/or size of the hernia) as laterally as possible. Triangulation was achieved as two 5-mm trocars were inserted, the first 7–8 cm cephalad and the second 7–8 cm caudal to the optical trocar. When a large incisional hernia was the case, an additional 5-mm trocar on the opposite side facilitated mesh tacking.

After having any encountered adhesions released with both blunt and sharp dissection the contents of the hernia were reduced with gentle traction. The peritoneal surface of the defect was subsequently cauterized with monopolar diathermy or ultracision (Ethicon Endosurgery®, Cincinnati, OH, USA) to minimize the incidence of postoperative seroma formation. A dual-surface mesh (Dual Mesh Plus®, Gore Flagstone, AZ, USA) of the appropriate dimensions to ensure coverage of at least 4 cm, preferably 5 cm, beyond the circumferential margin of the abdominal wall defect was inserted through the optical trocar. The pneumoperitoneum pressure was then reduced to 8 mm Hg and the mesh was secured in place using a Protack® device (USSC). Transfacial sutures were not used. No drain was used in any of the procedures. Finally, a self-adhesive bandage was used to compress externally the skin/subcutaneous tissue for the following 5–7 days.

We recorded the operative time, the type and size of the mesh used for the hernia repair. Any intraoperative incidents, especially those related to the method of anesthesia and/or the pneumoperitoneum such as changes in the cardiopulmonary function and/or hemodynamic status, shoulder pain, discomfort, nausea, etc. were also recorded. The patients were encouraged to ask for conversion of the anesthesia throughout the procedure if they felt so.

demographics.Postoperative analgesia was standardized (40 mg parecoxib sodium twice a day iv and 500 mg paracetamol tabl every 6 h per os). Antibiotic chemoprophylaxis was not routinely used and only patients who required a Foley catheter received a single dose of a second generation cephalosporin. On the other hand, all patients received low molecular weight heparin (Enoxaparin sodium 40 mg/daily) subcutaneously for deep vein thrombosis prophylaxis. Patients were allowed to get mobilized late in the afternoon after the procedure; they were given a light diet and were discharged the next morning unless a complication had supervened. The Visual Analogue Scale (VAS) was used in order to assess postoperative pain at the 4th, 8th and 24th postoperative hour. Additionally, we looked for immediate postoperative complications such as seroma, hematoma, or infection.

All patients were followed 10–15 days after the operation as outpatients, in order that early complications such as seroma, hematoma, infection as well as the degree of patient's satisfaction from the procedure could be assessed. Thereafter, they were clinically assessed as outpatients 6 and 12 months postoperatively. They were also contacted at the time of data collection for the preparation of this paper (January 2012) by phone interview in order to update the follow-up data regarding the long-term results, especially recurrences. When a doubt arose, a clinical examination at the outpatient clinic was scheduled.

Table 1
Patient's

Total number of patients	23
Age (mean ± standard deviation)	55.3 ± 13.5 (Range 28–75)
Gender (male:female)	10:13
BMI (kg/m^2 – mean ± standard deviation)	36.09 ± 5.61 (Range 30–51)
ASA (I–IV – mean ± standard deviation)	1.96 ± 0.77 (Range 1–3)

3. Results

From January 2007 to February 2010, twenty-three (23) ASA I–III patients (ASA I: 7 patients, ASA II: 10 patients and ASA III: 6 patients – Male: Female: 10:13) with a BMI greater than 30 kg/m^2 were included in the study. The patient's demographics and the concomitant morbidities present are shown in Tables 1 and 2 respectively. Regarding the type of the hernia, ten (10) patients had primary umbilical/para-umbilical hernia, six (6) had primary epigastric hernia, seven (7) had incisional hernia, two (2) had more than one aponeurotic defects and finally two (2) patients were operated due to a recurrent incisional hernia.

A laparoscopic mesh-based ventral hernia repair, as previously described, was undertaken in all cases. The median mesh surface area was 190 cm^2 (range 80–408). No conversions were recorder from both the anesthetic and the surgical point of view. The median operative time was 55 min (range 20–100) while regarding the technique itself no major intraoperative complications were recorded. Intra-operatively, shoulder pain requiring intravenous non-steroid anti-inflammatory drugs (NSAIDs) administration was recorded in six (6) patients (26%), three (3) patients (13%) developed bradycardia (defined as heart rate equal to or less than 50 beats/min) successfully reversed with intravenous atropine administration, while two (2) patients (8.7%) developed hypotension (defined as systolic blood pressure lower than 100 mmHg) requiring vasoactive agent administration and fluid overload.

During the immediate postoperative period, nausea and/or vomiting were recorded in four (4) patients (17.4%) treated with intravenous granisetron administration, while four (4) male patients (17.4%) experienced urinary retention requiring the placement of a Foley catheter. None of the patients complained of headache or other spinal related neurologic sequel. Median pain score on the 4th, 8th and 24th postoperative hour was 0.5 (range 0–5), 1.5 (range 0–6), and 1.5 (range 0–5) respectively. The median length of hospital stay was one (1) day (range 1–2) while no operation related readmissions were recorded.

At 2-weeks follow up one (1) patient (4.3%) developed wound infection –cellulitis- treated as outpatient with broad spectrum antibiotics, while two (2) patients developed small seromas requiring no specific treatment. Regarding the assessment of the long term results, two patients (8.7%) were lost to follow up. During a median follow up of 39 months (11–59 months), one (1) patient (4.7%) with primary epigastric hernia was diagnosed clinically with a recurrence some 12 months after the repair. No other late complications were recorded.

4. Discussion

Abdominal wall hernias, both primary and incisional, represent a challenging clinical problem. Approximately 3–10% of

Table 2
Incidence (no. of patients – %) of co-morbidities in the present patient sample.

Co-morbidities	No of patients (%)
Metabolic	
Type 2 diabetes mellitus	5 (21.7%)
Type 1 diabetes mellitus	1 (4.3%)
Cardiovascular	
Arterial hypertension	7 (30.4%)
Ischemic heart disease	2 (8.7%)
Dysrhythmias	1 (4.3%)
Pulmonary	
Chronic obstructive pulmonary disease	4 (17.4%)
Obstructive sleep apnea syndrome	1 (4.3%)

laparotomies result in the formation of an incisional hernia.[4] Predisposing factors include age, wound infection, immunosuppression, morbid obesity, previous operation, prostatism, and surgery of aneurismal disease.[10,11] From the pathology point of view, primary abdominal wall hernias have been associated with diseases of the extracellular matrix.[12] On the other hand, incisional hernias more often involve a combination of both mechanical and biological factors. Generally, laparotomy provokes defects in the process of wound healing by substantially decreasing the extracellular matrix synthesis.[12] However, besides the changes in the molecular level, pure mechanical causes are interfered as well. The increased pressure on the abdominal wall seen in conditions such as the obesity and the chronic obstructive pulmonary disease (COPD) seems to additionally contribute in the process of hernia formation.[13]

Generally, the open repair with mesh placement is the most widely used procedure for the treatment of ventral hernias.[2] By definition, open repair requires significant dissection of tissue usually of poor quality as well as the creation of a cutaneous flap increasing significantly the complication and recurrence rates.[4] Aiming in communicating the advantages of minimally invasive surgery, LVHR had been suggested from reports already in the early 90's. Several studies evaluating the two techniques (open and laparoscopic) suggested that the laparoscopic repair appears superior to open in terms of wound complications and recurrence rates.[2,14–19] However, the limitations of the need for careful patient selection and of the adequate expertise in endoscopic surgery are almost commonly underlined as prerequisites for a successful outcome.[14–19]

The concept of transmitting the benefits of minimally invasive surgery into a ventral hernia patient subgroup of by definition increased perioperative morbidity such as the obese patients seemed attractive. The co-existence – in a possible causative relation – of the two conditions (ventral hernia and obesity) is such high that, by excluding obese patients from the laparoscopic approach, very few patients with ventral hernias would eventually benefit from the well-established advantages of minimally invasive surgery. Indeed, LVHR can be safely performed in obese patients.[20–23] However in this study, we aimed to take LVHR in obese patients' one step forward.

Having proved mainly, the efficacy and safety of spinal anesthesia for laparoscopic cholecystectomy, TAPP inguinal hernia repair and LVHR mainly in non-obese patients,[7–9] we aimed to extend the spectrum and the benefits gained from the use of spinal anesthesia in class I,II and III obese patients undergoing ventral hernia repair. We hypothesized that, if the combination of a minimally invasive surgical technique – laparoscopic repair – with its anesthetic equivalent – spinal anesthesia – works, then extra benefits could be seen particularly on obese patients submitted to ventral hernia repair. The avoidance of general anesthesia along with the avoidance of an open repair in these ventral hernia patients at least sounds as a very attractive perspective.

A thin balance is encountered on the homeostasis of patients of BMI > 30 kg/m^2 summarized in the diminished pulmonary reserves and the distressed cardiovascular system along with the increased cardiac output.[24] The physiologically increased intra-abdominal pressure in obese patients could further complicate the field requiring higher insufflation pressures to achieve adequate exposure.[25] Within this framework, the pneumoperitonium-related effects such as venous stasis, reduced portal vein blood flow, decreased renal perfusion and output are augmented.[25] Spinal anesthesia could possibly makes things easier with the induced abdominal wall muscle relaxation effect i. permitting the completion of the procedure under lower net intra-abdominal pressures ii. achieving optimal repair conditions both for the hernia reduction and the mesh fixation using the laparoscopic tack device as well and ultimately iii. decreasing the impact of the operative stress on an already burdened patient.[26] Although the systematic use of agents that could depress the respiratory system i.e. opiates cannot be precluded even during spinal anesthesia, its use is by definition lower than in general anesthesia.

However, the limitations of regional anesthesia should be carefully considered as well. Even though a successful regional anesthetic allows minimal manipulation of the airway, the potential for airway compromise cannot be eliminated. In addition, the anthropometric changes associated with obesity can make the performance of spinal anesthesia technically difficult. BMI of more than 25 kg/m^2 represents an independent risk factor for block failure.[27] Furthermore, the rate of block failure seems to increase incrementally with BMI.[27] However, the adequate expertise in spinal anesthesia, the use of the proper instrumentation such as longer spinal needles and, when appropriate, the utilization of ultrasound for delineating the anatomy of the region could overcome the difficulties rendering obesity certainly not a contraindication for spinal anesthesia.

Our team, in a previously published study, proved the feasibility of laparoscopic ventral hernia repair under spinal anesthesia generally in non-obese patients. However, in the present study we tried to evaluate the feasibility and efficacy of LVHR under spinal anesthesia in patients with a BMI greater than 30 kg/m^2. All procedures were successfully completed as planned with spinal as the standalone and sole anesthetic method. No conversion of either the anesthetic or the surgical approach was required. The minor intraoperative incidences encountered such as hypotension (8.7%) and bradycardia (13%) could be reasonably attributed to the normal physiologic responses of the anesthetized spinal sympathetic nerve fibers and were easily reversed with the appropriate interventions. As one of the main challenges in this study was to avoid using agents that could further depress the already distressed respiratory system especially of ASA II and III obese patients, we hopefully managed to address complaints of intraoperative pain only with the use of NSAIDs. We additionally recorded postoperative parameters such as immediate postoperative pain (24 h), the incidence of wound infection and the length of hospital stay yielding absolutely acceptable results.

Urinary retention, a common complication after spinal anesthesia, was encountered in (4) four male patients (17.3%) all with known history of prostatism. Despite the fact that the observed urinary retention incidence of 17.3% in the study appears reassuring, the reduction of the result in the male subjects raises the urinary retention incidence to 40% (4 out of 10 male patients). Recently, we have focused our efforts in reducing this dismal complication by altering the composition of the mixture injected intrathecally. The reduction – if not the complete elimination – of morphine has yield really impressive yet anecdotal results.

However, the major fear after any kind of hernia repair is recurrence. Regarding the repair technique itself, we aimed for the

5 cm mesh-abdominal wall circumferential overlap. Although we believe that the placement of transfascial sutures would be feasible from the anesthetic and technical point of view we used nothing but tacks to secure the mesh in place, an approach not far from recent literature reports.[28,29] Only one patient in this series (4.7%) was diagnosed with a recurrence some twelve months after the operation. The observed recurrence rate validated through a follow up period of almost five years (median 39 months) lies well within the reported in the literature.[29] Though, a longer period of observation and a more homogeneous patient sample especially regarding the hernia characteristics (i.e. incisional hernias, size of hernia defect) would be ideal in order to evaluate recurrences more accurately.[30] In this study, according to the study design we do not have any objective data regarding the size of the hernias. However i. as the hernia characteristics was not among the inclusion for the study criteria and ii. because the 4–5 cm circumferential abdominal wall − mesh overlap rule was adopted in all case, an indirect indication of the median hernia defect size can be relatively accurately extracted through the median mesh surface area (190 m^2).

However, a few things should be kept in mind before interpreting the results of the present study. First, the results are expressed without the calibrating effect of a control group. Second, the relatively small number of patients finally included in the study renders generalizations regarding the reported incidence of the parameters studied i.e. postoperative complications, recurrences quite hazardous. Acknowledging the pilot nature of the study, represent the safest way to elicit and highlight only the positive aspects out of this report. In the present study we aimed to establish spinal as a valid anesthetic option for this patient group. Whether spinal is or is not superior to general anesthesia for ventral hernia repair in obese patients is a question that requires further well designed studies to be answered. Within this context, a controlled randomized study of LVHR in obese patients (BMI $>$ 30 kg/m^2) under spinal or general anesthesia is currently designed and standardized in our department in order to provide more solid evidences regarding the actual contribution of spinal anesthesia on the favorable results reported in the present study.

In conclusion, spinal anesthesia for LVHR in obese patients proved an efficient and safe alternative to general anesthesia in the given patient sample.

Ethical approval

Internal board approval and ethics committee permission was obtained prior to the initiation of this prospective study. Medical School of Larissa, University Hospital of Larissa, Greece.

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None.

Author contribution

SD, BI, KG, GS, EA, TG designed the study.
SD, TG, BI, KG drafted the article and analyzed the data.
KG, GS, BI acquired the data.
SD, TG, EA critically revised the article.
All authors approved the final version to be published.

Conflict of interest

Drs. DS, IB, GK, SG, EA and GT have no conflicts of interest or financial ties to disclose.

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