Hernia (2008) 12:367–371
DOI 10.1007/s10029-008-0363-3

ORIGINAL ARTICLE

Limited-conversion technique: a safe and viable alternative to conversion in laparoscopic ventral/incisional hernia repair

A. Sharma · M. Mehrotra · R. Khullar · V. Soni · M. Baijal · P. K. Chowbey

Received: 9 October 2007 / Accepted: 29 February 2008 / Published online: 1 April 2008

Abstract
Background During laparoscopic ventral/incisional hernia repair (LVIHR), conversion to conventional (open) technique is required when safe adhesiolysis is not possible, incarcerated bowel in hernial sac cannot be reduced or for repair of iatrogenic enterotomies. A formal laparotomy in these circumstances entails significant morbidity due to factors such as wound infection, prolonged immobility, and longer hospital stay.
Materials and methods During a period between 1994 and 2007, 1,503 LVIHRs were performed at our centre following a standardized protocol by five consultants and fellows. Out of these, 6 patients had a formal laparotomy in the initial part of our experience and 26 patients had a limited conversion to facilitate completion of LVIHR. We have devised the term "limited conversion" for the procedure wherein bowel reduction/adhesiolysis/enterotomy repair was performed through a small targeted skin incision. This was followed by laparoscopic placement of intraperitoneal mesh.
Results Conversion to an open procedure was required in 32 (2.1%) out of 1,503 LVIHR procedures. Twenty-six patients underwent a limited conversion and completion of the repair by laparoscopy. All but one of these patients had intraperitoneal placement of mesh by laparoscopic route. The wound complication rate was 3.8% (one patient), the mean hospital stay was 2.1 days, and mean operative time was 124 min.
Conclusion Limited conversion offers a safe alternative to a formal laparotomy in patients with bowel incarcerated in hernial sacs or in patients requiring extensive bowel adhesiolysis. Patient morbidity is reduced due to the targeted skin incision whilst retaining several advantages of a minimal access approach viz. laparoscopic evaluation of the entire abdominal wall and placement of a large intraperitoneal prosthesis.

Keywords Laparoscopic incisional hernia repair · Conversion · Enterotomy · Adhesiolysis

A. Sharma (✉) · M. Mehrotra · R. Khullar · V. Soni · M. Baijal · P. K. Chowbey
Minimal Access and Bariatric Surgery Centre,
Sir Ganga Ram Hospital, New Delhi 110060, India
e-mail: a_sharma1@vsnl.com

P. K. Chowbey
e-mail: chowbey1@vsnl.com

Introduction

Safe adhesiolysis is imperative when performing laparoscopic ventral/incisional hernia repair (LVIHR). However, dense adhesions of bowel to the abdominal wall and hernial sac in a patient with incisional hernia are not uncommon and present a challenging situation for a laparoscopic surgeon. The need to avoid an iatrogenic enterotomy is important in view of the need to place a mesh in modern incisional hernia repairs. In some patients, safe adhesiolysis may not be possible laparoscopically due to dense bowel adhesions with the abdominal wall. Also many patients have bowel incarcerated within multiloculated hernial sacs, which cannot be reduced by manipulation laparoscopically.

Limited conversion

Limited conversion is the term used for a limited targeted skin incision over the incisional hernial sac to aid in the safe and effective performance of adhesiolysis, followed by air-tight skin closure and laparoscopic intraperitoneal onlay placement of mesh.

Materials and methods

In a period between 1994 and 2007, 1,503 LVIHRs were performed at the Minimal Access and Bariatric Surgery Centre, Sir Ganga Ram Hospital, New Delhi. During this period, 32 patients required conversion to open surgery. Of these, 6 patients were converted to a formal laparotomy and 26 patients had limited conversion.

Preoperatively patients were investigated on an outpatient basis and were counseled regarding the possibility of conversion to a conventional (open) repair. All operations were performed with the intent of completing the ventral/incisional hernia repair laparoscopically.

Operative technique

The technique of LVIHR involves placement of a prosthetic biomaterial in the sublay position (commonly referred to as intraperitoneal onlay mesh repair).

The operating-room layout was essentially the same as for laparoscopic cholecystectomy. The anesthesia trolley was placed at the head end, the endovision equipment to the right of the patient and the instrument trolley at the foot end of the patient. The operating-room layout was changed for suprapubic hernias, in which case, the endovision equipment was placed at the foot end and instrument trolley to the left of the patient. This was done in accordance with the principle of surgeon, telescope, target area and monitor being located in a straight line for optimal ergonomics. The surgeon stands on the left of the patient with the assistant to his right and the scrub nurse to his left.

The patient was placed supine in Trendlenberg position with left flank raised to make it ergonomically efficient for the surgeon. An orogastric tube was routinely inserted before the initial peritoneal access. A urinary catheter was inserted only for hernias located infraumbilically. The initial access was by a Veress needle puncture. The site of entry was at least 10 cm away from the hernia/previous scar. This technique was used even in patients with multiple scars. The most preferred site for initial access was Palmer's point—a point 2 cm below the left costal margin in the midclavicular line. Alternative sites included the right hypochondrium and the right and left iliac fossae. Generally three trocars were used for small to moderate-sized hernias. However, if required, there was no hesitation in placing additional trocars. Ports were placed in the form of an arc around the hernial defect (triangulation of trocars). At least one 10/12-mm trocar was placed for insertion of the mesh.

Once the appropriate numbers of trocars were introduced into the abdomen, adhesiolysis was commenced. The entire scar and surrounding areas were explored to exclude multiple defects (Swiss cheese defects) and occult hernias. Adhesiolysis was performed for at least 5 cm around the hernial defects and the previous scar using cold scissors. In most patients there existed an avascular plane between the abdominal wall and viscera, which was accessed and developed for adhesiolysis. For dense bowel adhesions the parietal peritoneum was incised around the adhesions to avoid accidental enterotomy. For the reduction of bowel, atraumatic bowel graspers were used.

A decision to perform a limited conversion was made when there were dense adhesions of the bowel to the hernial sac (Fig. 1), adhesiolysis was deemed to be unsafe laparoscopically, or when the surgeon was unable to reduce incarcerated bowel from the hernial sac. The laparoscopic instruments were removed, however the ports were kept in place to retain pneumoperitoneum before the incision as this helped offer safe access by isolating the underlying viscera from the abdominal wall. For limited conversion, an incision of approximately 7–8 cm was made over the skin adjacent to the area with dense adhesions (Fig. 2).

Adhesiolysis was performed with conventional instruments (Fig. 3). The dissection in this way proceeded under direct vision following conventional techniques for adhesiolysis and to reduce incarcerated bowel loops in hernial sacs, which were often multiloculated. The bowel loops dissected by the laparoscopic route were also examined. Over-sewing of suspicious areas of bowel was performed and completeness of the adhesiolysis was checked by the operator by sweeping a finger all around the hernial defect. The abdominal wall was closed in an airtight fashion to avoid loss of pneumoperitoneum during subsequent

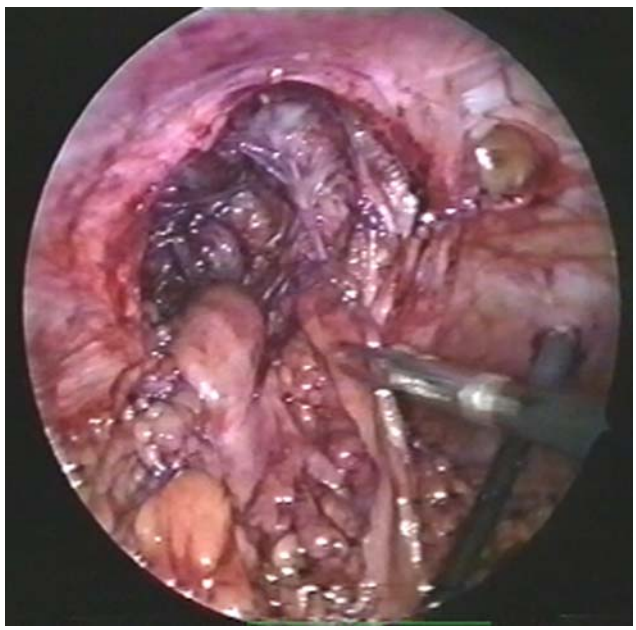

Fig. 1 Bowel loops entering the hernial sac and adherent to the previous scar

Fig. 2 Targeted skin incision for adhesiolysis and reduction of adherent bowel

Fig. 3 Dissection of hernia contents using conventional methods

laparoscopic mesh placement. No dissection was performed in subcutaneous planes, and no attempt was made to approximate the muscles or to do a formal tissue repair. The purpose of the incision was only to facilitate safe adhesiolysis and bowel reduction from the hernial sac by avoiding an enterotomy and also to recognize an inadvertent enterotomy. Pneumoperitoneum was recreated after closure of the incision (Fig. 4).

After adequate laparoscopic delineation of all defects and the previous scar, the size of the mesh required was assessed. Assessment of the hernial defect was done by

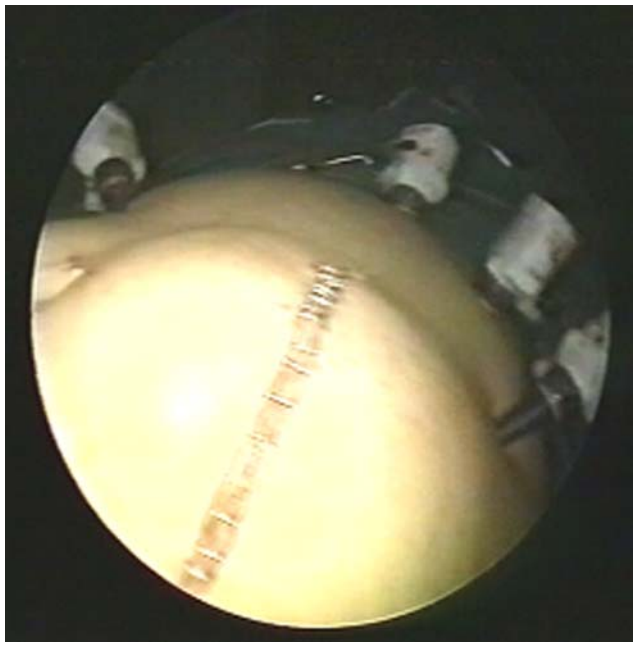

Fig. 4 Closure of skin incision for laparoscopic accomplishment of the repair

direct measurement of the largest diameter of the hernial defect as measured intra-abdominally, during laparoscopy. To the measured size of the defect, 5 cm was added in all directions to provide for overlap. The mesh configuration and site for four transfascial sutures were marked on the abdominal wall. A percutaneous centering suture was passed intra-abdominally through the skin over the midpoint of the hernial defect and was retrieved through the 10/12-mm port, which was to be used for the insertion of the mesh. The suture was then tied to the center of the mesh. The mesh was rolled and inserted through the same 10/12-mm port. All necessary precautions were taken to avoid contamination of the mesh with skin pathogens by avoiding contact of the mesh with the abdominal wall of the patient. The meshes used in all cases were either DualMesh (WL Gore and Associates, Flagstaff, AZ, USA) in 20 patients or Proceed (Ethicon, Somerville, NJ, USA) in 6 patients. Transfascial sutures were taken at the previously marked sites through a stab incision with the help of a fascia closure needle. The mesh was additionally fixed with the help of a fixation device (ProTack—Autosuture/US Surgical, Norwalk, CT, USA).

Post-operatively the patients were encouraged to ambulate as soon as they recovered from the effects of anesthesia. The patients were discharged when the pain was controlled with oral nonsteroidal anti-inflammatory drugs (NSAIDs). All patients were advised to wear abdominal corsets for 2 months post-operatively.

The patients were followed up at 7 days, 3 months and yearly thereafter.

Results

Out of 1,503 LVIHRs performed between 1994 and 2007, limited conversions were performed in 26 patients (females 18, males 8). All patients who had a limited conversion had incisional hernias. The reasons for conversion are shown in Fig. 5. Twenty-one patients had previous lower midline abdominal incisions, three patients had an upper midline incision, and one patient had a right subcostal incision. One patient had herniation of bowel into the anterior mediastinum, which was inaccessible by laparoscopy and hence approached by a small target incision. This patient had a post-coronary artery bypass graft wound dehiscence and osteomyelitis of the sternum following which the sternum was excised leaving a defect connecting the abdominal cavity with the anterior mediastinum.

All patients except one had placement of a mesh laparoscopically after closure of the limited-conversion incision. In one patient there was a large enterotomy and gross spillage of bowel contents and a decision was taken to repair the hernia laparoscopically at a later date.

The mean operative time was 124 min, and the mean operative blood loss was 90 ml. The patients were given visual analogue scales to grade the severity of pain in the post-operative period. The patients were discharged only when the pain was controlled with oral NSAIDs. The mean hospital stay was 2.1 days, which was comparable to our overall average hospital stay of 1.9 days for laparoscopic ventral incisional hernia repair patients.

Three patients developed seromas, all of which had resolved on conservative management at 3 months. Chronic pain was observed in four patients, one patient had deep vein thrombosis, and another patient developed superficial wound infection.

The mean follow-up was 4.3 years (8 months to 9.4 years). There was one recurrence in an obese (BMI: 42 kg/m^2) female patient, 10 months after the surgery.

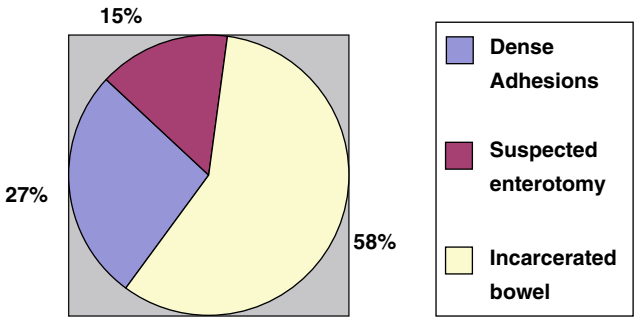

Fig. 5 Reasons for limited conversion

Discussion

Given the formidable recurrence rate of incisional hernia after conventional (open) hernia repairs, laparoscopic repair appears to be the technique of choice for repairing ventral/incisional hernias. Patients with incisional hernia usually have higher BMI than the average population and thus the incidence of perioperative complications is expected to be higher. Limited conversion decreases the operative time for the procedure, more importantly the period of exposure to pneumoperitoneum, which may be critical for patients with cardiovascular or respiratory comorbidities.

Laparoscopy has its limitations in difficult situations, such as incarcerated or obstructed incisional hernias where it may not be possible to reduce the bowel under direct vision. At times it is not possible to perform adhesiolysis around the hernial defect, and any manipulation of adherent bowel loops carries the risk of an inadvertent enterotomy. Incision at the neck of the hernial sac laparoscopically is not safe in close proximity to the bowel. In these circumstances a small targeted skin incision for reduction of hernia contents may be preferable to laparoscopic manipulation.

An enterotomy, in most circumstances, precludes the placement of a bioprosthesis, which is a prerequisite in modern incisional hernia repair. Limited-conversion technique helps by facilitating safe and quick adhesiolysis and allowing placement of the mesh during the same procedure. Apart from minimizing risk of enterotomy, this technique may be used for suture of enterotomies occurring inadvertently during adhesiolysis [1]. It can be especially useful for operators not skilled in endosuturing.

There is evidence in the literature to suggest that, due to the risk of a missed enterotomy in LVIHR, the risk-benefit ratio for this procedure may be high during the learning curve, when compared to open ventral/incisional hernia repair [2]. Another study suggests that the incidence of major complications such as a missed enterotomy is higher in the initial cases and can be disappointing for a surgeon in the learning curve [3]. Limited conversion also provides the opportunity for recognition of a missed enterotomy as the entire adhesiolyzed bowel can be brought out through the targeted incision and examined.

The laparoscopic approach used in this combined approach offers several benefits over a complete conversion to open technique. These include detection of occult hernias, placement of a larger prosthesis, decreased wound and mesh infection, and shorter hospital stay for the patient. All these advantages of the minimal access approach are retained in the limited-conversion technique. In this era of minimal access surgery, it is perhaps apt to suggest optimal utilization of the two approaches—the "open"/conventional

and the minimal access approach, to derive the best outcome for the patient. This technique can also serve as a bridge between the open and laparoscopic approach for surgeons during their learning curve.

Apart from the advantage of safe and quick adhesiolysis, limited conversion can also facilitate in improving the cosmetic outcome for the patient. The incision can be made to excise redundant skin/ill-formed scar thus leading to improved patient satisfaction as has been reported by Neff et al. [4] and Ng [5]. However, in an attempt to completely revise the previous scar there might be extensive dissection. This will negate the advantage of a shorter hospital stay and early mobilization, which are retained in the limited-conversion technique.

The occurrence of a single incidence of superficial wound infection in our series draws attention to the possible risk of increased wound-related morbidity as compared to the total laparoscopic approach. Furthering the above concern one may expect a higher incidence of mesh infection also. In our series there was no contact of the mesh with the skin of the abdominal wall of the patient prior to its insertion in the abdominal cavity. This may explain the absence of mesh infection in our series. Unlike Neff et al. [4], we strongly believe that the mesh should be inserted through the laparoscopy port and not through the wound itself as this may lead to contamination of the mesh by skin pathogens. In patients with no skin redundancy, a limited-conversion incision can lead to an inferior cosmetic outcome for the patient.

Conclusion

Limited-conversion technique offers the surgeon a method of overcoming the problem of incarcerated bowel and dense adhesions during surgery. It provides the unique opportunity to avoid, exclude, and repair an iatrogenic enterotomy in patients requiring extensive bowel manipulation and difficult adhesiolysis. Patient morbidity is reduced due to the targeted skin incision whilst retaining several advantages of a minimal access approach viz. laparoscopic evaluation of the entire abdominal wall and placement of a large intraperitoneal prosthesis.

References

1. Eitan A, Bickel A (2002) Laparoscopically assisted approach for postoperative ventral hernia repair. J Lap Adv Surg Tech 12(5):309–311
2. Salameh JR, Sweeney JF, Graviss EA, Essien FA, Williams MD, Awad S, Itani KM, Fisher WE (2002) Laparoscopic ventral hernia during the learning curve. Hernia 6(4):182–187
3. Barbaros U, Asoglu O, Seven R, Erbil Y, Dinccag A, Deveci U, Ozarmagan S, Mercan S (2007) The comparison of laparoscopic and open ventral hernia repairs: a prospective randomized study. Hernia 11(1):51–56
4. Neff M, Cantor B, Geis WP (2005) Laparoscopic-assisted primary repair of a complicated ventral incisional hernia. JSLS 9:241–244
5. Ng JW (2004) A case of small Spigelian hernias successfully treated by a simple laparoscopy-assisted technique. Surg Laparosc Endosc Percutan Tech 14(5):300–333