

Transumbilical Single-Port Laparoscopic Cholecystectomy

Colecistectomia Single-Port Laparoscópica

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ABSTRACT

Objectives: The well-established advantages of the laparoscopic approach have enabled this procedure to gain rapid worldwide acceptance. With advances in the field of minimally invasive surgery, single-incision laparoscopic surgery (SILS) was developed with the aim of reducing the invasiveness of traditional laparoscopy. The authors propose a single-incision laparoscopic (SILS) cholecystectomy as a step toward less invasive surgical procedures. We report a series of transumbilical single-port cholecystectomies performed with only a single umbilical scar. **Methods:** Transumbilical single-port cholecystectomies performed with three 5mm to 10mm incisions through the umbilicus and the introduction of three standard laparoscopic trocars through this one incision. The operative technique, along with the results of the first 11 patients operated in this way is described. **Results:** Eleven women with a mean age of 47 underwent the technique. Mean operative time was 74 min. Few complications were recorded after 30 days. One patient developed a local umbilical granuloma. Analgesic use was limited to first 24 hours. Cosmetic result was satisfactory in all cases. **Conclusion:** Transumbilical endoscopic surgery is feasible, safe and effective; and constitutes another option for scarless abdominal surgery.

Key words: Single Port Surgery, Single Access Surgery, Laparoscopy, Natural orifice surgery; NOTES; Cholecystectomy, SILS, LESS, SPA.

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INTRODUCTION

Cholecystectomy, the procedure most frequently performed laparoscopically worldwide, has been recognized since 1992 as the gold standard procedure for gallbladder removal. The well-established advantages of the laparoscopic approach have enabled this procedure to gain rapid worldwide acceptance. These advantages include better cosmetic results, less postoperative pain, and shorter recovery time than with open cholecystectomy. Increasingly, as suggested by the growing number of case reports, patients are asking surgeons to be operated without external scars.

The introduction of natural orifice transluminal endoscopic surgery (NOTES) has enabled the

treatment of digestive diseases such as acute appendicitis and gallstones, and even the creation of some kinds of fundoplication by means of a flexible scope (with multiple instruments) introduced through the stomach, rectum or vagina. This approach has opened a new surgical frontier in which the patient is operated on with less pain, less discomfort, and even without any scar.¹⁻⁸

Single-access or single-port surgery holds the promise of advancing minimally invasive surgical techniques to the next frontier with the use of only a single laparoscopic incision or multiple incisions that are placed within a single site such as the umbilicus to eliminate any visible abdominal scars. For example, rather than performing a laparoscopic

cholecystectomy through the conventional four laparoscopic trocars, the procedure would be performed through a single port or single incision placed within the umbilicus which then will be used for extraction of the gallbladder. A potential disadvantage with the single incision technique is restriction in the degree of movement of laparoscopic instruments and camera. This study presents a preliminary clinical series of a novel technique for transumbilical cholecystectomy employing existing instruments.

METHODS

All the patients were informed about the intervention technique and provided written consent. Prospective data regarding demographic data, operative time and bleeding estimation, and postoperative course and complications were recorded.

SURGICAL TECHNIQUE

The patient was positioned in a prone position with reverse Trendelenburg angulation, and the patient's right side was also tilted up. Using an open Hasson technique, a 2.5 cm incision was made through the umbilicus with dissection down to the linea alba. A 1 cm incision was made in the fascia and the peritoneum opened under direct vision. After placement of 0 Vicryl fascial stay sutures, a 10-mm blunt trocar was introduced into the abdomen. Establishment of a pneumoperitoneum using carbon dioxide to an intraabdominal pressure of 12 mmHg was achieved. A 30° 10-mm laparoscope was inserted through the trocar and a full diagnostic laparoscopy performed. Two 5-mm trocars were then inserted through separate areas of fascia in the midline within the same umbilical skin incision under direct vision, in some cases we were able to use one or two 10mm trocars (Figure 1). The operator stood at the left side of the patient with the camera holder to the patient's right side. When necessary, a 3-0 Mononylon suture was tied to the infundibulum through a transparietal straight needle, which allowed for improved visualization of Calot's Triangle. The left 5mm trocar was initially used to allow gallbladder retraction using a grasper (Figure 2). Dissection of gallbladder structures was achieved in the standard fashion using a Maryland Grasper in the right hand to manipulate the gallbladder, and an alligator grasper in the left hand

for retracting the gallbladder fundus. Once the cystic artery and duct were exposed, they were clipped separately using a 10-mm clip and divided (Figure 3). In cases when only 5mm trocars are used, mostly ligature was performed by external tied knots of polypropilene 2.0. The gallbladder was then dissected



Figure 1 - Introduction of 3 trocars inside the umbilical incision by 3 separate fascial wounds.



Figure 2 - Retraction of the gallbladder fundus by the left 5mm trocar.



Figure 3 - After dissection of the Calot's Triangle, 5mm clips are used to ligate the cystic duct and artery.

free from the liver bed using diathermy and a combination of repositioning the traction grasper for better exposure. Prior to complete removal of the gallbladder from the liver bed, hemostasis was achieved. Following complete dissection of the gallbladder, it was removed through the umbilical incision without the use of a bag in all cases (Figure 4). To allow this, the two or three separate incisions in the umbilical fascia sometimes had to be combined into a single larger incision. Closure of the aponeurosis was achieved using running 0 vicryl sutures. Skin closure was performed using 4-0 Mononylon suture.

RESULTS

A total of 11 female patients ranging in age from 24 to 66 (mean of 47) underwent the technique; data was recorded prospectively. Mean operative time was 74 min. Operative bleeding was a mean of less than 50ml. One patient required the addition of one subcostal laparoscopic 5mm trocar due to poor exposure of cystic structures. Colangiography was necessary in one patient. Few complications were recorded after 30 days. One patient developed a local umbilical granuloma, and the Vicryl suture was removed after 60 days. Analgesics were used only in the first 24 hours.

Resumption of oral intake was initiated on the same operative day, all patients were discharged within 24 hours of surgery.

The cosmetic result was satisfactory in all patients. A previous umbilical piercing remained untouched in two patients (Figure 5).

DISCUSSION

During recent years, laparoscopic surgery has developed rapidly. With great technical progress, the visualization and handling of the instruments has improved enormously. For this reason many surgical diseases can be treated laparoscopically with the same standard of safety as conventional surgery. Applying laparoscopic techniques, operations are less traumatic; there is less postoperative bowel ileus, which in turn allows faster progression of postoperative feeding. The cosmetic results of laparoscopic procedures are much better than those of traditional operations. Postoperative pain is reduced, which results in faster mobilization and a lower number of immobilization-



Figure 4 - Umbilical extraction of the gallbladder.



Figure 5 - Cosmetic aspect after single access umbilical cholecystectomy.

associated complications, such as venous thrombosis and pulmonary embolism.⁹⁻¹⁰

Furthermore, with laparoscopic procedures there is less pneumonia, less use of analgesics, and shorter hospital stays. In summary, the primary benefits for the patient include a faster recovery and better cosmetic result. Laparoscopic surgery not only benefits from technical improvements; since successfully applying the laparoscopic technique to cholecystectomy, many surgeons have attempted to reduce the number and size of ports used in laparoscopic cholecystectomy with the aim of reducing pain, disfigurement, and disability.^{11,12}

These efforts resulted in the development of natural orifice transluminal endoscopic surgery (NOTES), introduced in 2004, and more recent invention of singleport access laparoscopy (SPA).¹³ After pioneering work published by Zorron et al in

2007 using the transvaginal approach to cholecystectomy,³ other groups followed and performed the transvaginal technique combined with laparoscopic assistance.⁴⁻⁸ The natural orifice transluminal endoscopic surgery (NOTES) approach, aims to avoid transabdominal incisions completely^{14,15} by avoiding external incisions using a natural orifice, such as the mouth, anus, or vagina, followed by making an internal incision to insert the laparoscopic instruments. Therefore, a viscerotomy is performed. Although NOTES may be technically feasible, its use is limited by difficulty in access, lack of appropriate instruments, and concern over breaking the sterility barrier.

Transumbilical single-port surgery or single incision laparoscopic surgery (SILS) may be an alternative to NOTES, offering the potential of a technically easier operation, avoiding possible complications and obtaining the same abdominal cosmetic result. However, single access surgery may not reproduce all the advantages expected for natural orifice surgery, as the umbilicus is a natural scar, not an orifice, and the surgical wound produces somatic pain rather than visceral pain. Regarding this evolving concept, potential advantages in NOTES regarding avoidance of incision-related complications and somatic pain are absent in SILS.

Single Access Surgery has already been implemented clinically and is a rapidly evolving field,^{16,17} whereas NOTES has major barriers that limit its clinical application, such as spillage of gastric, urinary, or colonic contents within the abdomen, potential complications of leakage from a gastrotomy or colotomy, the difficult task of a viscerotomy closure, and difficulty maintaining spatial orientation.^{15,18} Moreover, NOTES requires special instruments, while SPA can be performed with standard laparoscopic instruments. Also, it is always possible to convert a single-port surgery to a multi-port conventional laparoscopic procedure as necessary, such that

surgical safety and outcomes remain uncompromised in single port surgery.

Single-access laparoscopic surgery was reported in the literature more than a decade ago for cholecystectomy,^{19,20} but it did not gain widespread use because of some technical barriers. Recently, a transumbilical laparoscopic cholecystectomy scarless technique with a 1-mm specially designed wire was developed,²¹ and represented an advancement for a virtually scarless surgery. However, it is hazardous to dissect Calot's triangle with one hand. Other groups reported variations of traditional laparoscopic cholecystectomy, such as needlescopic laparoscopy (minilaparoscopy) and using fewer trocars motivated by reducing surgical invasiveness.²²⁻³²

This study approached the "single-port" concept, consisting in a single-incision with multiple trocars, involving placing multiple, commercially available, standard laparoscopic ports through a single periumbilical incision. Choosing ports that have a lower external or internal profile allows for a wider range of instrument motion and the best combination of ports depends on the procedure being performed, but it typically includes three or four ports, each 10 to 5-mm or smaller. Transumbilical endoscopic surgery using normal laparoscopic trocars inserted intra-umbilically is feasible, safe and effective; and constitutes another option for abdominal surgery avoiding visible scars.

Objetivos: As vantagens bem estabelecidas da abordagem laparoscópica permitiram que esta técnica tivesse aceitação rápida no mundo inteiro. Com os avanços no campo da cirurgia minimamente invasiva, a cirurgia laparoscópica por incisão única (SIL) foi desenvolvida com o objetivo de reduzir a invasão da laparoscopia tradicional. Os autores propõem uma colecistectomia laparoscópica por incisão única (SIL) como um passo em direção a procedimentos cirúrgicos menos invasivos. Nós relatamos uma série de colecistectomias por porta única transumbilical.

RESUMO

Objetivos: As vantagens bem estabelecidas da abordagem laparoscópica permitiram que esta técnica tivesse aceitação rápida no mundo inteiro. Com os avanços no campo da cirurgia minimamente invasiva, a cirurgia laparoscópica por incisão única (SIL) foi desenvolvida com o objetivo de reduzir a invasão da laparoscopia tradicional. Os autores propõem uma colecistectomia laparoscópica por incisão única (SIL) como um passo em direção a procedimentos cirúrgicos menos invasivos. Nós relatamos uma série de colecistectomias por porta única transumbilical. **Métodos:** Foram realizadas 11 colecistectomias por porta única transumbilical. Foram realizadas três incisões de 5 a 10 milímetros através do umbigo, com a introdução de três trocartes laparoscópicos tradicionais através desta incisão única. **Resultados:** Onze mulheres com idade média de 47 anos foram submetidas à esta técnica. O tempo operatório médio foi de 74 min.

Poucas complicações foram registradas após 30 dias. Uma paciente desenvolveu um granuloma umbilical. O uso de analgésico limitou-se às primeiras 24 horas. O resultado estético foi satisfatório em todos os casos. Conclusão: cirurgia endoscópica transumbilical é viável, segura e eficaz, e constitui outra opção para a cirurgia abdominal praticamente sem cicatriz.

Palavras chave: cirurgia por incisão única, laparoscopia, NOTES; colecistectomia; SILS; LESS.

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