



Original article

Laparoscopic transumbilical cholecystectomy. Results with the gel device and literature review[☆]

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A B S T R A C T

Introduction: The appearance of single transumbilical incision surgery has opened a new era in the minimally invasive approach of cholecystectomy. Specific ports for this technique have made it easier to perform.

We report our initial experience, from July 2008 to June 2009 and give an updated bibliographic review.

Patients and methods: A prospective, longitudinal and interventional study that included 30 patients with symptomatic cholelithiasis, from 10 July 2008 to 30 June 2009, on whom a single transumbilical incision laparoscopic cholecystectomy was performed (LESS technique), without other minilaparoscopic ports or traction stitches.

A gel port was used for all surgeries (R-Port, Tri-Port[®]), as well as straight and roticulating laparoscopic graspers.

Surgical time, analgesia requirements, postoperative hospital stay, conversions and complications were registered.

Results: The median age was 34.8 years (range, from 21 to 53), with a BMI between 21 kg/m² and 39.5 kg/m² (mean 25.8 kg/m²). Surgical time was 65.1 minutes (ranging from 40 to 150) and postoperative length stay was less than 24 hours. Postoperative pain was measured with the VAS scale, giving a low score. Up to now, two wound infections and a bile leak have been observed.

Conclusions: LESS cholecystectomy is a safe and feasible technique performed by experienced surgeons in minimally invasive surgery, and requires a greater learning curve than that of the conventional laparoscopic cholecystectomy.

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Colecistectomía laparoscópica transumbilical. Resultados con el dispositivo de gel y revisión de la literatura

R E S U M E N

Palabras clave:

Cirugía laparoendoscópica de sitio único
Colecistectomía laparoscópica
Colecistectomía transumbilical

Introducción: La aparición de la cirugía con una única incisión transumbilical ha venido a abrir una nueva época en el abordaje mínimamente invasivo de la colecistectomía. La existencia de puertos específicos para este abordaje facilita su realización.

Presentamos la experiencia inicial de nuestro grupo, entre julio de 2008 y junio de 2009 y una puesta al día de la bibliografía sobre el tema.

Pacientes y método: Se realizó un estudio prospectivo, longitudinal y de intervención, que incluyó a 30 pacientes con colelitiasis sintomática, entre el 10 de julio de 2008 y el 30 de junio de 2009, a los que se les realizó una colecistectomía por una única incisión transumbilical (técnica *laparoendoscopic single site surgery*), sin apoyo en otros puertos de minilaparoscopia ni puntos tractores.

Las intervenciones se realizaron utilizando un puerto de gel (R-Port®, Tri-Port®) y pinzas de laparoscopia rectas convencionales y articuladas.

Se estudiaron el tiempo quirúrgico, la necesidad de analgesia postoperatoria, la estancia media, las conversiones y las complicaciones.

Resultados: La edad media fue de 34,8 años (rangos que fluctúan entre 21 y 53 años), con un *body mass index* de entre 21 y 39,5 kg/m² (media de 25,8 kg/m²). La duración media de la intervención fue de 65,1 min (rango que varía entre 40 y 150 min) y la estancia media fue menor de 24 h. El dolor postoperatorio medido con la escala visual analógica fue bajo. Hasta la fecha se han presentado 2 infecciones de herida y una fuga biliar.

Conclusiones: La colecistectomía *laparoendoscopic single site surgery* es una operación técnicamente reproducible por cirujanos con experiencia en cirugía mínimamente invasiva, segura, que requiere una curva de aprendizaje mayor que la colecistectomía laparoscópica convencional.

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Introduction

Laparoscopy has emerged as one of the most significant advances in surgery of the twentieth century. Since Philippe Mouret conducted the first laparoscopic cholecystectomy in 1987, laparoscopy has become the surgical approach of choice for this technique, and currently it is the most commonly performed laparoscopic procedure in the world.¹

Numerous studies have revealed accumulating evidence of the advantages of laparoscopic cholecystectomy versus open cholecystectomy, such as less postoperative pain, faster recovery and better cosmetic results.^{2,3}

The evolution of minimally invasive techniques has led to the emergence of two new surgical approaches and multiple intermediate pathways. On the one hand, there is surgery through natural anatomical openings (natural orifice transluminal endoscopic surgery [NOTES]). On the other hand, there is surgery through a single incision (laparoscopic surgery single incision [SILS®], now called Laparoendoscopic single site surgery [LESS]) that in most cases is the navel, which uses the embryological opening to perform surgery (embryonic transumbilical natural orifice endoscopic surgery/LESS).⁴

Following the latter route, in July 2008 our group performed the first LESS cholecystectomy in our country⁵ and spent

a year using this technique in daily surgical practice on all patients who met selection criteria and by the same group of surgeons.

The aim of this paper is to present the group's experience between July 2008 and June 2009, during which there have been 30 LESS cholecystectomies.

Patients and methods

We present a prospective, longitudinal and interventional study, which included 30 patients with symptomatic cholestasis between 10 July 2008 and 30 June 2009, upon which were performed a cholecystectomy through a single transumbilical incision (laparoendoscopic single site surgery technique) without using other minilaparoscopy ports nor "tractor stitches".

Inclusion criteria were as follows: 1) symptomatic cholelithiasis; 2) lack of evidence of episodes of cholecystitis and prior choledocholithiasis; 3) no previous surgery in the supramesocolic compartment; and 4) have a body mass index (BMI) of less than 40 kg/m².

The interventions were performed using a gel port (R-Port®, Tri-Port®, Advanced Surgical Concepts®, Wicklow, Bray, Ireland), and conventional, straight and jointed tools for the individual steps of the surgical procedure.

Variables studied included surgical time, need for post-operative analgesia, average hospital stay, complications and conversions both in traditional and open laparoscopic surgery.

The same team of surgeons performed all interventions, and prior informed consent was obtained for the intervention, with the approval of the Bioethics Committee and Research and the legal counsel of our hospital.

For all patients, surgical intervention followed the technique described below:

- General anaesthesia.
- Laparoscopic cholecystectomy in the French position, with the surgeon between the patient's legs and the assistant on the right.
- After cleaning and disinfection with chlorhexidine umbilical, the navel was everted, and an incision approximately 1.5 cm in length is made. At the fascial level, the hole is enlarged to 2.5 cm in length. Through this opening was introduced a gel port (R-port®, Triport®, Advanced Surgical Concepts®, Wichlow, Ireland), which is anchored to the inner surface of the anterior abdominal wall by a ring of flexible PVC.
- We carried out a controlled pneumoperitoneum to 14 mmHg of pressure.
- In the majority of cases, the videocamera used was 30 and 5 mm (Olympus Exera Endoeye® videolaparoscopy).
- The gallbladder is pulled as close as possible to the Hartmann's pouch, to raise the right hepatic lobe and at the same time have an adequate view of the triangle of Calot.
- None of the interventions used traction sutures, miniports, trocars or Veress needles to facilitate traction or separation of the liver.
- Straight laparoscopic approach instruments were used, except to identify the cystic duct and cystic artery, for which jointed material was briefly used (Roticulator Roticulator Endo Dissect® and Roticulator Endo mini-shears®, Covidien, Autosuture).
- Peritoneal adhesions were sectioned with Ligasure® 5 mm (Valleylab, Boulder, CO., USA). This instrument was also used for coagulation and section of the cystic artery.
- The cystic duct was sectioned between 5mm clips (5mm Clip by Ethicon Endosurgery®).
- Cholecystectomy was performed in depth with monopolar electrocoagulation.
- After a thorough review of gallbladder bed haemostasis, the gallbladder is removed by using the inner plastic container of the R-Port®.
- The fascial incision is closed with polyglycolic acid (Vicryl®, Ethicon Inc.) of size 2/0, and the skin is closed with intradermal suture or interrupted suture with Surgilene® 4/0 (Covidien Autosuture).

Results

The average age of the patients was 34.8 years (range: 21-53) (Figure 1). The average weight was 65.1 kg (range: 49-110 kg). The average BMI was 25.8 kg/m² (range 18.7 to 39.6) (Figure 2).

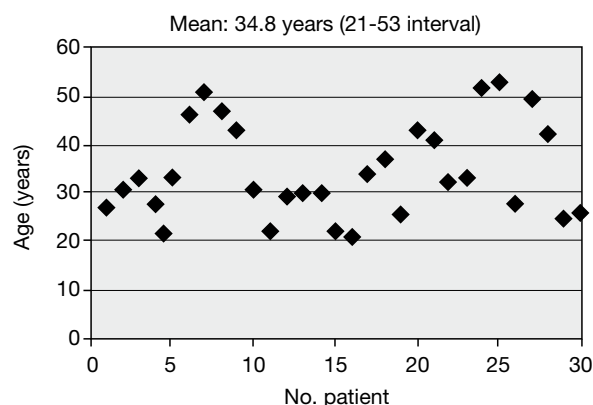


Figure 1 – Age.

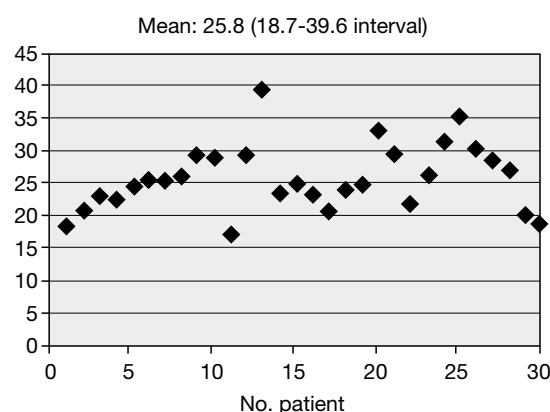


Figure 2 – Body mass index.

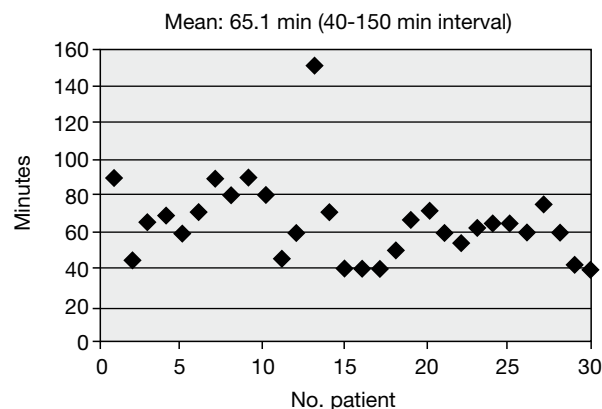


Figure 3 – Surgical time.

The intervention was successful in 29 of the 30 patients (one conversion to conventional laparoscopy, with the insertion of two trocars, subxiphoid and right upper quadrant, due to gallbladder bed bleeding).

Mean operative time was 65.1 min (range: 40-150 min) (Figure 3). The assessment of postoperative pain by visual analogue scale at 6 h and 12 h averages were 4.46 (range: 3-6) and 2.56 (range: 1-4) points (Figure 4).

The average stay was 25.2 hours (range: 18-48 h) (Figure 5).

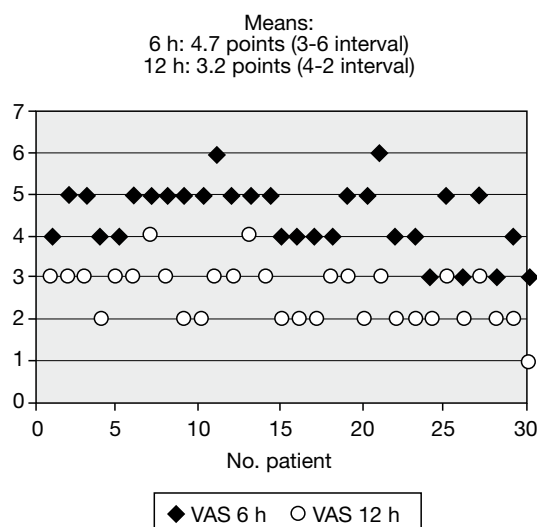


Figure 4 – Visual analogue scale (VAS).

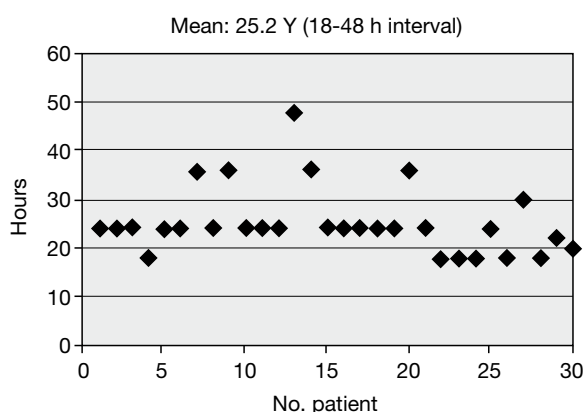


Figure 5 – Average length of stay.

Mean follow-up of patients after surgery was 6.8 months (range: 1-16).

Regarding postoperative complications, we had two minor complications, surgical wound infections (among the first 5 surgeries), and as major complications we had a bilioperitoneum presented on the 6th postoperative day in conjunction with a thermal scar in the insertion of the cystic stump. This complication required relaparoscopy and was resolved using the same umbilical port, with an R-Port® and a subxiphoid trocar of 10mm to suture the defect at the proper angle (Vicryl® 4/0). The patient was discharged on the 5th postoperative day. There were no deaths among the group of patients.

Discussion

A large volume of scientific evidence has accumulated in recent years regarding the advantages of the laparoscopic approach for cholecystectomy. It aims to reduce morbidity

associated with minimally invasive surgery and, to this end, two recent innovations have been developed, either pure or hybrid⁶⁻¹¹: endoscopic surgery through natural orifices (NOTES), in which intraperitoneal access is gained from the mouth, anus, vagina or urethra, and endoscopic surgery through transumbilical embryological openings (embryonic natural orifice endoscopic transumbilical surgery/LESS), where the surgical incision is made at the base of the navel, a natural embryological orifice.¹²⁻¹⁴

Since Kalloo et al. published the transgastric approach in 2004 there has been steady growth in the application of these techniques, but there are some basic issues for implementation in the clinic yet to be resolved.¹⁵⁻¹⁸

Although public dissemination has accompanied the NOTES techniques, surgeries through a single opening (Single Port Access®), have been done since the 1990s, if we restrict ourselves to cholecystectomy.

The evolution of both approaches has led to the creation of many acronyms, which will unify criteria to standardise the type of technique referred to by each author (Table).

In 1997, Navarre et al reported what was considered the first transumbilical access cholecystectomy.¹² For that, two trocars were inserted in the umbilical region with the help of transabdominal sutures placed in the right upper quadrant. Two years later, Piskun¹³ described a similar technique and highlighted the cosmetic benefits and the possible decrease in complications of surgical wounds. In that same year, Besadrola¹⁴ compared conventional laparoscopic cholecystectomy and transumbilical cholecystectomy through two ports and demonstrated a reduced need for analgesia and reduced pain perception in transumbilical cholecystectomies.

In 2001, Lomanto et al¹⁹ and Leggett et al²⁰ reported two variants of the minimally invasive approach that seemed to provide the same benefits.

At the same time, Tadashi et al²¹ published a series of 40 patients with a precursor of gel trocars. The trocar, called Twin-Port®, allowed the insertion of a camera and an instrument through a flexible ring in a similar way as using the Tri-Port®. However, it required the introduction of a second trocar in the epigastrium of 5 mm and three of the 40 patients included in the study needed the placement of a third trocar.

However from May 2007 the first pure transumbilical cholecystectomies were made public. On the one hand, Curcillo (on the website of Drexel University) and similarly,

Table – Nomenclature

SPA®	Single port access
NOTES	Natural orifice transluminal endoscopic surgery
OPUS	One port umbilical surgery
TUES	Transumbilical endoscopic surgery
SILS®	Single incision laparoscopic surgery
NOTUS	Natural orifice transumbilical surgery
E-NOTES	Embryonic natural orifice transumbilical endoscopic surgery
LESS	Laparoendoscopic single site surgery

Rao (on the website of Advanced Surgical Concepts) publicised the performance of this technique.

The use of devices such as the Tri-Port® appears in the literature for the first time in 2007 and was described by Rane.²² The same author wrote,²³ a year later, about the first world series of cholecystectomies performed by the SILS technique. Of a total of 20 patients, they managed to perform SILS cholecystectomy in 17. Of these, seven required an additional transabdominal suture retraction of the fundus, and 3 required an accessory port.

From this point on, during the year 2008, publications have multiplied regarding this technique, either pure (single port) or with variations, designed in most cases to achieve vesicular traction or a better view of the Calot triangle and structures.²⁴⁻²⁶

Cuesta et al²⁷ developed a technique that uses two umbilical trocars with the help of a Kirchner needle of 1 mm in diameter, placed in the right upper quadrant to lift the fundus and better expose the Calot triangle. Patients (n=10) had gallstones without episodes of cholecystitis, and their average BMI was 23 kg/m². They achieved an average procedure time of 70 min.

Not all opinions are unanimous, and there are experts who still hint at some of the problems and potential hazards that these techniques may present.²⁸⁻³⁰

LESS techniques, in contrast to NOTES techniques, use tools, resources and training in laparoscopic surgery that most surgeons today have available.

Our group has encountered some difficulties, such as:

- Adequate exposure of the field.
- Triangulation.
- The perception of the depth of the surgical field.
- The need for movements in different planes with reference to a central point.
- The need to change, by crossing the apparatus, the habitual use of the hands of the surgeon (in some cases and with technical variations).

That is why, to try to facilitate the applicability of the technique, straight instruments are used, except for concrete steps in which jointed tools are required. Therefore, we follow the original description of Rane.²²

In this way, without further support, 90.3% (29/30) of the cholecystectomies have been completed. The operative time reported of an average of 65.1 (range: 40-150) is among the times reported in recent series as is the mean hospital stay.³¹⁻³³

Most authors select patients with similar criteria. Rosemurgy et al³² compared their prospective group with a control group of conventional cholecystectomies during the same period of time, without statistically significant differences. It should be noted that all publications have LESS cholecystectomies in short series (between 37 and 290 patients)³¹⁻³³ thereby diminishing their relevance when drawing comparative conclusions.

The benefits that our group has found are:

- Pain during the immediate postoperative period is in the very low range for cholecystectomy.

- The average stay is, at least, within the usual standards in our area for this disease.
- The aesthetic benefits are remarkable.

The study has clear limitations as to the results of the umbilical wound infection, due to the limited number of cases performed. Surgical wound infections accounted for 6.7% (2/30) and occurred in the first 5 surgeries. From then on, we began a program of washing the umbilical region with chlorhexidine starting at 3 days before hospital admission, and so far additional umbilical infections have not occurred (25/30).

There are currently no studies comparing the incidence of postoperative umbilical hernia between this new approach and conventional laparoscopy. Furthermore, there is no series with long-term follow-up to give us perspective on the potential impact of this complication. Nonetheless, it is a late complication to consider and it will be related to the method used to close the umbilical hole.

The serious complication (bilioperitoneum) does not seem as related with the transumbilical approach, but instead a possible complication of any laparoscopic surgery, although it is very important to have adequate vision, and at all times the instruments inside the abdominal cavity.

The only factor we could relate in our series with an increase of surgical time is obesity (1/30 patients).

Conclusions

Cholecystectomy according to the LESS technique is safe, reproducible by surgeons experienced in laparoscopic surgery and it has aesthetic advantages and appears to offer a reduction in postoperative pain.

We believe that patient selection is still needed, although in the near future, with improved apparatus and acquisition of experience by the various surgical groups, its application may widen.

LESS cholecystectomy according to the technique seems to us the optimal gateway for progressive implementation to other complex diseases.

Multicentre collaborative studies are needed, that select a sufficient number of cases, to demonstrate the potential advantages that this technique can provide, in addition to the aesthetic advantages.

Conflict of interest

The authors AFFIRM that they have no conflicts of interest.

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