Transumbilical endoscopic surgery: History, present situation and perspectives

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Abstract

Transumbilical endoscopic surgery or laparo-endoscopic single site (LESS) surgery has become an exciting area of surgical development as innovation continues to move in the 21st century to minimally invasive surgery. The history, present situation and perspectives are reviewed and the nomenclature of this technique is discussed in this article. The range of this technique has been applied in almost all abdominal diseases, surgeries for morbid obesity, hernia and so on, in recent years. It is estimated that 50%-80% of traditional laparoscopic surgery could be performed transumbilically in the next five years according to the LESSCAR consensus. Although the concept of transumbilical laparoscopic surgery is gaining traction rapidly and the instruments have been improved greatly, we should not advocate for slightly improved cosmetic value over safety. Multicenter, randomized and clinical trials are necessary to further elucidate the safety and efficiency of this new technique. Research that examines the efficacy of the new instruments on the market may be helpful to simplify the confusing landscape of new and novel products designed for this purpose.

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Key words: Transumbilical; Laparoscopy; Surgery; Transumbilical endoscopic surgery; Minimally invasive surgery

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INTRODUCTION

Transumbilical endoscopic surgery (TUES) or laparo-endoscopic single site (LESS) surgery has become an exciting area of surgical development as innovation continues to move the 21st century to minimally invasive surgery. The fundamental idea is to have all of the working ports entering the abdomen through a single incision, which could have better cosmetic results and fewer traumas. Many people have shown great interest in this relatively new technique.

NOMENCLATURE

Several terms are used to describe the surgical procedure. The most popular is “single-incision laparoscopic surgery” (SILS). Compared with natural orifice transluminal endoscopic surgery (NOTES) or TUES, it is not easily pronounced. Sometimes, SILS can evoke confusion: how long is the single incision? Almost all open surgeries are a single but very long incision. Another widely used term is “single-port access” surgery.

This could be a precise description when placing a TriPort or SilsPort either around the umbilicus or other site. But sometimes it cannot be defined as “single-port access” when several small trocars are placed around the umbili-
cure. Embryonic-NOTES cannot be considered a better term because the umbilicus is not an orifice but a defect that closed at birth. The recently convened Consortium at the Cleveland Clinic agreed to accept the term “laparoscopic single-site” (LESS) surgery to describe the techniques that use a single incision to accomplish laparoscopic surgeries. LESS should be much better than single incision in describing the procedures which can be performed with either laparoscope or endoscope. In 2007, we put forward the term “TUES” to describe the procedure which would be suitable for most surgeries through the umbilical pathways of access except that a “single incision” was not made at the umbilicus. TUES is easily pronounced and better corresponds to NOTES. Therefore, TUES could be an option that is relatively simple and not easily confusing in describing the exciting new developments in minimally invasive surgery.

**HISTORY**

The history of TUES starts a long time ago when a laparoscope with an operating channel through which a working instrument could be introduced was used to inspect the abdomen and make a biopsy.

Bresadola[6] and Piskun[7] tried transumbilical laparoscopic cholecystectomy in 1999 when the modern laparoscopic technique was widely accepted. It is bemusing that there has been no publication on this aspect for more than eight years since we introduced our preliminary work in a short paper[8] in 2007. But during the last three years, a huge amount of publications on transumbilical or single port laparoscopic surgery has appeared. The reason could be the technical difficulty in trying NOTES. TUES becomes another option in scarless abdominal surgery.

On 21 May 2007, we successfully completed our first TUES surgery, transumbilical endoscopic liver cyst fenestration, using a standard flexible endoscope followed by TUES endoscopic abdominal exploration and appendectomy and we named the technique TUES[9]. The transumbilical endoscopic cholecystectomy was completed by both trichannel trocar and umbilical double-trocar techniques[9]. However, the procedure is more difficult than traditional laparoscopic surgeries due to associated technical challenges, including laparoscope and instruments crowding around the umbilicus, loss of triangulation between the two instruments in the operative field and the required ambidexterity of the surgeon to adopt relatively difficult maneuvers. The enlarged end of the trocar is the main reason for external interference. Another factor is the instrument handles which are usually very close to the ports and not long enough to reach the operative field. The crowding around the umbilicus can be effectively overcome by using our improved ports as their maximum diameters are much smaller than those of commercially available trocars. The distance from the handles to the ports becomes longer when using the lengthened instruments which results in longer distance between the instrument handles and can partly avoid external interference.

Several approaches in transumbilical endoscopic surgery have been reported in the early stage of “modern” transumbilical laparoscopic surgery. Cuesta et al[10] introduced a transumbilical scarless cholecystectomy technique in ten patients with gallstones. Two 5 mm trocars were introduced parallel to each other through an umbilical incision. The 5 mm laparoscope and instrument were used to dissect the gallbladder which was grasped by a 1 mm Kirschner wire introduced at the subcostal line. A rigid instrument may be more easily maneuvered than a flexible one but the fundus of the gallbladder is fixed by the Kirschner wire according to Cuesta’s approach. It would be difficult to dissect the gallbladder by using one instrument. Zornig et al[11] described another hybrid technique - combined transvaginal and transumbilical cholecystectomy for a patient with gallstones. Conventional laparoscopic instruments and techniques are used in this procedure which provides a chance to optimize cholecystectomy in selected cases without help from endoscopic specialties. Of course, this technique is limited to female patients only. Palanivelu et al[12] presented another variant of transumbilical endoscopic cholecystectomy in ten patients with gallbladder stones. A flexible double-channel endoscope was introduced transumbilically into the abdominal cavity and a 3 mm rigid transcutaneous trocar was placed in the left hypochondrium for liver retraction. Four cases had to be converted to conventional laparoscopic technique due to difficulty in dissection (two cases) or uncontrollable hemorrhage (two cases). Those authors concluded that the approach had not yielded satisfactory results and that further instruments and accessory improvements may increase success rate and acceptance.

**PRESENT SITUATION**

TUES technique has been developed very quickly during the last two years which involves transumbilical laparoscopic surgery for morbid obesity, hernia, gastrointestinal diseases and so on. According to the recent LESSCAR consensus statement, 50%-80% of laparoscopic surgeries could be performed transumbilically within the next five years[13]. Undoubtedly, the technique benefits patients with better cosmetic results. Therefore, whether it can decrease surgical trauma with a lower complication rate and benefit more patients is still controversial and needs to be further confirmed by randomized, controlled and multicenter clinical trials.

The major drawback to such a surgical approach is that the concept of “triangulation” to which laparoscopic surgeons have grown accustomed in terms of both the instruments and scope is lacking. This, however, seems to be overshadowed by the increasing acceptability of in-line viewing in transumbilical laparoscopic surgery. Industries are showing great interests in developing new instruments to try to resolve the problems as great business opportunities. Different kinds of ports have been developed including TriPort, SilsPort and Airseal[14] which should be evaluated from the aspects of costs, agility and simple maneuvers.

In order to overcome the problem of in-line viewing
caused by lack of “triangulation”, several articulated instruments have been developed[8]. A line of instruments that can be articulated and rotated, which includes a dissector, grasper and scissors, was developed by Covidien Company in the US. All three instruments have 0°-80° articulation at the distal end of the shaft. This creates difficulty in performing tasks that require fine motor control, particularly at full articulation. Novare Surgical Systems, Inc. developed the RealHand instruments which articulate similarly to a human wrist. The surgeon articulates the handle against the fulcrum of the port and the distal shaft of the instrument articulates in a mirror image fashion. Cambridge Endo manufactured instruments similar to those in the Novare instrument line. The tips of the instruments including a needle driver, dissector, scissors and a monopolar hook. The instruments could theoretically help in overcoming the problem of in-line viewing.

PERSPECTIVES

The technique of transumbilical laparoscopic surgery has developed rapidly over the last three years. Almost all traditional laparoscopic surgeries could be performed transumbically, including surgeries for morbidity obesity, liver, splenic or gastrointestinal diseases. It is estimated that 50%-80% of traditional laparoscopic surgery could be performed transumbically in the next five years according to the LESSCAR consensus[11]. Whether or not it benefits the patient needs to be further studied according to the principle of evidence based medicine.

In his editorial published in the recent issue of the Chinese Journal of Minimally Invasive Surgery, Dr. Michel Gagner made a comment on the TUES technique. He said that most patients that we operate on are middle aged or elderly and so wearing a bathing suit and competing for Miss Universe is no longer on their radar screen. So, it is fine if the surgeon does a good job inside the abdomen and leaves a few scars of a few millimeters or centimeters. So then, why do all this - a more difficult operation, often longer, at higher costs and potentially putting our patients at risk of more complications, such as common bile duct injury from a poor view and poor instrument triangulation. Another author emphasized that the technique is difficult and may increase the rate of common bile duct injury. So history should not be allowed to repeat itself[8].

Following the recent upsurge of single port surgery, different kinds of instruments have been developed which mainly include ports and articulated instruments. The best choice of ports should be stable, cheap and easy to use. We are conducting research to evaluate which port is more flexible, spending less force in moving the instruments in the ports. Some people imagined that articulated instruments are conducting research to evaluate which port is more flexible. The best choice of ports should be stable, cheap and easy to use. We mainly include ports and articulated instruments. The best different kinds of instruments have been developed which history should not be allowed to repeat itself and may increase the rate of common bile duct injury. So jury from a poor view and poor instrument triangulation. The risk of more complications, such as common bile duct injury, at higher costs and potentially putting our patients at risk of scar.

In a word, the concept of transumbilical laparoscopic surgery is gaining traction rapidly in the world. However, we should not advocate for slightly improved cosmetic value over safety. Multicenter, randomized and clinical trials are necessary to further elucidate the safety and efficiency of this new technique. Research that examines the efficacy of new instruments on the market may be helpful to simplify the confusing landscape of new and novel products designed for this purpose.

REFERENCE

1 Zhu JF, Hu H, Ma YZ, Xu MZ. Totally transumbilical endoscopic cholecystectomy without visible abdominal scar using improved instruments. Surg Endosc 2009; 23: 1781-1784
2 Zhu JF. Scarless endoscopic surgery: NOTES or TUES. Surg Endosc 2007; 21: 1898-1899
3 Zhu JF. Which term is better: SILS, SPA, LESS, E-NOTES, or TUES? Surg Endosc 2009; 23: 1164-1165
4 Bresadola F, Pasqualetti A, Donini A, Chiarandini P, Anania G, Terrosu G, Sistu MA, Pasetto A. Elective transumbilical compared with standard laparoscopic cholecystectomy. Eur J Surg 1999; 165: 29-34
5 Piskun G, Rajpal S. Transumbilical laparoscopic cholecystectomy utilizes no incisions outside the umbilicus. J Laparoendosc Adv Surg Tech A 1999; 9: 361-364
6 Zhu JF, Hu H, Ma YZ, Xu MZ, Yu JL. Transumbilical endoscopic surgery (TUES): another option towards scarless abdominal surgery. Cir Endosc 2008; 9: 119-125
7 Zhu JF, Hu H, Ma YZ, Xu MZ, Li F. Transumbilical endoscopic surgery: a preliminary clinical report. Surg Endosc 2009; 23: 813-817
8 Cuesta MA, Berends F, Veenhof AAFA. The “invisible cholecystectomy”: a transumbilical laparoscopic operation without a scar. Surg Endosc 2007; 18: 9588-9590
9 Zornig C, Emmermann A, von Waldenfels HA, Mofid H. Laparoscopic cholecystectomy without visible scar: combined transvaginal and transumbilical approach. Endoscopy 2007; 39: 913-915
10 Palanivelu C, Rajan PS, Rangarajan M, Parthasarathi R, Senthil Nathan P, Praveenraj P. Transumbilical flexible endoscopic cholecystectomy in humans: first feasibility study using a hybrid technique. Endoscopy 2008; 40: 428-431
11 Gill IS, Advincula AP, Aron M, Cadeddu J, Canes D, Curcillo PG, Desai MM, Ewanke JC, Falcone T, Fazio V, Gettmann M, Gumbs AA, Haber GP, Kaouk JH, Kim F, King SA, Ponsky J, Remzi F, Rivas I, Rosemurgy A, Ross S, Schauer P, Sotelo R, Speranza J, Sweeney J, Teixeira J. Consensus statement of the consortium for laparoendoscopic single-site surgery. Surg Endosc 2010; 24: 762-768
12 Romanelli JR, Earle DB. Single-port laparoscopic surgery: an overview. Surg Endosc 2009; 23: 1419-142713 Connor S. Single-port-access cholecystectomy: history should not be allowed to repeat. World J Surg 2009; 33: 1020-1021