

Laparoscopic Transumbilical Cholecystectomy: Surgical Technique

Marco Aurélio de George, Marlon Rangel, Rafael William Noda, William Kondo

ABSTRACT

Background: Laparoscopic cholecystectomy is generally performed using 4 ports by transperitoneal access. Recent developments regarding laparoscopic surgery have been directed toward reducing the size or number of ports to achieve the goal of minimally invasive surgery, by mini-laparoscopy, natural orifice access, and the transumbilical approach. The aim of this article is to describe our laparoscopic transumbilical cholecystectomy technique using conventional laparoscopic instruments and ports.

Methods: The Veress needle was placed through the umbilicus, which allowed carbon dioxide inflow. A 5-mm trocar was placed in the periumbilical site for the laparoscope followed by the placement of 2 additional 5-mm periumbilical trocars. The entire procedure was performed using conventional laparoscopic instruments. At the end of the surgery, trocars were removed, and all 3 periumbilical skin incisions were united for specimen retrieval.

Results: Five transumbilical cholecystectomies were performed following this technique. The mean BMI was 26.6 kg/m². The mean operative time and blood loss were 46.2 minutes and 55 mL, respectively. No intraoperative complications occurred. Analgesia was performed using dipyrone (1g IV q6h) and ketoprofen (100 mg IV q12 h). Time to first oral intake was 8 hours. Mean hospital stay was 19.2 hours.

Conclusion: Laparoscopic transumbilical cholecystectomy seems to be feasible even using conventional laparoscopic instruments and can be considered a potential alternative for traditional laparoscopic cholecystectomy.

Key Words: Laparoscopic cholecystectomy, Minimally invasive surgery, Scarless cholecystectomy, Single-site

surgery, Transumbilical cholecystectomy, NOTUS, Single-port surgery, TUES.

INTRODUCTION

Since the initial report of a laparoscopic cholecystectomy by Mouret¹ in 1987, this technique has progressively replaced open surgery as the standard procedure for gallbladder removal whenever possible. Advantages of the laparoscopic technique are well established and include less postoperative pain, shorter hospital stay, reduced convalescence, more rapid return to full activity, and improved cosmesis.²

Recent developments regarding laparoscopic cholecystectomy have been directed toward reducing the size or number of ports to achieve the goal of a minimally invasive surgery.³⁻⁵ Some authors have even published their initial experience with transvaginal cholecystectomy⁶ to try to minimize the trauma even more by eliminating the incision through the abdominal wall and by using natural orifices, but this technique still needs further evaluation before its current clinical implementation.

A competing surgical technology to transvaginal cholecystectomy is transumbilical surgery. This approach uses the umbilicus, a natural scar, for the introduction of surgical instruments. Transumbilical cholecystectomy has already been described using single-port devices,⁷ multifunctional flexible scopes through the umbilicus,⁸ and multiple periumbilical incisions.⁹⁻¹¹ The aim of this article is to describe our technique for performing laparoscopic transumbilical cholecystectomy using three 5-mm trocars and conventional laparoscopic instruments.

METHODS

Since October 2007, laparoscopic transumbilical cholecystectomy has been performed at our center in select cases. All patients who underwent surgery with this approach were prospectively evaluated, and data were collected for subsequent analysis.

Department of General Surgery, Vita Curitiba Hospital, Curitiba, Paraná, Brazil (all authors).

Address correspondence to: William Kondo, Av. Getulio Vargas, 3163 ap 21, 80240-041, Curitiba - Paraná - Brazil. Telephone: (55) (41) 9222-1065, E-mail: williamkondo@yahoo.com

DOI: 10.4293/108680809X12589998404281

© 2009 by JSL, *Journal of the Society of Laparoendoscopic Surgeons*. Published by the Society of Laparoendoscopic Surgeons, Inc.

Patient selection was determined by any case of symptomatic cholelithiasis scheduled for elective surgery. Exclusion criteria included patients who had undergone multiple abdominal procedures.

Informed consent for the procedure was obtained from all patients.

After satisfactory general anesthesia, the abdomen was prepared with a povidone iodine solution. The Veress needle was placed transumbilically (**Figure 1A**), and pneumoperitoneum was established with carbon dioxide, maintaining an intraabdominal pressure between 12 mm Hg and 14 mm Hg.

Three 5-mm periumbilical incisions were performed, and trocars were placed adjacently: one 5-mm trocar for the 30-degree laparoscope and two 5-mm trocars for the instruments (**Figure 1B**). In this way, the surgeon works using 2 ports, with the instruments in parallel. We did not use special trocars or articulating instruments for the procedure to demonstrate the feasibility of transumbilical surgery with conventional laparoscopic instruments and to minimize cost.

Each intraoperative step was accomplished with confidence, similar to standard multiport laparoscopy. Briefly, retraction of the gallbladder was done by using the long grasping forceps through the 5-mm trocar, whereas dis-

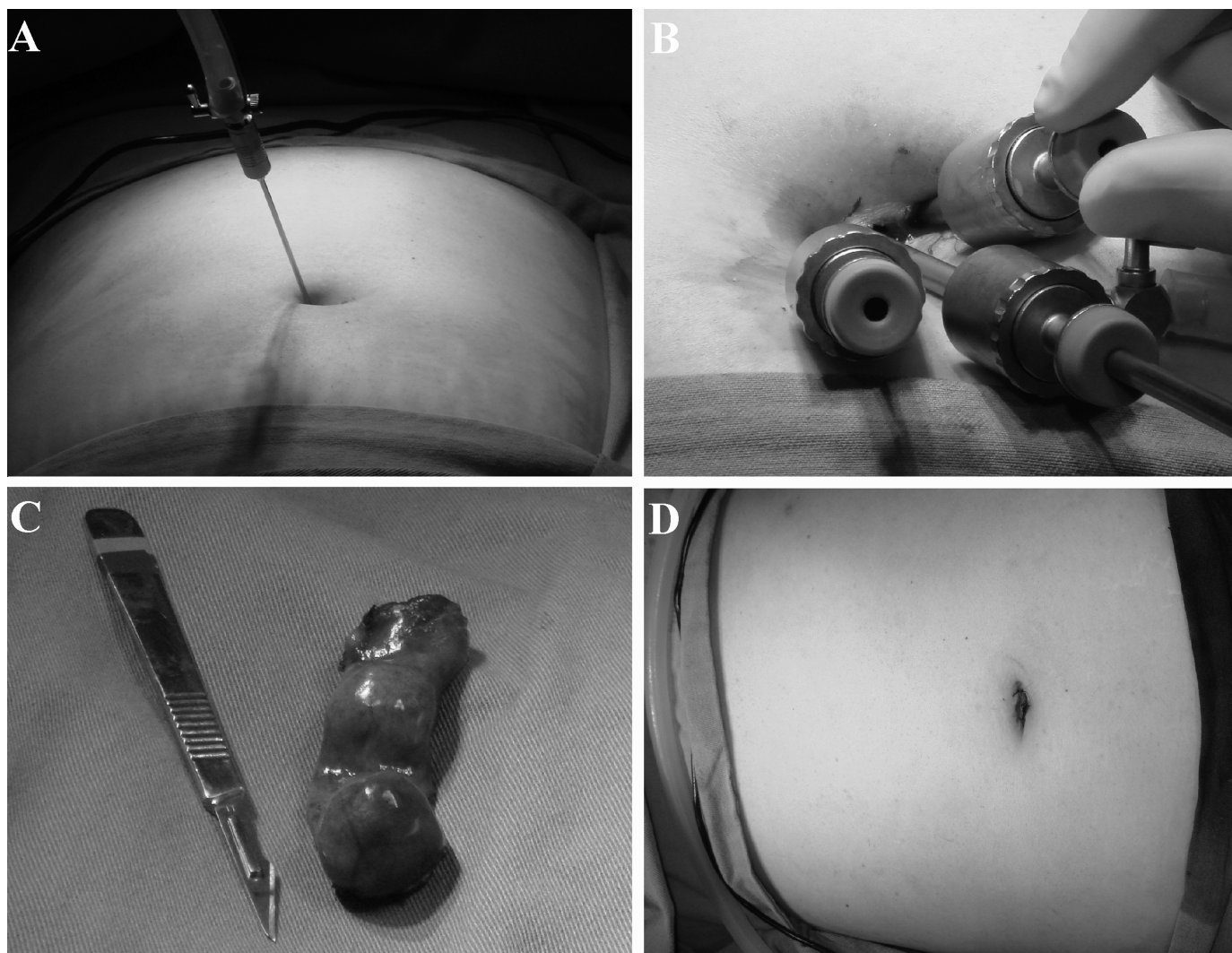


Figure 1. (A) Placement of the Veress needle through the umbilicus. (B) Three 5-mm trocars positioned adjacently. (C) Surgical specimen. (D) Final scar.

section was accomplished through the other 5-mm port. The cystic duct (**Figures 2A and 2B**) and cystic artery (**Figure 2C**) were identified and clipped using 5-mm titanium clips (ENDO CLIP 5 mm, Autosuture Covidien plc, Dublin, Ireland). The gallbladder was dissected from the liver bed (**Figure 2D**), and the specimen was held with a grasper. The trocars were removed, and all 3 periumbilical skin incisions were united in a sole λ-shaped incision. The aponeurosis opening was enlarged, and the gallbladder was retrieved (**Figure 1C**).

The abdominal cavity was checked for any bleeding. Aponeurosis and skin were sutured using 1 polyglactin 910 (Vicryl, Ethicon, Somerville, NJ) and 4.0 mononylon, respectively (**Figure 1D**).

RESULTS

Laparoscopic transumbilical cholecystectomy was successfully performed in 5 patients. The intraoperative and early postoperative data are summarized in **Table 1**.

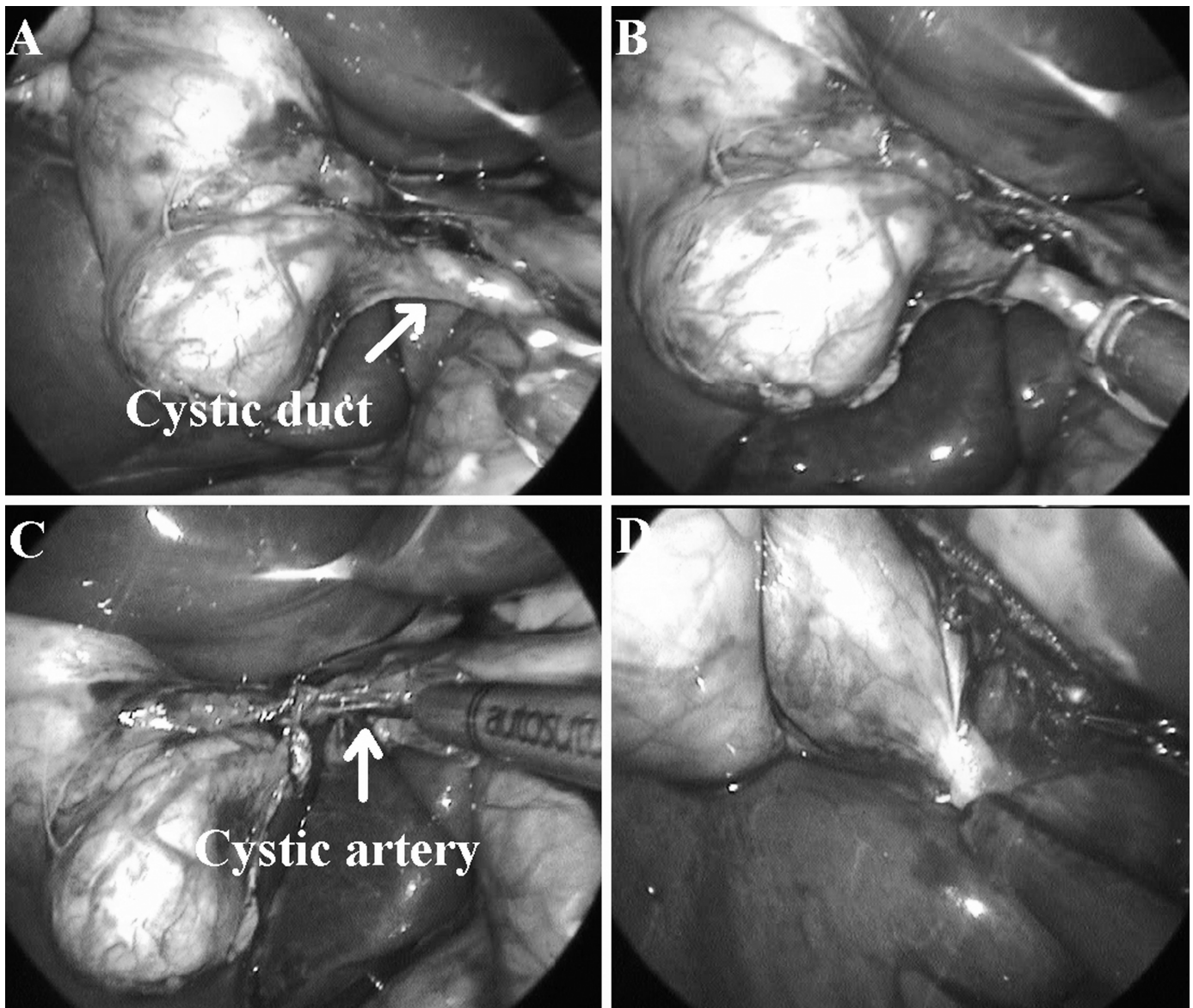


Figure 2. (A and B) Dissection and ligation of the cystic duct. (C) Ligation of the cystic artery. (D) Dissection of the gallbladder from the liver bed.

Table 1.
Laparoscopic Transumbilical Cholecystectomy Intraoperative and Early Postoperative Outcomes in 5 Female Patients

Patient Age (yrs)	BMI* (kg/m ²)	Surgical Time (minutes)	Hospitalization (hours)	EBL* (mL)	Time to First Oral Intake (hours)	Complications
30	25	56	18	50	8	None
35	27	30	18	25	8	None
42	23	35	18	50	8	None
27	32	60	24	100	8	None
53	26	50	18	50	8	None

*BMI = body mass index; EBL = estimated blood loss.

The mean body mass index (BMI) of the patients was 26.6 kg/m². Surgical exposure was adequate in all cases, and standard laparoscopic surgical steps were duplicated through this transumbilical approach.

The mean operative time and blood loss were 46.2 minutes and 55 mL, respectively. No intraoperative complications occurred, and no patients needed blood transfusion. The patient with the highest BMI had the longer operative time and the higher estimated blood loss.

Analgesia was performed using dipyrone (1g IV q6h) and ketoprofen (100mg IV q12h). Time to first oral intake was 8 hours. Mean hospital stay was 19.2 hours.

No early postoperative complications developed. Postoperative follow-up on days 7, 14, and 30 demonstrated a good postoperative evolution, with no complications, and all patients were satisfied with the umbilical scar.

DISCUSSION

Since the first report of a successful laparoscopic cholecystectomy in humans, the standard technique has included the use of 4 trocars. As experience accumulated with this technique, many surgeons found that the most lateral port played a minor role in the operation and therefore decided to omit it.¹² Other authors^{5,13} have gone further and perform laparoscopic cholecystectomies using only 2 ports. This approach is suggested to be less invasive than other techniques and also to have cosmetic and cost advantages.¹³

The use of mini-instruments is another step toward reduction of operative trauma by decreasing the size of the trocars used in the procedure. The use of needlescopic instruments in cholecystectomy has been reported since 1998.¹⁴ This technique has been associated with less postoperative pain and better cosmesis than the conventional

4-port laparoscopic cholecystectomy.^{3,4} However, surgical procedures with needlescopic forceps are of limited value because of problems in manipulating these fragile instruments.

Natural orifice transluminal endoscopic surgery (NOTES) is an extension of these concepts of minimally invasive procedures by approaching the abdominal cavity through natural orifices, thus obviating external abdominal scars. Animal models have been used to demonstrate the potential applications of NOTES.¹⁵ Our group has already demonstrated the feasibility of performing hybrid transvaginal cholecystectomy⁶ and nephrectomy¹⁶ in human beings by using a combined transvaginal and transabdominal approach, and totally transvaginal endoscopic tubal ligation.¹⁷ Potential benefits of NOTES include lack of an abdominal scar, reduction of postoperative pain, ability to be performed under conscious sedation, and faster recovery.

In a quite similar manner, the umbilicus is an embryonic (E) natural orifice that, since it is a scar itself, conceals the intraabdominal entry point for surgical procedures. As such, Gill et al¹⁸ proposed the term E-NOTES (embryonic natural orifice transumbilical endoscopic surgery) for this surgical approach. Other terms already used to describe this technique are transumbilical endoscopic surgery (TUES), natural orifice transumbilical surgery (NOTUS), single-port, single-access, single-incision or keyhole surgery, all based on the principle of a single abdominal incision for the placement of a special trocar through which articulating laparoscopic instruments are inserted to perform the procedure.

In our series, we put 3 conventional laparoscopic trocars adjacently in the periumbilical area to perform the cholecystectomy. By positioning the incisions separately, there is a greater degree of freedom for instrument movement,

thus reducing the technical complexity of the operation.¹⁰ All procedures were performed successfully with a mean operative time of 46.2 minutes. Because all the ports were placed in the periumbilical site, they were easily united in an elliptical incision to retrieve the specimen. Neither intraoperative nor postoperative complications occurred. This is only a small series, but we observed that the patient with the highest BMI (32 kg/m²) had a longer surgical time and greater blood loss. Maybe high BMI can be considered a relative contraindication to this technique, but larger studies are necessary to confirm that.

Advantages of the laparoscopic transumbilical cholecystectomy include (1) the technique is similar to traditional laparoscopic surgery,¹⁹ (2) the minimization of skin incision morbidities (temporary incision pain and muscle spasms, avoidance of epigastric vessel injury), (3) one incision can be hidden within the umbilicus, rendering the procedure scarless (superior cosmesis), (4) the method allows the surgeon to “convert” the procedure to a conventional laparoscopic approach at any point during the operation, if needed,²⁰ (5) compared with the standard NOTES technique, laparoscopic transumbilical cholecystectomy is simpler and safer,²¹ (6) the ability to use a rigid instrument to retract the gallbladder with dynamic retraction provided by the operating surgeon and the ability to use conventional laparoscopic clips rather than flexible endoscopic clips (used in NOTES).

Disadvantages of laparoscopic transumbilical cholecystectomy include (1) the smaller degree of instrument triangulation compared with that in conventional laparoscopy and the lack of lateral retraction during dissection of the triangle of Calot,¹⁰ (2) the parallel and close positioning of the right- and left-hand instrument shafts tends to result in “crowding” of the laparoscope and instruments,^{18,22} (3) the clashing of instruments and the laparoscope is common and, as such, significant coordination between the surgeon and the camera person is essential,²⁰ and (4) dissection through a single port is more difficult than in conventional multi-port laparoscopy.²²

CONCLUSION

We report on a small series of laparoscopic transumbilical cholecystectomies. This technique provides a familiar anatomic view of the gallbladder similar to that obtained with the traditional laparoscopic technique and can be considered a potential alternative to it in a select group of patients. High BMI can be a potential relative contraindication because it makes retraction of the structures diffi-

cult. Further studies comparing transumbilical and traditional laparoscopy are necessary to confirm the safety, indications, and benefits of each technique before the delivery of a final judgement.

References:

1. Mouret P. How I developed laparoscopic cholecystectomy. *Ann Acad Med Singapore*. 1996;25:744–747.
2. Barkun JS, Barkun AN, Meakins JL. Laparoscopic versus open cholecystectomy: the Canadian experience. The McGill Gallstone Treatment Group. *Am J Surg*. 1993;165:455–458.
3. Bisgaard T, Klarskov B, Trap R, Kehlet H, Rosenberg J. Microlaparoscopic vs conventional laparoscopic cholecystectomy: a prospective randomized double-blind trial. *Surg Endosc*. 2002;16:458–464.
4. Cheah WK, Lenzi JE, So JB, Kum CK, Goh PM. Randomized trial of needlescopic versus laparoscopic cholecystectomy. *Br J Surg*. 2001;88:45–47.
5. Poon CM, Chan KW, Lee DW, Chan KC, Ko CW, Cheung HY, et al. Two-port versus four-port laparoscopic cholecystectomy. *Surg Endosc*. 2003;17:1624–1627.
6. Branco Filho AJ, Noda RW, Kondo W, Kawahara N, Rangel M, Branco AW. Initial experience with hybrid transvaginal cholecystectomy. *Gastrointest Endosc*. 2007;66:1245–1248.
7. Romanelli JR, Mark L, Omotosho PA. Single port laparoscopic cholecystectomy with the TriPort system: a case report. *Surg Innov*. 2008;15:223–228.
8. Palanivelu C, Rajan PS, Rangarajan M, Parthasarathi R, Senthilnathan P, Praveenraj P. Transumbilical flexible endoscopic cholecystectomy in humans: first feasibility study using a hybrid technique. *Endoscopy*. 2008;40:428–431.
9. Branco AW, Branco Filho AJ, Noda RW, George MA, Camargo AHLA, Kondo W. New minimally invasive surgical approaches: transvaginal and transumbilical. *Bras J Video-Sur*. 2008;1:29–36.
10. Nguyen NT, Reavis KM, Hinojosa MW, Smith BR, Wilson SE. Laparoscopic transumbilical cholecystectomy without visible abdominal scars. *J Gastrointest Surg*. 2009;13(6):1125–1128. Epub 2008 Aug 15.
11. Gumbs AA, Milone L, Sinha P, Bessler M. Totally transumbilical laparoscopic cholecystectomy. *J Gastrointest Surg*. 2009;13:533–534.
12. Trichak S. Three-port vs standard four-port laparoscopic cholecystectomy. *Surg Endosc*. 2003;17:1434–1436.
13. Kagaya T. Laparoscopic cholecystectomy via two ports, using the “Twin-Port” system. *J Hepatobiliary Pancreat Surg*. 2001;8:76–80.

14. Gagner M, Garcia-Ruiz A. Technical aspects of minimally invasive abdominal surgery performed with needlescopic instruments. *Surg Laparosc Endosc.* 1998;8:171–179.
15. Kalloo AN, Singh VK, Jagannath SB, et al. Flexible transgastric peritoneoscopy: a novel approach to diagnostic and therapeutic interventions in the peritoneal cavity. *Gastrointest Endosc.* 2004;60:114–117.
16. Branco AW, Branco Filho AJ, Kondo W, et al. Hybrid transvaginal nephrectomy. *Eur Urol.* 2008;53:1290–1294.
17. Kondo W, Noda RW, Branco AW, Rangel M, Branco Filho AJ. Transvaginal endoscopic tubal sterilization. *J Laparoendosc Adv Surg Tech A.* 2009;19:59–61.
18. Gill IS, Canes D, Aron M, et al. Single port transumbilical (E-NOTES) donor nephrectomy. *J Urol.* 2008;180:637–641.
19. Gettman MT, Box G, Averch T, et al. Consensus statement on natural orifice transluminal endoscopic surgery and single-incision laparoscopic surgery: heralding a new era in urology? *Eur Urol.* 2008;53:1117–1120.
20. Kaouk JH, Haber GP, Goel RK, et al. Single-port laparoscopic surgery in urology: initial experience. *Urology.* 2008;71:3–6.
21. Zhu JF. Scarless endoscopic surgery: NOTES or TUES. *Surg Endosc.* 2007;21:1898–1899.
22. Desai MM, Rao PP, Aron M, et al. Scarless single port transumbilical nephrectomy and pyeloplasty: first clinical report. *BJU Int.* 2008;101:83–88.