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Transvaginal Laparoscopic Appendectomy Simultaneously with Vaginal Hysterectomy: Initial Experience of 10 Cases

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Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Background: Natural orifice transluminal endoscopic surgery (NOTES) involves the introduction of instruments through a natural orifice into the peritoneal cavity to perform surgical interventions. The vagina is the most widely used approach to NOTES. We report the utilization of the vaginal opening at the time of vaginal hysterectomy as a natural orifice for laparoscopic appendectomy.

Material/Methods: We reviewed cases of 10 patients with chronic appendicitis who underwent transvaginal laparoscopic appendectomy simultaneously with vaginal hysterectomy. A laparoscopic approach was established after removal of the uterus, and the appendix was removed transvaginally. Among the 10 cases, 5 were conducted under gasless laparoscopy by using a simple abdominal wall-lifting instrument.

Results: All procedures were performed successfully without intraoperative or major postoperative complications. The appendectomy portion of the procedure took approximately 21 minutes to 34 minutes. All patients were discharged less than 4 days after surgery, without external scars.

Conclusions: Transvaginal appendectomy with rigid laparoscopic instruments following vaginal hysterectomy appears to be a feasible and safe modification of established techniques, with acceptable outcomes.

MeSH Keywords: Appendectomy • Hysterectomy, Vaginal • Laparoscopes

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Background

Minimally invasive surgery is defined as performing major operative procedures through smaller incisions. This results in less trauma and pain, faster recovery, and a better cosmetic outcome for the patients. Natural orifice transluminal endoscopic surgery (NOTES) involves the introduction of instruments through a natural orifice into the peritoneal cavity to perform diagnostic and therapeutic surgical interventions [1,2]. Although many reports have demonstrated the technical feasibility of *per os*, transgastric and transcolonic approaches to certain procedures, current endoscopes and instruments are too flexible and insufficient to allow wide usage of this technology for procedures. The combination of conventional rigid laparoscope and instruments with the natural orifice technique, such as transvaginal, may allow less-invasive procedures and favorable outcomes.

The technique of vaginal hysterectomy has become more commonly used, and in many countries it is the operation of choice for benign uterine disease requiring surgery [3]. The safety and reliability of vaginal hysterectomy have been confirmed by many studies. The establishment and closure of transvaginal access to the abdominal cavity have become conventional techniques in this procedure, which also provide a theoretical basis and technical support for transvaginal NOTES procedures. The vagina is the most widely used approach to NOTES because it is easy to clean and disinfect and, more importantly, because it provides safe access to the peritoneal cavity and the incision can easily be closed manually [4].

In dedicated collaboration with gynecologists and surgeons, we successfully performed transvaginal appendectomy using conventional rigid laparoscope and instruments, using the vaginal opening, at the time of vaginal hysterectomy. The procedure is described herein.

Material and Methods

Ten patients underwent transvaginal laparoscopic appendectomy at the time of vaginal hysterectomy at Shengjing Hospital of China Medical University between November 2010 and November 2012. The mean patient age was 46.7 years (range, 27 to 63 years). The indications for hysterectomy were abnormal uterine bleeding (1 case), symptomatic leiomyomata (7 cases), and endometrial hyperplasia (2 cases, 1 of them combined with symptomatic leiomyomata). The diagnoses of chronic appendicitis were made when the patient had 1 or more attacks of acute appendicitis and a fecalith was present on computed tomography scan or no filling of the appendix on barium enema. The exclusion criteria included a history of multiple prior open abdominal operations, body mass index (BMI) >35 kg/m^2 (because morbid obesity may affect the exposure of the appendix by the transvaginal route, unlike transvaginal hysterectomy alone), and extremes of age (<18 yr. or >65 yr.).

All patients gave written informed consent for surgery, institutional review board approval was obtained for the study, and patient confidentiality was maintained at all times.

All patients underwent routine preoperative mechanical and chemical bowel preparation and received a single dose of prophylactic intravenous antibiotics immediately prior to the start of the procedure. Under general endotracheal anesthesia (7 patients) or epidural anesthesia (3 patients), all subjects were placed in the lithotomy position.

Vaginal hysterectomy was performed in the usual fashion; once the uterus was removed, attention was turned to the appendix. Three trocars were placed through the opening of the vagina in the fashion of a reverse triangle (Figure 1). Before the above procedure, sparse sutures on the opening end of vagina were taken to maintain the trocars' place and pneumoperitoneum. A 30° rigid laparoscope (Stryker Endoscopy, U.S.A.) was used throughout the procedures.

Usual pneumoperitoneum style (5 cases)

No umbilical or abdominal ports were used. The 13-mmHg pneumoperitoneum was maintained. Using 5-mm conventional ultrasonic ace (Ethicon, U.S.A.), the mesoappendix was coagulated and cut, mobilizing the appendix to its base (Figure 2). Closure of the appendicular base was performed with Hemo-lock clips (Weck Closure Systems, U.S.A.). Two clips were placed at the proximal portion of the appendicular base. The appendix was cut using ultrasonic ace (Figure 3). The appendix was then removed via the colpotomy without the use of an endoscopic bag (Figure 4). After hemostasis was confirmed, the vaginal cuff was sutured manually in the routine fashion for vaginal hysterectomy. A "T"-shaped tube as vault drainage was placed through the opening of vagina (removed at 48 hours after surgery).

Abdominal wall-lifting/gasless style (5 cases)

During the laparoscopic procedures with pneumoperitoneum, it is not easy to keep the vaginal incision tightly sealed, and a gas leak or the use of suction can significantly affect operative field visibility and instrument maneuverability. We used 2 towel forceps to form a parallel double-line suspension at the right lower quadrant, around McBurney's point, as we described previously [5], which is able to provide better exposure in the pelvis to facilitate gasless surgery – the first suspension device makes room for surgery, while the second expands the space so that instruments can be manipulated with greater ease.

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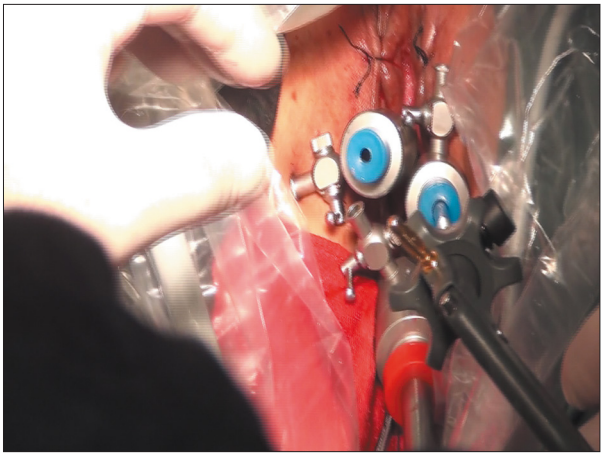

Figure 1. Transvaginal trocars introduced through the vaginal opening.

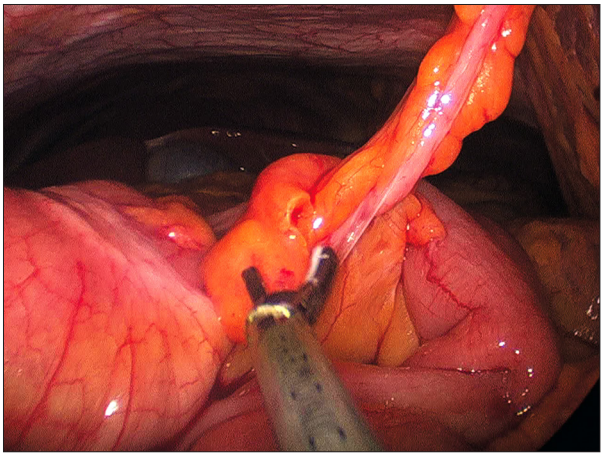

Figure 2. Appendix divided from the mesoappendix by using ultrasonic ace (usual pneumoperitoneum style).

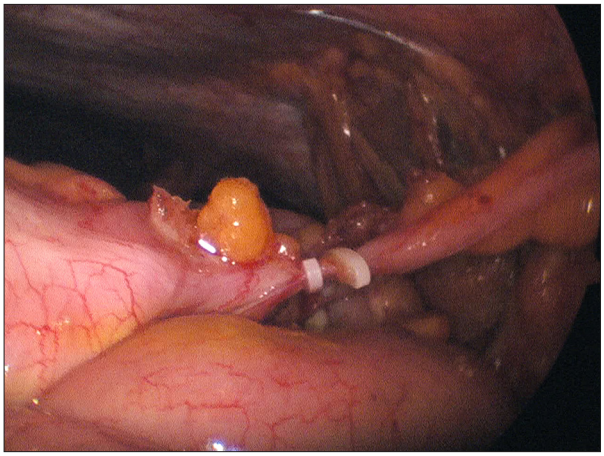

Figure 3. Closure of the appendicular base by placing 2 clips in the proximal portion of the appendicular base (usual pneumoperitoneum style).

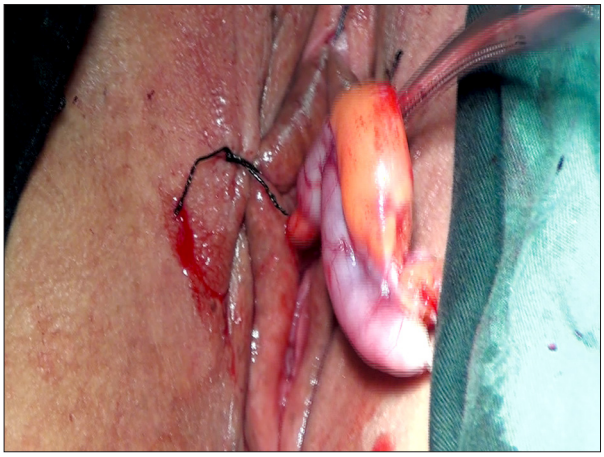

Figure 4. Appendix removed.

Results

To date, 10 patients have undergone transvaginal appendectomy with rigid laparoscopy. All intended surgical procedures were carried out successfully and additional transabdominal ports were not required. The appendectomy procedure time was measured from the establishment of the operating space to the complete closure of the vaginal cuff. The average operating time was 27.2 min (range, 21 to 34 min), and the estimated blood loss was minimal. No intraoperative complications or major postoperative complications occurred. Postoperative analgesia was considered routine for the vaginal hysterectomy procedure; additional medication requirements were not noted. All patients were started on a clear liquid diet on postoperative day 1 and advanced to a low-residue diet without difficulty within 48 hours. The mean postoperative hospital stay was 2.7 days, with 4 patients discharged home on the second postoperative day, 5 on the third day, and 1 on the fourth day. Pathological examination of all appendectomy specimens revealed fibrosis in the appendiceal wall, partial to complete obstruction of the lumen, evidence of old mucosal ulceration and scarring, or infiltration of the wall of the appendix with chronic inflammatory cells.

Patients were seen for follow-up visits during postoperative weeks 1 and 6. No patients required narcotic pain medications after hospital discharge. Minor outpatient postoperative complications were as follows: 1 urinary tract infection successfully treated with oral antibiotics, and 1 vaginal cuff granulation tissue repair 3 months after surgery. There were no febrile episodes or vaginal cuff infections. The patients were advised to abstain from sexual activity for 2 weeks postoperatively, and all sexually active patients reported a return to normal sexual activity 2 weeks later.

Discussion

NOTES represents a new field that is drawing the attention of surgeons and endoscopists alike, which comprises several new

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endoscopic and surgical entryways into the abdominal cavity. Transvaginal surgery, traditionally limited to gynecologists for the purpose of performing hysterectomies [6], is now being used for abdominal operations such as appendectomy [7,8], cholecystectomy [9,10], nephrectomy [11,12], hernia repair [13], adrenalectomy [14], and sleeve gastrectomy [15]. One of the advantages of NOTES is the ability to provide female patients with a superior cosmetic alternative to the traditional laparoscopic techniques. Moreover, there is the potential for decreased postoperative pain and shortened recovery times [16,17]. Nonetheless, this new frontier of surgical approaches has been received critically from the surgical community.

The vaginal hysterectomy route appears to have little effect on postoperative sexual function [18], but overall pain scores are improved with the vaginal approach, over abdominal hysterectomy [19,20]. The establishment and closure of transvaginal access to the abdominal cavity have become conventional techniques in gynecology, which provide a theoretical basis and technical support for transvaginal NOTES. Effective closure of natural tract-wall incisions and prevention of intra-abdominal infections are 2 key factors affecting the development of the NOTES technique. Manual closure of a vaginal incision is much easier and safer than closing wounds of the stomach and colorectal walls [21,22]. The transvaginal approach does not have the serious potential risk of causing intestinal fistula, unlike the transgastric and trans-colorectal approaches. Thus far, no vaginal wound dehiscence or hernias have been reported [4,23,24]. In addition, with adequate preoperative vaginal preparation, the risk of abdominal infection can be effectively reduced so as to establish a safe and reliable NOTES pathway [25].

Based on our previous animal NOTES experiments and a large number of umbilical laparoscopic surgeries, we decided to perform transvaginal laparoscopic appendectomy. Because the target organ (the appendix) is close to the operation pathway (the vagina), and appendectomy is a relatively simple procedure, we tried this procedure in our initial series. From our results, transvaginal laparoscopic appendectomy using rigid instruments proved to be feasible, safe, and cost-effective.

The major drawback to this technique is the frequent collision of laparoscopic instruments, both extra- and intracorporeally, ascribed to the lack of triangulation necessitated by the narrow instrument-insertion space and the limited operating area. In addition, when surgical instruments are almost coaxial with the light source, a strong sense of space misappropriation is generated and it becomes even more difficult when multiple instruments are simultaneously needed for a collaborative operation.

Vaginal opening gas leak is another important problem that seriously affects transvaginal laparoscopic procedure performed under conventional pneumoperitoneum. It is difficult to ensure that the vaginal incision is as absolutely airtight as an abdominal incision, and a surgical gas leak or the use of extensive suction will influence the operative view and instrument maneuverability; waiting for resufflation will prolong surgery. We used an abdominal lifting device so that the procedure could be performed under gasless conditions, and thus avoided this problem. It also has other advantages, such as avoiding the complications of carbon dioxide pneumoperitoneum (e.g., subcutaneous or mediastinal emphysema), hypercapnia, air embolism, cardiopulmonary dysfunction, and hemodynamic changes. Under gasless surgery, the back or loin pain usually associated with pneumoperitoneal laparoscopy is not an issue [26,27]. Our technique employs 2 towel forceps to form a parallel double-line suspension to provide better exposure in the pelvis, which is more simple, convenient, time-saving, and cost-effective.

Transvaginal laparoscopic appendectomy is in the exploratory stage of clinical application, and is far from achieving the same popularity as conventional laparoscopic surgery. Knuth et al. [28] prospectively analyzed 13 patients following transvaginal hybrid NOTES appendectomy. For their procedure, rigid instruments were used and the procedure was performed with 2 transvaginal and 1 transumbilical access points, with the specimen retrieved transvaginally. Roberts et al. [29] reported that pure transvaginal appendectomy was a safe and well-tolerated procedure, with significantly less pain and faster recovery compared to traditional laparoscopic appendectomy. Recently, some authors also reported the utilization of the vaginal opening at the time of laparoscopic-assisted vaginal hysterectomy or total laparoscopic hysterectomy as a natural orifice for appendectomy and achieved acceptable outcomes [30,31]. Although the transvaginal approach is the preferred surgical route, controversy still exists as to the ethical aspects. The results of some questionnaire surveys have shown that the acceptance of transvaginal NOTES is still low in the public [32]. Not all couples can both accept transvaginal endoscopic surgery [33]. In addition, transvaginal NOTES has numerous limitations. The presence of severe adhesions, obesity, or the need for a complex operation are still technical bottlenecks for pure NOTES, as is the lack of appropriate surgical instruments. Development of special access devices and instruments will remove some of the present limitations of NOTES surgery so that it may be applied to a wider variety of surgical fields.

Conclusions

We have applied laparoscopy to transvaginal appendectomy for the first time, and gained the desired results. Based on this initial series, transvaginal laparoscopic appendectomy, following

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vaginal hysterectomy, seems to be a safe and effective modification of established techniques, with acceptable outcomes. The new surgical technique requires further evaluation through more widespread application and prospective studies.

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Disclosure

Drs. Tian Y, Wu SD, Chen YH and Wang DB have no conflicts of interest or financial ties to disclose.

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