

Embryonic-Natural Orifice Transluminal Endoscopic Surgery Nephrectomy

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We describe our initial experience with embryonic-natural orifice transluminal endoscopic surgery (E-NOTES) nephrectomy in a nonfunctioning kidney. E-NOTES was performed with modified single port access by using a surgical glove and wound retractor. We used several laparoscopic instruments, such as articulating laparoscopic instruments, clips, conventional laparoscopic graspers, and dissectors. The operative time was 80 minutes. There were no intraoperative complications. (**Korean J Urol 2009;50:609-612**)

Key Words: Laparoscopy, Minimally invasive, Nephrectomy

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Laparoscopic urologic surgery used to be performed in selected cases in the 1990s, and has become an alternative to conventional open surgery for both malignant and benign disease.¹ In recent studies, minimization of the size and number of laparoscopic trocars has been of great importance in consideration of cosmetic issues and minimal invasiveness.²⁻⁵ The use of smaller and fewer trocars may reduce postoperative pain; therefore, researchers have been working to develop a less invasive technique compared with conventional laparoscopic surgery. Recently, embryonic-natural orifice transluminal endoscopic surgery (E-NOTES) has been performed by the single-port approach through the umbilicus, a natural embryonic orifice.⁶ The single port in this technique needs to allow the introduction of a laparoscope, multiple instruments, and gas insufflations through different channels. This can be achieved with a commercial multichannel trocar such as R-port (Advanced Surgical Concepts, Dublin, Ireland) or Uni-X™ Single Port (Pnavel Systems Inc, Morganville, USA), which is critical for performing single-port surgery. These single-port systems, however, have not yet been approved by the Korean Food and Drug Administration. We used a modified single port introduced by Rhu⁷ made with a surgical glove and wound retractor and report on a simple nephrectomy in a nonfunctioning kidney caused by ureteropelvic junction obstruction.

CASE REPORT

1. Materials

A 26-year-old male was diagnosed with an incidental non-functioning kidney and was referred to our institution. No specific symptoms or signs were noted in the review of systems and in the physical examination. He did not have a specific surgical or past medical history. His serum creatinine was 1.13 mg/dl in the blood chemistry done preoperatively, and other laboratory examinations were within the normal range. Ultrasound showed hydronephrosis with parenchymal thinning of the right kidney, which was confirmed on computed tomography. A nephrectomy was performed (Fig. 1).

2. Methods

Under general anesthesia, the patient was placed in the semilateral decubitus position. A paramedian incision 3 cm in length was made along the margin of the umbilicus. To make a single port similar to a commercial multichannel trocar, a wound retractor (Alexis, Applied Medical) was put through the incision and wrapped with a surgical glove that had 3 trocars inserted into the fingers. Pneumoperitoneum was induced by CO₂ gas insufflations (Fig. 2). We used conventional and articulating laparoscopic instruments (Roticulator; Autosuture,

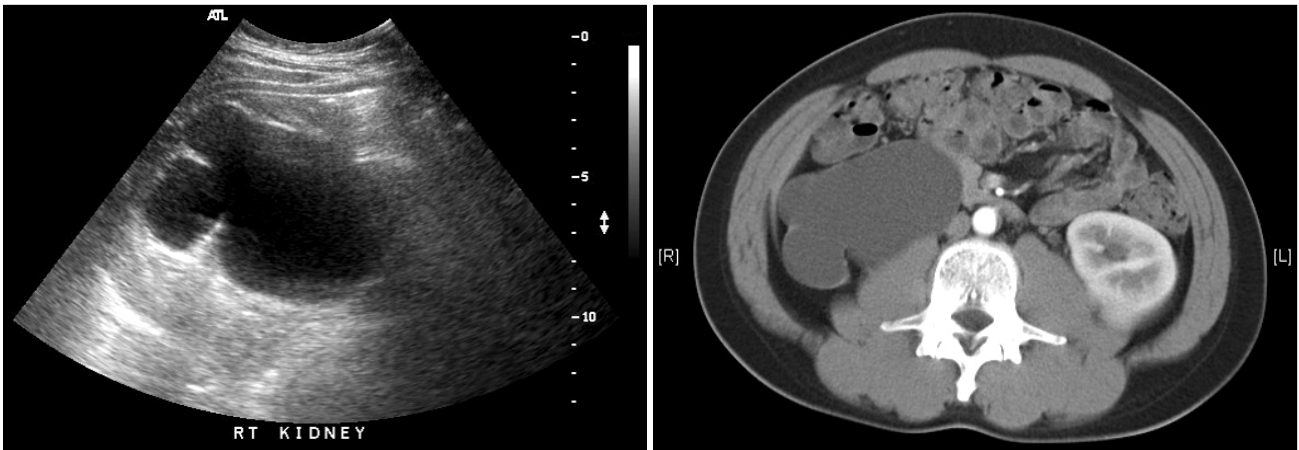


Fig. 1. Preoperative ultrasound and computed tomography showing severe hydronephrosis with parenchymal atrophy in the right kidney.

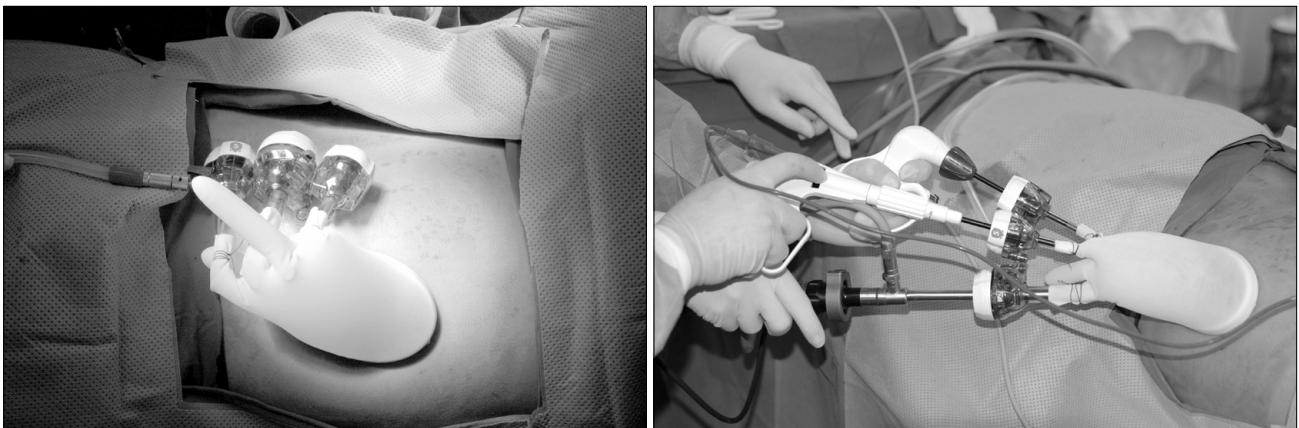


Fig. 2. Single-port access with surgical glove and wound retractor (Alexis, Applied medical).

Norwalk, USA). Articulating laparoscopic graspers and dissectors were flexible up to 80° in the abdominal cavity. A simple nephrectomy was performed in the same manner as conventional laparoscopic nephrectomy (Fig. 3). The dissected kidney was put into a laparoscopic bag and retrieved through the abdominal incision.

The total operation was 180 minutes, and the pure laparoscopic manipulation time was 80 minutes after time for preparation, such as for pneumoperitoneum and skin closure, was excluded. There was no detectable intraoperative bleeding or other complications. The patient complained of postoperative pain caused by residual CO₂ gas. He was discharged on postoperative day 3.

On pathologic evaluation, chronic pyelonephritis with hydronephrosis of the right kidney was reported. During a follow-up visit, the wound was clear after the stitches were



Fig. 3. The dissection of the upper pole of the right kidney with articulating and conventional laparoscopic instruments.



Fig. 4. Port incision site. Day of operation (A) and postoperative day #7 after the stitches were taken out (B).

removed, and the patient did not complain of any symptoms. His serum creatinine was 1.3 mg/dl in the blood chemistry analysis (Fig. 4).

DISCUSSION

Laparoscopic surgery, a type of minimally invasive surgery (MIS), has become mainstream in urologic practice. However, many surgeons have been focusing on developing a newer technique that takes into account the cosmetic benefits and reduced postoperative pain that are the strong points of MIS. Some surgeons have tried to minimize the number or diameter of trocars used. Furthermore, the development of NOTES, a minimally invasive approach that passes through the umbilicus, a natural embryonic orifice, has been vigorously studied.^{8,9}

We attempted pure NOTES nephrectomy with only 2 gastroendoscopes through the stomach and vagina in a porcine model and found that the currently available instruments were not sufficient for control of the renal hilum. However, we successfully performed nephrectomy with hybrid NOTES, in which we obtained an operative view with a gastroendoscope introduced through the vagina and continued the operation with instruments introduced through the abdominal trocar. The kidney was retrieved through the vagina. Some authors have criticized the limitations of NOTES; there are possibilities for infection at the incision site by the normal flora of natural orifices or leakage at the closed site.¹⁰

E-NOTES is a single port technique that approaches through the umbilicus and resolves the weak points of pure NOTES mentioned above. E-NOTES has additional benefits, such as a

reduction in the number of trocars and postoperative pain and the cosmetic advantage of hiding the operation scar in the umbilicus.⁵

In this case, intraoperative injury to adjacent organs was not noted and perioperative bleeding was not detectable. In particular, the operation scar was clearly closed and could barely be seen on physical examination. The patient was fully satisfied with the results of the scar.

However, we verified some limitations in practice. First, the instruments for single port surgery do not yet fulfill our expectations. To secure the full range of motion of laparoscopic instruments, we used articulating instruments that were bent up to 80°, but single-port surgery was barely possible because of imperfect delivery of torque or power of the surgeon to push and pull the tissue. Therefore, we changed to conventional laparoscopic instruments despite their limitations of motion. Second, the heads of disposable trocars (Excel, Ethicon, US) bumped into each other extra-abdominally and limited the range of motion of the laparoscopic instruments. Furthermore, the trocars that we used were too long to enter through a single port together, and the trocars bumped into one another. Shorter laparoscopic trocars with smaller heads could be used to secure a wider range of motion. Third, in single-port surgery, an additional instrument to lift the liver should be put through the single port, not an additional port, which may be an inconvenience when moving working instruments. This is another problem to be solved in operations of the upper pole of the right kidney or the right adrenal.

In conclusion, we safely performed a simple nephrectomy in a benign renal lesion with E-NOTES. Improvements, however,

are mandatory for the development of applicable instruments and adaptation of the technique. Proof of safety and standardization of the technique should be investigated in further studies.

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