

Single Access Laparoscopic Nephrectomy

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Abstract

Laparoscopic nephrectomy has assumed a central role in the management of kidney diseases. Laparoscopy, inspite of its less morbidity than open surgery, still requires several incisions. These incisions carry risks of bleeding, ventral hernia, damage to internal organs and decreased cosmesis.

An alternative to laparoscopy is the single access or keyhole surgery. This keyhole surgery utilizes the new laparoscopy access port (R-Port), single port access (SPA) procedure, one port umbilical surgery (OPUS), the "belly button" entry, natural orifice transluminal endoscopic surgery, and the magnetic anchoring and guidance system (MAGS) technology.

Keywords: SILS, SILS nephrectomy, Laparoscopic nephrectomy.

INTRODUCTION

Open nephrectomy performed through the muscle splitting flank incision was the gold standard therapy for many kidney diseases. This was replaced by the less morbid procedure, the laparoscopic nephrectomy. Since the first laparoscopic nephrectomy by Clayman and colleagues in 1991, minimally invasive urologic surgery has gained significant momentum. In an effort to reduce the sequelae of laparoscopic nephrectomies, single access or keyhole surgeries have developed.

ARTICULATING LAPAROSCOPIC INSTRUMENTATION

This involves using articulating instrumentation via a single large caliber trocar or small/adjacent trocars. Advances in technology have led to the development of new access port (R-Port, Advanced Surgical Concepts, Wicklow, Ireland and Uni-X single port, P navel systems, Cleveland, OH, USA) capable of allowing multiple instruments to be inserted through different cannulas of a single port. Alternatively, adjacent 5 mm trocars can be utilized with skin trocars connected at the time of specimen extraction.

Currently, articulating laparoscopic graspers, endoshears and laparoscopic needle drivers are commercially available for clinical use.

In conjunction with articulating instrumentation, the development of novel intra-abdominal retractor will further facilitate evolution of laparoscopic procedures. One such device is the pardon endoscopic exposing retractor (PEER). Another important component is 45 degrees 5 mm rigid laparoscope with an end light source (karl storz) or a 5 mm

deflectable tip video laparoscope (Olympus, Orangeburg, NY, USA).

CLINICAL EXPERIENCE

Raman and colleagues reported their experience with keyhole nephrectomy in a porcine model and human subjects. In their series, keyhole nephrectomy was completed successfully in 8 porcine renal units and in all three human subjects. The mean operative time for the porcine nephrectomies was 49 minutes with a mean blood loss of 20 cc. Incision size ranged from 3 to 5 cm. The mean operative time for the human nephrectomy cases was 133 minutes, estimated blood was 30 cc and the kidneys were extracted through a solitary 2 to 4.5 cm periumbilical incision. There were no perioperative complications and all three patients were discharged from hospital on day 2.

The attractiveness of keyhole umbilical nephrectomy is multifaceted. First, it improves cosmesis by allowing a single umbilical incision. Second, it is within a surgeon's comfort range since specimen extraction occurs via the abdomen. Third, the learning curve appears to be much shorter than for NOTES. Finally, keyhole umbilical surgery provides a "familiar" anatomical view of the kidney.

NOTES

Natural orifice transluminal endoscopic surgery approaches abdominal surgery through natural orifices (mouth, vagina, and rectum). Animal models have been used to demonstrate the potential application of NOTES, including transgastric and transvesical peritoneoscopy, transvaginal tubal ligation, hysterectomy, and cholecystectomy.

Gettman and colleagues reported in 2002 on the successful completion of six laparoscopic transvaginal nephrectomies using conventional instrumentation in a porcine model. Clayman et al also performed single-port NOTES transvaginal nephrectomy using the purpose-built multi-lumen operating platform.

There were drawbacks in both the above procedures in which the operative duration was longer than the conventional laparoscopy.

MAGNETING ANCHORING AND GUIDANCE SYSTEM (MAGS)

An alternative to conventional laparoscopy and NOTES is single access or keyhole surgery utilizing a magnetically

anchored guidance system, articulating laparoscopic instruments, and/or specialized trocars.

Park and colleagues have recently developed a novel adjunct laparoscopic system consisting of a movable, "lockable" platform that is positioned intra-abdominally and stabilized by an external permanent magnet on the abdominal skin. MAGS can be used to actively control an intra-abdominal camera and working instruments through a single trocar.

Zeltser et al have subsequently described the first successful completion of two porcine nephrectomies via a single 15 mm transumbilical trocar using a prototype MAGS camera and a magnetically anchored robotic arm cauterizer.

Prior to widespread adoption of the MAGS platform, both clinical and engineering limitations must be addressed.