

Chapter 2

Overview: Rationale and Terminology

Hagop Sarkissian and Brian H. Irwin

Keywords LESS • Laparoendoscopic single-site surgery • Single site • Nomenclature
• NOTES • Natural orifice transluminal endoscopic surgery

Introduction

In the last several decades, with the advent of the Internet and globalization, the world has seen unprecedented information dissemination and exchange. Accompanying this explosion of information has been an unquestionable and previously unparalleled increase in the development and propagation of technology and techniques in medicine and, in particular, in minimally invasive surgery.

Urology has long remained at the forefront of the development and implementation of such technologies. Its involvement in the improvement and distribution of these techniques worldwide is not surprising. Urology has long been a discipline with a dependence on innovative technology to minimize the invasive nature of our procedures. The nature of the urinary tract within the human body seems to spur innovation and has allowed urologists to keep at the leading edge of minimally invasive technological revolutions. In their simplest forms, single-site surgery and even NOTES procedures have been used by urologists for decades with the use of percutaneous nephrolithotomy via a single small incision and a multitude of transurethral endoscopic procedures. The application of similar principles to surgeries traditionally performed via open, or more recently laparoscopic and robotic-assisted, approaches is simply a natural extension of the urologist's current armamentarium to continue on his or her quest to minimize access-related trauma and improve outcomes.

H. Sarkissian, M.D. • B.H. Irwin, M.D. (✉)

Division of Urology, Department of Surgery, University of Vermont College of Medicine,
111 Colchester Ave, ACC EP5 Urology, Burlington, VT 05401, USA
e-mail: hagop.sarkissian@vtmednet.org; brian.irwin@vtmednet.org

In the early 1990s, when conventional laparoscopy (CL) was in its infancy and Clayman performed the first laparoscopic nephrectomy [1], a revolution of surgical approach and thought occurred very rapidly. As it became clear that even the most complex of urologic reconstructive and oncologic procedures could be performed in ways that would allow for earlier recovery and minimization of morbidity, the scope of minimally invasive urology exploded. Today, the technology and techniques utilized during conventional laparoscopy have matured. These surgical approaches have evolved and, as a direct result, have given the minimally invasive community two progeny that are very much interrelated: natural orifice transluminal endoscopic surgery (NOTES) and laparoendoscopic single-site (LESS) surgery.

Prior to delving further into the world of urologic minimally invasive techniques and procedures, it is important to understand the history and rationale behind the development of these techniques, and the evolution of the standardization of their nomenclature. Current advances and issues that these approaches face, based on currently published white papers, clinical trials, and patient attitudes toward the new breed of minimally invasive surgical techniques, will also be reviewed.

Nomenclature

While the clinical applications of LESS have largely outshined those of NOTES mainly due to technical challenges related to access and instrumentation, the nomenclature and original studies of NOTES actually predate those of LESS. For this reason, most discussions of NOTES and LESS prefer to address them chronologically rather than the order in which they have been adopted into the clinical surgical repertoire.

NOTES

NOTES is the acronym used to describe procedures performed via natural orifice transluminal endoscopic surgery.

In its purest intended form, NOTES entails using one or more naturally occurring openings of the human body (i.e., mouth, nares, vagina, urethra, and anus) with the intention of puncturing through the wall of the accessed hollow organ (stomach, vagina, urinary bladder, and/or colon) to gain access to another body cavity/space (peritoneum, retroperitoneum, thorax, etc.). Following access, the surgeon then proceeds with the specific task of the intended operation using instruments introduced through the opening.

Other criteria related to the definition of NOTES have also been generally accepted and are as follows [2]:

- If instruments or ports are used transabdominally along with the natural orifice opening, but greater than 75 % of the dissection and operation is performed via the natural orifice, then the procedure is deemed a hybrid NOTES procedure.

- If the natural orifice is used only for additional port placement, but the majority of the operation is conducted via transabdominal ports, then the procedure takes on the designation of NOTES-assisted.
- If the natural orifice is used as an extraction point only, it is not considered NOTES.
- The umbilicus is not considered a natural orifice for purposes of NOTES designation.

LESS

LESS is also an acronym describing an endoscopic procedure. It stands for laparoendoscopic single-site surgery.

LESS procedures rely on a single access site, usually involving the transabdominal or retroperitoneal placement of ports. Because of the breadth of potential applications, the definition has become slightly more involved. It has been generally accepted that LESS also adheres to the following [2, 3]:

- A single, a multiple, or a single multi-port platform used through the single incision.
- If the umbilicus is used for access, the letter “U” shall be placed in front of the procedure, e.g., “U-LESS.”
- Enlarging an incision for specimen retrieval does not exclude the procedure from being considered a LESS procedure.
- The adjunctive use of small needlescopic instruments/ports is encouraged if they enhance the surgeon’s confidence and the patient’s safety.
- A single incision with multiple fascial openings is not excluded from the LESS definition.

As seen, these are highly specific terminology and definitions that have been attached to a myriad of surgical procedures. The acronyms NOTES and LESS are the currently agreed-upon versions of a minimally invasive primordial alphabet soup that existed prior to 2006.

Nomenclature History

Prior to the consensus statement by the NOTES Working Group in 2008, the nomenclature used above for the procedures was referred to by several different combinations and acronyms, a few of which can be seen in Table 2.1.

The lack of standardization of terminology led to confusion in the academic examinations of these techniques. It became difficult to perform meaningful literature searches and define inclusion criteria, making it impossible to report consistent results. Many centers were duplicating work due to the inability to accurately

Table 2.1 Descriptive terms and corresponding acronyms used in the literature

Descriptives	Acronyms
Natural orifice surgery	NOS
Natural orifice transluminal endoscopic surgery	NOTES
Natural orifice transluminal endoscopic surgery nephrectomy	
Embryonic NOTES	E-NOTES
Hybrid natural orifice transluminal endoscopic surgery	H-NOTES
Robotic NOTES	R-NOTES
Robot assisted single port access	
Umbilical natural orifice transluminal endoscopic surgery	U-NOTES
Laparoendoscopic single-site surgery	LESS
One port umbilical surgery	OPUS
Single access-site laparoscopic surgery	SAS
Single incision laparoscopy	SIL
Single Incision laparoscopic surgery	SILS
Single port access	SPA
Single port access surgery	
Transumbilical laparoscopic assisted surgery	TULA
Visibly scarless urologic surgery	VSUS
Combined single port access	
Pure single port access	
Pure natural orifice transluminal endoscopic surgery	
Scarless single port transumbilical surgery	
Single keyhole surgery	

describe these new techniques. It became clear that standardization was necessary. As an example of the resulting confusion, Box et al. [2] described a Medline/PubMed and ARGH online acronym database searches in which 8,710 and 11,010 citations, respectively, were obtained, using 720 different definitions of the searched acronyms to describe what would, some time later, be termed NOTES and LESS procedures. Fortunately for the urologist, 362 of the PubMed articles and only 5 of the ARGH acronyms pertained to urology from a period spanning 1990–2008. There seemed to have been a significant overlap with other specialties and keywords associated with alternative nonsurgical meanings. In a similar manner, Sanchez-Salas et al. [4] reported on 412 manuscripts, with 64 pertaining to urology, while searching PubMed for descriptive words of single port, single site, NOTES, LESS, and single-incision surgery from 2002 to 2009.

In 2006, the Natural Orifice Surgery Consortium for Assessment and Research (NOSCAR) Working Group convened to address the problem of confusion of nomenclature in the literature. The working group was a joint initiative between the American Society for Gastrointestinal Endoscopy (ASGE) and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) [2, 5]. As a result of this meeting, the term NOTES was coined and adopted as the accepted standard for the procedures falling into the previously described definitions. Subsequently, the term was trademarked by the same entity.

In urology, the Urologic NOTES Working Group was established in 2007 not only to address the nomenclature, but also to aid in the safe implementation of clinical research and to help standardize outcomes reporting and training for these new techniques [2, 4–6]. This working group was composed of members of the Endourological Society as an ad hoc gathering of individuals interested in NOTES. The group's vision was one of the safe and systematic implantation of NOTES along a defined pathway from conception of procedures to bench research to animal lab protocols, ultimately culminating in improvements in patient care through clinical trials. It was felt the new techniques in development should at the very least match, if not exceed, the efficacy, economy, and safety of the current standard of care for minimally invasive procedures. But, above all else, all agreed that patient safety was of the utmost importance.

The other working group that was influential in defining the role of LESS was LESSCAR, or Laparo-Endoscopic Single-Site Surgery Consortium for Assessment and Research. They have taken the helm in the standardization of nomenclature and implementation of LESS procedures. Most of the members of the Urologic NOTES Working Group are also the founding members of LESSCAR, formed in 2008 [3, 7]. Their consensus statement in 2010 further delineated and specified the nomenclature, research, and outcomes reporting procedures. For example, the 2010 consensus statement requires the inclusion of clear and full standards of reporting procedures, called “mandatory descriptive second line,” for research publications. This brief statement should be included in all manuscripts and should state the following information in a concise manner [3]:

- Single incision length and location (abdominal, thoracic, etc.)
- Approach (percutaneous intraluminal, transperitoneal, etc.)
- Number and type of ports used
- Type of surgery (laparoscopic, endoscopic, robotic)
- Type of laparoscope used (flexible, straight)
- Type of instruments used (straight, curved, articulating, etc.)
- Whether or not a 2-mm needlescopic instrument was used

The LESSCAR group has also taken steps in trademarking the acronym LESS with a similar rationale of the NOSCARGroup's. It is to ensure that the acronym can have universal availability to the surgical and/or medical community and that industry does not have exclusive rights and benefits for profiting or marketing from its usage.

We owe a tremendous debt of gratitude to the thought leaders in the NOSCARGroup, Urologic NOTES Group, and LESSCAR working groups. Aside from the standardization of the nomenclature to the procedures, a daunting task in itself, they also set forth guidelines for research, publication, and ultimately patient safety regarding NOTES and LESS. Due to their efforts, a clear increase in interest and in the number of publications can be seen in the literature in both single-site and NOTES surgery, as shown in Figs. 2.1 and 2.2.

Fig. 2.1 Number of NOTES publications found as a result of PubMed search on the following terms: “natural orifice transluminal endoscopic surgery OR Robotic NOTES OR natural orifice surgery OR umbilical NOTES OR embryonic NOTES” (*red*) and with the addition of the search term “AND urology” (*white*)

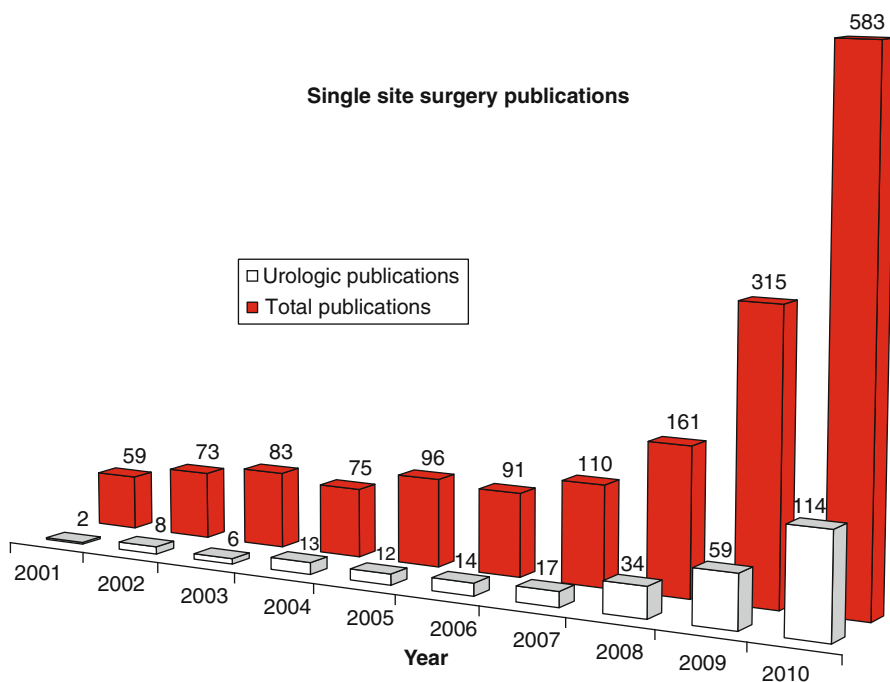
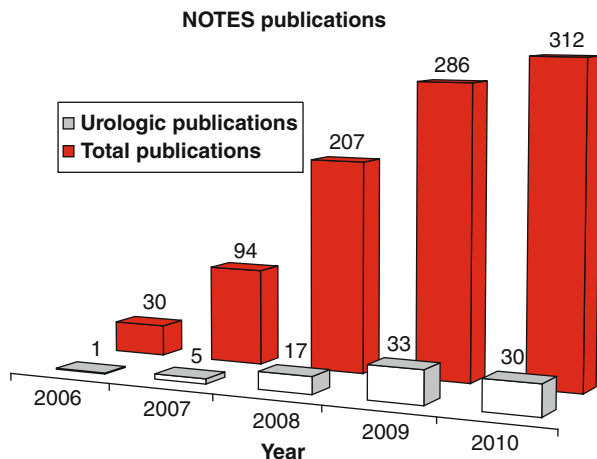


Fig. 2.2 Number of single-site surgery publications found as a result of PubMed search on the following terms: “laparoendoscopic single site surgery OR single port access surgery OR single port access OR single incision laparoscopic surgery OR single port laparoscopy OR single port laparoscopic surgery OR single incision laparoscopy OR one port umbilical surgery OR single trocar laparoscopic surgery OR keyhole surgery” (*red*) and with the addition of the search term “AND urology” (*white*)

Evolution of Procedures

Gettman et al. described the first application and feasibility of NOTES by successfully completing transvaginal nephrectomy in a porcine model [6, 8]. Note that the procedure predates the acronym NOTES. The first NOTES series (transgastric liver biopsies in a porcine model) was published by Kalloo et al. in 2004 [9]; it was not until 2006 that the official name, NOTES, entered the surgical lexicon. Subsequently, there have been hybrid and pure NOTES procedures in both animal and human cases, including appendectomies, cholecystectomies, nephrectomies, and others.

Advanced LESS in urology, on the other hand, which describes a single transabdominal incision as its mainstay, was pioneered early on by two groups, the University of Texas Southwestern Medical Center and the Cleveland Clinic [6]. Today, LESS has gained momentum in pyeloplasty, nephrectomy, and even prostatectomy and has been adopted at centers worldwide.

The first case reports of NOTES and LESS in porcine models showed the feasibility of the techniques and set the stage for the evolution of CL toward NOTES and LESS. It started a paradigm shift in thought leading to changes in technique and innovation in surgical specialties.

In 2006 at the SAGES conference, Rao et al. presented the first transgastric NOTES appendectomy in humans [5, 7]. In 2009, Marescaux et al. described the first transvaginal NOTES cholecystectomy [5, 10]. Urologically, as mentioned, in 2002 Gettman et al. reported their experimental case series of transvaginal NOTES nephrectomies in the porcine model. It was not until 2007 that there was a resurgence of NOTES in urologic procedures with publications by Clayman [11] and Lima [12], in animal models. The experimental stages in the animal models and the success that followed helped move the procedures to the human cadaveric realm, where Aron et al. [13] explored the idea of transvaginal NOTES nephrectomies. Prior to this, hybrid NOTES procedures were successfully completed in humans by Gill et al. [14] and Branco et al. [15]. On the heels of Aron's transvaginal NOTES nephrectomies, Kaouk et al. reported the first successful human pure NOTES transvaginal nephrectomy procedure in 2009 [16].

Addressing LESS in urology, the first two cases of single-port surgery were reported by Rane et al. in 2007 at the 25th World Congress of Endourology and subsequently in *Urology*, of five human subjects using an R-port (two simple nephrectomies, one orchidopexy, one orchidectomy, and one ureterolithotomy) [17]. Raman et al. presented a case series of 7 nephrectomies, 4 in a porcine model and 3 in humans, using a single access site termed "single keyhole umbilical nephrectomy" [18]. In 2009, Barret et al. reported their experience with LESS extraperitoneal radical prostatectomy in a cadaveric model [19]. Since the initial case series above, well over 300 upper and lower urinary tract procedures have been described in the world literature using a single access site in humans. The earliest ones include Desai et al.'s single-port transumbilical nephrectomy [20], Rane et al.'s LESS nephrectomies [21], Stolzenburg et al.'s 10 LESS radical nephrectomies [22], and Gill et al.'s four single-port transumbilical live-donor nephrectomies [23]. In fact, two large series involving as many as 100 cases each exist in the LESS literature [24, 25].

Table 2.2 The evolution of surgical techniques and the anticipated benefits to the patient, surgeon, and technology

	Open surgery	Conventional laparoscopy	Robot-assisted laparoscopy	LESS	Robotic LESS
Patient	+	+++		(+)	(+)
Surgeon	+	–	+	– –	(+)
Technology	+	++	+++	(++)	(+++)

It is clear that with each step forward, improvements are possible and necessary, but to date they have not all been realized (shown in parentheses)

Rationale

The move from open procedures to conventional laparoscopy was a huge paradigm shift that allowed a large positive leap forward in the reduction of patient morbidity. Patient safety; reduction in blood loss, pain, length of stay, and convalescence; and an increase in quality of life are consistently shown as advantages of conventional laparoscopy over open procedures. Has this same leap forward been seen with the advent of NOTES and/or LESS? To date, the answer is no. This is in part due to the concept of diminishing returns. Since the leap from open surgery to conventional laparoscopy was so radical, much of the benefit from the minimization of access has already been realized. Advances now are largely centered on providing ergonomic benefit to the surgeon and improving technology, while incremental benefits to the patient remain quite small, as shown in Table 2.2.

Currently, there is a lack of large prospective clinical trials or substantial case series to compare conventional laparoscopy to NOTES/LESS procedures with regard to patient safety and outcomes. The path for NOTES and LESS procedures does diverge here somewhat. NOTES procedures, by their very nature, have much higher technological constraints (i.e., inadequate instrumentation, visceral closure shortcomings, etc.). This has led to the inability of the vast majority to be able to perform these procedures clinically in humans. The only true comparative studies that exist in the current literature compare LESS to conventional laparoscopy. Irwin et al. presented a multicenter experience of complications and subsequent conversion from LESS to open in upper tract urinary procedures [26]. A total of 125 patients underwent LESS, comprising 13.3 % of urologic laparoscopic procedures at these institutions. Only 5.6 % of LESS were converted to CL due to a variety of reasons (facilitate dissection, reconstruction, or homeostasis). Complications were noted in 15.2 % of patients undergoing LESS (urine leak, DVT, hemorrhage). Subset analysis revealed a higher rate of complication in reconstructive cases compared to extirpative ones. Before we dismiss LESS as too difficult to be performed safely, historical data tell us that conversion rates for laparoscopic cholecystectomy during its infancy ranged from 4 % to 5 % as well [26–29]. In urology, conversion rates from CL to open procedures during laparoscopic nephrectomy ranged from 8 % to 10 % in early series [26, 30–32].

Two prospective randomized trial comparing LESS to CL have been very recently published, showing similar results and suggesting some improvement with regard to convalescence in patients undergoing LESS procedures [33, 34].

The above does not show the superiority of LESS over conventional laparoscopy, at least not during the early phases of the procedure's adoption. But does it need to? As the LESSCAR group mentions in their consensus statement, the goal is to have at least equal efficacy and patient safety in comparison to CL. Simply showing the noninferiority of the technique would be adequate to justify continued study into these techniques. In mentioning this, we should not neglect the needs and wants of our patients. While patient safety, efficacy, and cost are of paramount consideration, patient perception of surgical outcomes and body image are important as well.

Bucher et al. tried to evaluate the perception and/or preferences of women in Geneva regarding different operative modalities (CL, U-LESS, and transvaginal NOTES). Of the respondents, 87 % preferred umbilical LESS vs. 4 % transvaginal NOTES vs. 8 % CL. Eighty-two percent preferred NOTES/LESS due to cosmesis. Ninety-six percent responded with apprehension regarding the transvaginal approach/access for fear of dyspareunia, short-term sexual abstinence, decreased sensation during intercourse, and infertility [35]. The same author conducted another study wherein the expectations for surgical treatment and surgical approach preference were queried. The first concern of the respondents was that of safety or risk of complications (92 % of respondents). At 74 %, cure was the overwhelming concern for the respondents compared to cosmesis at 3 %. But, when asked for their preference if operative risk was similar, 90 % preferred scarless surgery (i.e., LESS and NOTES) [36]. These numbers represent a cross section of a European population. While cross-continental differences may exist, a regional stratification of preferences may be even more prevalent in certain parts of the United States, lending importance to cosmesis in cities where body image has higher perceived social cost to the patient. A similar North American study regarding patient preference of these surgical approaches might lend further credence to NOTES and LESS especially if noninferiority in comparison to conventional laparoscopy can be shown.

Shortcomings

The basic concepts of exposure, visualization retraction/countertraction, and triangulation learned from our collective experience with conventional laparoscopic surgery pose serious technical issues when applied to either NOTES or LESS procedures. By limiting the access point, the nature of the procedure becomes one of an in-line surgical procedure. NOTES and LESS suffer from the lack of triangulation and clashing of instruments or robotic arms with current technologies and platforms. As with many new procedures, they also suffer from a lack of instrument specificity. Recently, the development of better docking platforms, access ports, specialized instruments, and improved optics have allowed new procedures to evolve and move forward. New innovations such as low-profile robotic arms, miniature intraabdominal robotic

devices, camera holding robots, magnetically anchored instruments and scopes, articulating instrumentation and improved tissue closure devices have and will need to continue to contribute to the successful transition of NOTES and LESS from the lab and animal models toward the generalizability of their use in hospitals and in human trials. Further prospective clinical trials are needed to address improvements made in technique, instrumentation, and patient outcomes in comparison to CL.

Current Trends and Future Directions

As conventional laparoscopy was in its infancy 25 years ago, NOTES and LESS are currently in theirs. Since LESS represents a more direct evolution from conventional laparoscopy, it has had a shallower learning curve and a much more extensive early clinical adoption than NOTES. Anatomical and access similarities suggest LESS will evolve slightly faster than NOTES.

Bench research, technological advancements set forward by industry, animal research, and prospective human studies conducted within the guidelines set forth by NOSCART and SCARLESS are crucial in the growth of these novel minimally invasive techniques. Aside from the above, we still do not know how to teach these techniques due to their novelty. It is assumed that today's surgeon has a working knowledge of conventional laparoscopic techniques and instrumentation, but where do we go from there? Do trainees learn most effectively from animal models, virtual reality or mechanical trainers, under the direct supervision of another surgeon during live patient procedures, or a combination of these methods? What is the optimal way of learning these techniques and implementing them into the urologist's practice in a safe and efficacious manner? This point is crucial if the technological advancements in NOTES and LESS are to be incorporated into mainstream surgical practice.

Today, the working groups continue to meet, evolve, modify, and refine their goals and standards. They are actively moving the minimally invasive surgical procedures of NOTES and LESS toward their maturity. But ultimately, lest we forget, it is the patient who will benefit from these procedures.

References

1. Clayman RV, et al. Laparoscopic nephrectomy: initial case report. *J Urol*. 1991;146(2): 278–82.
2. Box G, et al. Nomenclature of natural orifice transluminal endoscopic surgery (NOTES) and laparoendoscopic single-site surgery (LESS) procedures in urology. *J Endourol*. 2008;22(11): 2575–781.
3. Gill IS, et al. Consensus statement of the consortium for laparoendoscopic single-site surgery. *Surg Endosc*. 2010;24(4):762–8.
4. Sanchez-Salas RE, et al. Current status of natural orifice trans-endoscopic surgery (NOTES) and laparoendoscopic single site surgery (LESS) in urologic surgery. *Int Braz J Urol*. 2010;36(4):385–400.

5. Autorino R, et al. Current status and future perspectives in laparoendoscopic single-site and natural orifice transluminal endoscopic urological surgery. *Int J Urol*. 2010;17(5):410–31.
6. Gettman MT, 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(6):1117–20.
7. Rao GV, Reddy N. Transgastric appendectomy in humans. Oral presentation at: Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) Conference; 2006; Dallas, TX, USA 26–29.
8. Gettman MT, et al. Transvaginal laparoscopic nephrectomy: development and feasibility in the porcine model. *Urology*. 2002;59(3):446–50.
9. Kalloo AN, et al. Flexible transgastric peritoneoscopy: a novel approach to diagnostic and therapeutic interventions in the peritoneal cavity. *Gastrointest Endosc*. 2004;60(1):114–7.
10. Marescaux J, et al. Surgery without scars: report of transluminal cholecystectomy in a human being. *Arch Surg*. 2007;142(9):823–6; discussion 826–7.
11. Clayman RV, et al. Rapid communication: transvaginal single-port NOTES nephrectomy: initial laboratory experience. *J Endourol*. 2007;21(6):640–4.
12. Lima E, et al. Third-generation nephrectomy by natural orifice transluminal endoscopic surgery. *J Urol*. 2007;178(6):2648–854.
13. Aron M, et al. Transvaginal nephrectomy with a multichannel laparoscopic port: a cadaver study. *BJU Int*. 2009;103(11):1537–41.
14. Gill IS, et al. Vaginal extraction of the intact specimen following laparoscopic radical nephrectomy. *J Urol*. 2002;167(1):238–41.
15. Branco AW, et al. Hybrid transvaginal nephrectomy. *Eur Urol*. 2008;53(6):1290–4.
16. Kaouk JH, et al. Pure natural orifice transluminal endoscopic surgery (NOTES) transvaginal nephrectomy. *Eur Urol*. 2010;57(4):723–6.
17. Rane AP, Rao P. Single-port-access nephrectomy and other laparoscopic urologic procedures using a novel laparoscopic port (R-port). *Urology*. 2008;72(2):260–3; discussion 263–4.
18. Raman JD, et al. Laboratory and clinical development of single keyhole umbilical nephrectomy. *Urology*. 2007;70(6):1039–42.
19. Barret E, et al. A transition to laparoendoscopic single-site surgery (LESS) radical prostatectomy: human cadaver experimental and initial clinical experience. *J Endourol*. 2009;23(1):135–40.
20. Desai MM, et al. Scarless single port transumbilical nephrectomy and pyeloplasty: first clinical report. *BJU Int*. 2008;101(1):83–8.
21. Rane A, et al. Single-port “scarless” laparoscopic nephrectomies: the United Kingdom experience. *BJU Int*. 2009;104(2):230–3.
22. Stolzenburg JU, et al. Technique of laparoscopic-endoscopic single-site surgery radical nephrectomy. *Eur Urol*. 2009;56(4):644–50.
23. Gill IS, et al. Single port transumbilical (E-NOTES) donor nephrectomy. *J Urol*. 2008;180(2):637–41; discussion 641.
24. Desai MM, et al. Laparoendoscopic single-site surgery: initial hundred patients. *Urology*. 2009;74(4):805–12.
25. White WM, et al. Single-port urological surgery: single-center experience with the first 100 cases. *Urology*. 2009;74(4):801–4.
26. Irwin BH, et al. Complications and conversions of upper tract urological laparoendoscopic single-site surgery (LESS): multicentre experience: results from the NOTES Working Group. *BJU Int*. 2011;107(8):1284–9.
27. Delaitre B, et al. Complications of cholecystectomy by laparoscopic approach. *Apropos of 6512 cases*. *Chirurgie*. 1992;118(1–2):92–9; discussion 100–2.
28. Peters JH, et al. Safety and efficacy of laparoscopic cholecystectomy. A prospective analysis of 100 initial patients. *Ann Surg*. 1991;213(1):3–12.
29. Scott TR, Zucker KA, Bailey RW. Laparoscopic cholecystectomy: a review of 12,397 patients. *Surg Laparosc Endosc*. 1992;2(3):191–8.
30. Eraky I, et al. Laparoscopic nephrectomy: an established routine procedure. *J Endourol*. 1994;8(4):275–8.

31. Eraky I, el-Kappany HA, Ghoneim MA. Laparoscopic nephrectomy: Mansoura experience with 106 cases. *Br J Urol.* 1995;75(3):271–5.
32. Wilson BG, et al. Laparoscopic nephrectomy: initial experience and cost implications. *Br J Urol.* 1995;75(3):276–80.
33. Kurien A, et al. First prize: standard laparoscopic donor nephrectomy versus laparoendoscopic single-site donor nephrectomy: a randomized comparative study. *J Endourol.* 2011;25(3):365–70.
34. Tugcu V, et al. Laparoendoscopic single-site surgery versus standard laparoscopic simple nephrectomy: a prospective randomized study. *J Endourol.* 2010;24(8):1315–20.
35. Bucher P, et al. Female population perception of conventional laparoscopy, transumbilical LESS, and transvaginal NOTES for cholecystectomy. *Surg Endosc.* 2011;25(7):2308–15.
36. Bucher P, et al. Population perception of surgical safety and body image trauma: a plea for scarless surgery? *Surg Endosc.* 2011;25(2):408–15.

Scar-Less Surgery

NOTES, Transumbilical, and Others

Rane, A.; Cadeddu, J.A.; Desai, M.M.; Gill, I.S. (Eds.)

2013, XVI, 358 p. 81 illus., 77 illus. in color., Softcover

ISBN: 978-1-84800-359-0