

# Public Perception of “Scarless” Surgery: A Critical Analysis of the Literature

Riccardo Autorino, Wesley M. White, Matthew T. Gettman, Ali Khalifeh, Marco De Sio, Estevão Lima, and Jihad H. Kaouk

Evidence relating to the perception and view of patients and physicians on natural orifice transluminal endoscopic surgery (NOTES) and laparoendoscopic single-site surgery (LESS) was scrutinized. A comprehensive literature search was performed through PubMed. A total of 18 studies were included in the analysis. Patients demonstrated interest in scarless surgery, with a preference for LESS over NOTES. Safety and efficacy remain the key factors in the decision-making process of patients. With more information about the safety and reproducibility of LESS and NOTES, and with improved educational efforts, patients and physicians alike may feel more comfortable in widespread application of scarless surgery. *UROLOGY* 80: 495–502, 2012. © 2012 Elsevier Inc.

Minimally invasive surgery has revolutionized the management of urologic disease, and our aggressive application of laparoscopy has translated into improved surgical outcomes.<sup>1</sup> The introduction of surgical robotics has further accelerated this paradigm shift and placed urology at the forefront of minimally invasive innovation.<sup>2</sup> By contrast, this trend has faced some issues such as the need for specific training and the costs related to new technology.<sup>3,4</sup>

A litany of new iterations of laparoscopy has been proposed recently, with purported benefits including further reductions in postoperative pain and optimized esthetics.<sup>5</sup> Laparoendoscopic single-site surgery (LESS) uses a single incision through which the abdominal cavity and/or retroperitoneum is entered, the surgical field is exposed, and the diseased organ is directly addressed.<sup>6</sup> Early reports with LESS have cited its feasibility and potential for improved outcomes, particularly cosmesis. However, serious questions remain regarding its pragmatism outside of centers of excellence.<sup>7</sup>

Even more experimental and technically challenging is the concept of natural orifice transluminal endoscopic surgery (NOTES).<sup>8–10</sup> NOTES uses transgastric, transvesical, transcolonic, and/or transvaginal access to approach the peritoneal cavity and organ of interest. The ultimate goal is to avoid trauma to the abdominal wall.

Without question, NOTES represents a significantly more challenging approach even compared with LESS. Not only do substantial engineering limitations still exist with regards to instrumentation, but there also remain larger questions regarding the wisdom of transvisceral access. Thus far, reports of successful NOTES procedures remain anecdotal, and the use of this technique is still investigational.<sup>7</sup>

Laparoscopic cholecystectomy was introduced in the late 1980s and embraced by a minority of surgeons. Early studies showed that laparoscopy resulted in little patient benefit, increased cost, and potential harm to patients.<sup>11</sup> The public, however, with help from the lay press and industry, essentially demanded that their surgeons provide this innovative operation. Thus, the rapid dissemination and establishment as the current gold standard was actually driven largely by public demand. Thus, besides a more reliable assessment of the outcomes and the need for better instrumentation, a major issue for any novel surgical procedure is represented by the patients' demand and perception of techniques.<sup>12</sup>

Despite the myriad limitations inherent to LESS and NOTES, and despite a paucity of evidence to support its superiority compared with standard laparoscopy, there has been increasing public interest for these techniques. Naturally, supply has followed such demand, owing to competitive pressures, and the industry has responded to demands from surgeons for improved engineering and a robotics interface.<sup>13</sup> The larger question then becomes the public's perception and expectations of “scarless” surgery and how we as providers should address the role of these techniques during surgical counseling.

The purpose of this review is to provide an evidentiary overview of the available published literature on the specific issue of public views on these latest developments in minimally invasive surgery.

**Financial Disclosure:** The authors declare that they have no relevant financial interests.

From the Glickman Urological and Kidney Institute, Cleveland Clinic, Cleveland, OH; Urology Unit, Second University of Naples, Naples, Italy; Division of Urologic Surgery, University of Tennessee, Knoxville, TN; Department of Urology, Mayo Clinic, Rochester, MN; and Department of Urology, Hospital of Braga, Life and Health Sciences Research Institute (ICVS), ICVS/3Bs - PT Government Associate Laboratory, University of Minho Braga/Guimarães, Portugal

Reprint requests: Riccardo Autorino, M.D., Ph.D., Glickman Urological and Kidney Institute, Cleveland Clinic, 9500 Euclid Avenue Q10, Cleveland, OH 44195. E-mail: [ricautorino@tin.it](mailto:ricautorino@tin.it); [autorino@ccf.org](mailto:autorino@ccf.org)

Submitted: February 29, 2012, accepted (with revisions): April 2, 2012

**Table 1.** NOTES techniques: patients' preference and perception

Reference	Origin	Comparator	Procedure	Questionnaire Items	Study Population	Preferred Technique (rate)
Hagen et al., <sup>15</sup>	Switzerland	Lap And open	NS	7	292 pts (median age 43 y; 51% female) hospital visitors	NA
Varadarajulu et al., <sup>14</sup>	US	Lap	Chole	10	100 pts (mean age 45; 64% female) from outpatient clinics	NOTES (78%)
Swanstrom et al., <sup>17</sup>		Lap And open	Chole	58	192 prospective surgical pts (mean age 50; 51% female) in outpatient clinics	NOTES (56%)
Peterson et al., <sup>16</sup>		Lap	NS	10	100 women (age 18-79 y) from outpatient clinics and university campus	NOTES (68%)
Strickland et al., <sup>18</sup>	Australia	Lap	Chole	12	300 women (mean age 39.9 y; 195 health professionals, 37 pts undergoing/undergone lap chole, 68 gyn clinic pts)	Lap (65%)
Olakkengil et al., <sup>19</sup>		Lap	DN	15	49 women (51 y) (range 25-67 y) who had undergone laparoscopic DN	Lap (63%)
Rocchietto et al., <sup>20</sup>	Italy	Lap And open	Bariatric surgery	13	62 obese pts undergoing bariatric surgery	Lap (25%)
Li et al., <sup>21</sup>	China	Lap And open	Ns	3	1797 pts (mean age 47.8 y; 45.7% female) surgical candidates in 14 different hospitals	NOTES (44.6%)

Lap, laparoscopy; Chole, cholecystectomy; DN, donor nephrectomy; pts, patients; NS, not specified; NA, not available.

## MATERIAL AND METHODS

A comprehensive electronic literature search was performed in December 2011 using the MEDLINE database through PubMed as a search engine. The search was conducted using a free-text protocol and included the following terms: *natural orifice transluminal endoscopic surgery, laparoendoscopic single-site surgery, single-port laparoscopy, scarless urologic surgery, mini-laparoscopy, needlescopic surgery, patient preference, patient view, patient opinion, patient perception, body image, and cosmesis*. A hand search of article references was done to ensure that further relevant publications could be found and included.

## RESULTS

Eighteen studies were identified and included in the analysis: 11 on NOTES, 3 on LESS, and 4 on both techniques. The first 3 reports were published in 2008, whereas half of the studies appeared in 2011 only. Investigators from the United States (8 studies) and Europe (7 studies) contributed primarily to the field. General surgery specialties, including digestive, bariatric, and transplant surgery, represented (12/18) the studies most frequently conducted, the remaining being in gastroenterology (3 studies), urology (2 studies), and gynecology (1 study).

Most of the available studies were conducted on NOTES compared with laparoscopy (Table 1). Three

studies recently published in the urology literature looked at patients' view on LESS (Table 2). More recent reports have taken into account both NOTES and LESS as "scarless" options; thus, comparative analyses have become available (Table 3).

## COMMENT

### Which Patients Would Prefer NOTES and Why?

Varadarajulu and colleagues performed the first study that specifically addressed the issue of patient preferences for NOTES. The authors evaluated patient perception of NOTES cholecystectomy by assessing their preference regarding the orifice for NOTES as well as the procedural risks they were willing to accept.<sup>14</sup> This cross-sectional survey of 100 patients included patients with an intact gallbladder who were undergoing evaluation for abdominal pain. Seventy-eight percent of the patients preferred NOTES, and the most common reasons for this preference were lack of external pain and lack of scarring. Young age, female sex, and prior endoscopy were associated with a bias in favor of NOTES. Study limitations included selection bias, limited available information on NOTES that could be provided to patients, evaluation only in the setting of cholecystectomy, and lack of a validated questionnaire.

**Table 2.** LESS: patients' views

Reference	Origin	Comparator	Procedure	Questionnaire Items	Study Population	Main Study Findings
Lucas et al., <sup>24</sup>	US	Lap	Kidney surgery	15	79 pts (median age 54.8 y; 65% men) returning to clinic after transperitoneal laparoscopy	Cosmesis score increased in females, patients <50 y, and benign surgical indication. LESS preferred in 30.4% vs lap in 39.2% Concern for cosmesis associated with LESS preference
Olweny et al., <sup>25</sup>	US	Lap and open	Kidney surgery	4	90 pts (mean age 51.1 y; 44.4% male) scheduled for kidney surgery	"Surgeon reputation" and "no complications" most important factors Score for "size/number of scars" significantly higher for the LESS cohort before surgery, but nonsignificant after surgery Score for "size/number of scars" before surgery significantly higher for younger and nononcology patients
Benesath et al., <sup>26</sup>	US	Lap and open	Chole	5	125 women (mean age 31.4 y) who underwent lap chole	<50% of pts remembered the number of incisions -65.5% cited the umbilical site as the most painful -68.6% would have preferred to eliminate an incision (63% of them choosing to eliminate the umbilical incision)

Abbreviations as in Table 1.

**Table 3.** NOTES vs LESS: comparative views

Ref.	Origin	Comparator	Procedure	Questionnaire Items	Study Population	Most Preferred (rate)
Rao et al., <sup>27</sup>	UK	Lap and open	Append	4	736 (78.4% <40 years; 49.6% female) medical (doctors and nurses) and nonmedical groups	LESS (80.6%)
Bucher et al., <sup>28</sup>	Switzerland	Lap	NS	11	420 participants (median age 37 y): medical staff (n = 120), paramedical staff (100), surgical pts (100), general population (100)	LESS (75%)
Bucher et al., <sup>29</sup>	Switzerland	Lap	Chole	11	300 participants (median age 35 y; 100 medical/paramedical staff, 100 surgical pts, 100 general population)	LESS (87%)
Ross et al., <sup>30</sup>	US	Lap	NS	7	152 pts (mean age 38 y; 55% female) friends or relatives of preoperative Clinic pts or of hospital personnel	NS
Chow et al., <sup>12</sup>	UK	Lap and open	Chole	5	1006 individuals (54.5% female) from general public	LESS (79%)

NS, not specified; Append, Appendectomy; other abbreviations as in Table 1.

In a similar fashion, Hagen et al used a 7-item questionnaire in structured interviews with hospital visitors.<sup>15</sup> After a detailed explanation of terms used and of possible complications, groups of 10 participants were sequen-

tially asked questions concerning the importance of cosmetic results in abdominal surgery, satisfaction regarding existing scars, hypothetical acceptance of increased risk as a trade-off for the absence of scars, and other issues.

Findings from this survey demonstrated that cosmetic results are an important and perhaps co-dominant issue among healthy individuals.

Peterson and colleagues focused on what concerns women would have, as well as what they perceive as incentives to having NOTES.<sup>16</sup> An anonymous, 10-question, validated survey was distributed to 100 women. Notably, 68% indicated that, assuming an equivalency between laparoscopic and transvaginal procedures, they would prefer the transvaginal approach. Reasons to consider transvaginal procedures were cosmetic/aesthetic ones, minimizing the risk of hernia formation, and decreased pain. There was no difference in the percentage of women who would choose a NOTES approach over laparoscopy based on age or parity. Nulliparous women would also more often consider transvaginal surgery for cosmetic/aesthetic benefits. Perceived benefits of the NOTES approach appeared to be minimization of hernia formation and pain, as well as optimization of cosmesis. Limitations of this survey were the relatively small sample size and the narrow focus group.

Swanstrom et al created a 58-item survey instrument to assess patient attitudes toward NOTES using NOTES cholecystectomy as the index procedure. In this study, surgical patients seen in 2 busy gastrointestinal surgical clinics were evaluated.<sup>17</sup> Subjects reported the risk of having a complication, recovery time, and the amount of postoperative pain to be of greater importance than the length of hospital stay, anesthesia type, cosmesis, or cost. NOTES was perceived to be associated with less pain, cost, risk of complications, and recovery time, but it required more surgical skill. Fifty-six percent of the patients reported that they would opt for a NOTES approach. Patients older than 70 years and those who had undergone previous flexible endoscopy were less likely to select NOTES.

From Australia, Strickland et al investigated the opinions of female patients and health care workers at a teaching hospital.<sup>18</sup> In their study, 300 individuals were surveyed, including 195 health professionals, 37 patients who were undergoing or had recently undergone laparoscopic cholecystectomy, and 68 gynecologic clinic patients. The results suggested that the compelling incentive for NOTES, namely the absence of abdominal scars, might not be such an important factor for many patients. The majority (66%) of respondents were not concerned about the scars caused by surgery. However, as expected, younger respondents were more concerned with cosmetic issues. When given the option of an operation not causing scars, scarcely more than half of the individuals surveyed responded positively, although this response decreased significantly with increasing age. These findings appear to be in contrast to those obtained from previously conducted investigations, all of which were conducted in the United States.<sup>14,16,17</sup> Australian women therefore appear to be less convinced about the potential benefits of NOTES procedures than their

American counterparts. This may be a result of cultural differences but a more likely explanation stems from public awareness and perception of the technique.

In another study from the same multidisciplinary Australian group, a 15-point questionnaire was administered to women who had previously undergone laparoscopic donor nephrectomy.<sup>19</sup> Participants were asked their thoughts on a transvaginal approach for this procedure. Although the majority (90%) of these women did not have adverse feelings toward scars, 37% stated that they would consider a transvaginal NOTES donor nephrectomy. However, this figure was increased to 51% if the patients could be reassured that NOTES was as safe as standard laparoscopy.

Given the potential dovetailing role that NOTES could play in bariatric surgery, Rocchietto et al carried out a study with the aim of investigating female bariatric patients' opinions about NOTES.<sup>20</sup> Overall, 62 patients (mean body mass index 45.3 kg/m<sup>2</sup>) entered the study. The risk of complications was classified as the most important factor by 87.1% of patients. Postoperative pain, hospital length of stay, recovery time, and cosmetic result were classified as most important by 19.4%, 4.8%, 16.1%, and 16.1% of patients, respectively. A total of 74.2% of patients stated that even with knowledge of NOTES, they would still prefer a traditional surgical approach. None of the patients would accept an increase in complication rates in favor of a better cosmetic outcome. Among those agreeing to a NOTES approach, 22.2% would undergo it for an aesthetic purpose, 88.9% to minimize the risk of incisional hernias, and 94.4% to reduce postoperative pain.

In the largest reported survey on this topic, Li et al investigated the preference for scarless surgery among Chinese patients.<sup>21</sup> Overall, 1797 surgical candidates for various gastrointestinal disorders from 14 different hospitals were enrolled. The vast majority (86.7%) of them preferred minimally invasive surgery, including either NOTES (44.6%) or laparoscopy (42.1%) compared with open surgery. Female patients were more likely to choose a NOTES procedure. The mean age was marginally lower in the NOTES group than in the laparoscopy group, but it was significantly higher in the open surgery group. Persons with a higher educational background were more inclined to choose minimally invasive surgery. Those who had previously undergone both laparoscopy and open surgery strongly favored NOTES. Overall, the main reasons for adoption of a surgical technique were found to be safety and efficacy. There was a significant difference among these groups in citing the first reason for selection of a surgical procedure. Abdominal incisions and postoperative scarring were valued more highly among respondents who preferred NOTES. The authors also speculated that in Asian culture it might be more difficult for female patients to accept the concept of a transvaginal procedure.



## What Do Physicians Think About NOTES?

For NOTES to advance and become a mainstream surgical procedure, it will need to be accepted and embraced by both patients and physicians. Thus the understanding of physician perceptions of NOTES is also important to help guide the trajectory of research efforts and the allocation of research and development funding. Two studies have investigated surgeons' perceptions of NOTES.

Thele et al assessed physician attitudes regarding transvaginal access to the abdominal cavity within the gynecologic community.<sup>22</sup> A questionnaire was sent to 181 gynecologic departments in Germany, Austria, and Switzerland. Fifty-two questionnaires were returned (response rate 28.7%). The transvaginal approach was classified as medically acceptable by 69.2% of the respondents, whereas the other 30.8% considered it experimental. Only 32.7% of respondents considered NOTES transvaginal access a suitable approach for intraabdominal surgery, and the vast majority of respondents indicated patients over the age of 50 to be most suitable for this approach. With identical operative risks, only 28.8% of the respondents would suggest transvaginal NOTES to their patients. Regarding potential complications, 73.1% were concerned about the risk of infection/peritonitis, whereas 61.5% feared visceral lesions and 44.2% worried about the risk of infertility after transvaginal NOTES. Regarding potential long-term sequelae after NOTES transvaginal surgery, respondents were most concerned with dyspareunia and infertility. On the basis of the aforementioned responses, it appears that the plurality of gynecologists perceive NOTES transvaginal access and surgery to be best confined to women who are past the reproductive age and/or are no longer sexually active.

Volckmann et al conducted an opinion survey of surgeons from 3 major surgical societies.<sup>23</sup> A 75-item survey was completed electronically by 357 members of the Society for Surgery of the Alimentary Tract, Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), and American College of Surgeons. In deciding on a surgical approach, the risk of a complication was the most important consideration. Further, the risk of a complication, recovery time, degree of postoperative pain, and length of stay were each felt to be more important than cosmesis, cost, or anesthesia type. When NOTES was compared independently with laparoscopy and laparotomy, it was felt to require significantly greater technical skill and to be associated with less pain, shorter recovery, higher costs, and an increased risk of complications. Seventy-two percent of these surgeons expressed an interest in becoming trained in NOTES. Stepwise logistic regression analysis of physician characteristics showed that age less than 60, minimally invasive surgery specialization, and SAGES membership correlated significantly with increased interest in NOTES training. Only 3% would still prefer NOTES if the complication rate was significantly higher (10% vs 1%). Among the 56% of

surgeons who would not prefer to perform cholecystectomy by NOTES, 88% indicated that they would change to a NOTES approach if data demonstrated improved outcomes vs laparoscopy. However, when surgeons were asked whether they would choose to personally undergo NOTES, having these data available, only 26% of them opted for NOTES.

## What Are Patients'

### Explicit Concerns About NOTES?

In multiple studies, safety and efficacy represented the most common reasons for patients to prefer laparoscopy as opposed to NOTES.<sup>14,17,19,21</sup> In the previously cited study by Peterson et al, most women who were unwilling to undergo transvaginal surgery were most concerned with the potential for infectious complications. Not surprisingly, young and nulliparous women were more often concerned about dyspareunia and fertility after transvaginal surgery.<sup>16</sup> In the study by Rocchietto et al, 83.9% of patients stated that they were concerned about the postoperative infection rate related to NOTES.<sup>20</sup> Among younger patients, all reported concerns about NOTES' effects on their sexual activity and the potential risk of dyspareunia. Moreover, the influence of NOTES on future fertility was considered very important for 85.7% of the nulliparous women who were surveyed. When asked about the reason they would refuse a NOTES procedure, 9.7% indicated that it is too dangerous, 83.9% indicated a lack of defined benefits, and 6.5% declared that they were not interested in it. None of the patients would accept an increased risk of surgical complications for a better cosmetic result.

## What Would Be the Trade-off to Choose NOTES?

An interesting and important finding of the study by Varadarajulu et al addressed the specific risk-benefit trade-off inherent among newer technologies.<sup>14</sup> Specifically, among patients in the aforementioned survey who preferred NOTES, up to 99% demanded complication rates comparable with the standard of care—in this case laparoscopy. This preference for NOTES declined to 15% if the complication rate was twice that of laparoscopy, and it further declined to 6% if the complication rate was 3 times that for laparoscopy. These findings somewhat held true in the study by Hagen and colleagues. An absolute complication rate of 10% was considered acceptable among respondents if a total absence of scarring could be guaranteed. In keeping with similar findings, younger patients valued cosmesis more highly and were willing to accept an increased complication rate as a result.<sup>15</sup> Likewise, Swanstrom et al found that 80% of those respondents who stated a preference for NOTES were willing to accept a modicum of complications. However, this willingness to choose NOTES decreased incrementally in tandem with an increased risk of complications, increased surgical costs, and decreasing surgeon experience.<sup>17</sup>

## What About LESS?

Lucas et al surveyed patients returning to clinic after transperitoneal laparoscopy.<sup>24</sup> Patients were first asked to rate certain factors and how these factors affected their choice to pursue open surgery, laparoscopy, or LESS. Patients were likewise asked whether they preferred LESS or laparoscopy, assuming equivalence of outcomes. Respondents were thereafter asked their opinions on LESS, assuming comparative surgical naivety on the part of the operating surgeon, and how increased complication rates and/or surgical failure would affect their decision to pursue LESS. In the second survey, a validated cosmesis and body image impact survey was administered. The findings of the surveys were intriguing. First, surgical success and complications were considered the driving factors among patients. Pain and convalescence were of moderate import, whereas scars carried less importance. Postoperative cosmesis was valued more heavily among women, younger patients, and those with benign surgical indications. Finally, the authors found a slight preference for laparoscopy (39%) compared with LESS (30%).

Olweny et al evaluated the importance of scarring in urology patients relative to other surgical outcomes.<sup>25</sup> Patients scheduled for LESS, laparoscopic, or open kidney surgery were recruited for the study. Overall, 90 patients completed surveys. The LESS cohort was younger and more likely to be undergoing surgery for benign indications. Before surgery, the most important surgical consideration was "surgeon reputation" and the least important factors were "delay in resuming normal diet" and "size/number of scars." After surgery, the most important considerations were "surgeon reputation" and "no complications," whereas "size/number of scars" represented the second least important consideration. Among the subset of patients who completed surveys both before and after surgery, there was no significant change in median scores for any of the outcomes except "duration of hospital admission." The median score for "size/number of scars" was significantly higher for the LESS cohort before surgery, but there was no significant difference among the cohorts after surgery. The median preoperative score for "size/number of scars" was significantly higher for younger patients and those with benign surgical conditions. Overall, the authors demonstrated that, when compared with surgeon reputation or avoidance of complications, surgical scarring was a relatively unimportant outcome for most patients before and after undergoing kidney surgery. Younger patients and those undergoing surgery for benign indications ranked scarring higher than older patients and those with oncologic indications before surgery, but these differences were nonsignificant after surgery. The primary study limitation was a response bias given that patients had decided on a particular surgical approach before completion of the study.

In the nonurology field, Bencsath et al reported a study intended to determine whether single-incision ap-

proaches to laparoscopic cholecystectomy might be desirable to patients.<sup>26</sup> Of 281 eligible patients, 125 were successfully contacted and consented to inclusion (44.5% response rate). Only sixty patients (47.2%) correctly recalled the exact number of incisions. The primary finding of the study was that patients appear interested in reducing the number of incisions. Not unexpectedly, pain seemed to be a motivating factor because an overwhelming majority of patients who identified one incision as most painful were interested in eliminating that same incision.

## NOTES versus LESS: Comparative Analysis

Rao et al were the first to evaluate both NOTES and LESS and the potential competitive role of these approaches.<sup>27</sup> A hypothetical scenario was then presented to respondents in which the necessity for an emergent appendectomy was defined. Overall, only 34.4% of the participants felt comfortable using newer surgical techniques. Overall, LESS was the preferred choice (80.6%) of surgical technique for an appendectomy. The authors speculated that LESS may be more acceptable because it is an adaptation of an already established surgical technique (laparoscopy) that offers a virtually scarless appearance. Conversely, NOTES was considered a completely novel technique without proven benefit. Moreover, patients were hesitant to undergo transvisceral access. Secondary findings included physician preference for open surgery, especially compared with nurses and nonmedical personnel. Nurses favored laparoscopic surgery more than doctors and the nonmedical group, whereas the nonmedical group favored LESS more than nurses and doctors. The authors concluded that medical professionals might appreciate the difficulties of any new surgical technique and therefore be hesitant to proceed in this manner. With respect to age, a surprising finding was a preference for LESS in >30% of patients over the age of 60 years. Thus, one should not assume that only the young are interested in these emerging techniques.

Chow et al conducted a questionnaire-based study among 1006 individuals from the general public.<sup>12</sup> Questions were asked regarding preference for surgical techniques, including open surgery, laparoscopic surgery, NOTES, and LESS in the situation of acute appendicitis. The authors elected to focus on the scenario of emergent appendicitis because patients in this situation typically have a limited time frame during which to consider their treatment options. The vast majority of respondents cited safety as the paramount factor in choosing a surgical approach. Only 37.9% of patients stated they would be comfortable undergoing a new procedure without an established safety profile. If all safety profiles were reported as equal, most participants reported a preference for LESS and only 20.7% of patients preferred NOTES. Moreover, transvaginal NOTES was considered an unpopular surgical approach.

Bucher and his group conducted 2 different surveys.<sup>28,29</sup> In the first one, participants were queried about

their expectations for surgical treatment and their approach preference.<sup>28</sup> Again, the main concern of the survey responders was the risk of surgical complications (92%). When asked about the relative importance of different parameters, cure was placed first by 74%, safety by 33%, and cosmesis by only 3%. By assuming a similar operative, 90% of the participants preferred a scarless approach (75% preferred LESS and 15% NOTES) to laparoscopy and this preference was significantly higher among the younger participants. A decreasing trend of preference for LESS and NOTES was observed with increased procedural risks. Thus, despite safety representing the first concern among patients, the importance of cosmesis is not neglected. NOTES was preferred by only 15% of participants, which may contradict previously reported surveys.<sup>14,15,17,19</sup> In all of these studies, NOTES was offered as the sole scarless option to laparoscopy, and population acceptance of LESS was not investigated. In the following survey, the authors focused their attention on a specific procedure, ie, cholecystectomy.<sup>29</sup> With similar operative risk, 87% preferred LESS, 4% NOTES, and 8% laparoscopy. LESS/NOTES choice was influenced by a desire of improved cosmetics and lower pain. Ninety-six percent had concerns regarding the transvaginal access, including dyspareunia, decreased sensibility during intercourse, short-term sexual abstinence, and infertility. By contrast, the most frequent concerns about the transumbilical access were umbilical pain, postoperative umbilical sensibility, and incisional hernia. Postoperative intercourse abstinence after transvaginal NOTES elicited worry in 76% of responders. As previously reported,<sup>18</sup> concerns related to sexual function and fertility must be taken into account when dealing with a female population.

Finally, Ross et al sought to evaluate public perceptions of LESS and NOTES, including factors that may influence decision making.<sup>30</sup> A validated 7-item tool, as well as a visual analog scale, were administered. Most adults were unwilling to undergo LESS if it was associated with additional surgical risk compared with standard operative approaches. Participant body image satisfaction was the only variable that was reported as a compelling justification for LESS. With regard to NOTES, nearly one third of participants were willing to undergo NOTES rather than conventional "open" or laparoscopic operations, which is different from previously reported findings.<sup>16</sup>

## CONCLUSIONS

Based on the results of our literature analysis, patients demonstrate a modicum of interest in scarless surgical approaches, with a preference for LESS over NOTES. We speculate that reasons for this preference might include the newness of NOTES as a concept, whereas LESS can be somehow regarded as an evolution of laparoscopy. Moreover, different cultural backgrounds and geographic

origins influence the patients' perspectives and expectations about scarless surgery.

Because most patients still cite safety and efficacy as the most important factors in their decision making, surgeons must be honest and balanced when offering conventional vs investigational treatment options. Certainly, there is a need for objective, multicenter outcomes that specifically address the safety and reproducibility of LESS and NOTES. With such information in hand, and with improved educational efforts, patients and physicians alike may feel comfortable in the widespread application of scarless surgery.

## References

1. Kerbl DC, McDougall EM, Clayman RV, et al. A history and evolution of laparoscopic nephrectomy: perspectives from the past and future directions in the surgical management of renal tumors. *J Urol*. 2011;185(3):1150-1154.
2. Skolarus TA, Zhang Y, Hollenbeck BK. Robotic surgery in urologic oncology: gathering the evidence. *Expert Rev Pharmacoecon Outcomes Res*. 2010;10(4):421-432.
3. Patel HR, Linares A, Joseph JV. Robotic and laparoscopic surgery: cost and training. *Surg Oncol*. 2009;18(3):242-246.
4. Autorino R, Haber GP, Stein RJ, et al. Laparoscopic training in urology: critical analysis of current evidence. *J Endourol*. 2010;24(9):1377-1390.
5. Gettman MT, White WM, Aron M, et al. Where do we really stand with LESS and NOTES? *Eur Urol*. 2011;59(2):231-234.
6. Kaouk JH, Autorino R, Kim FJ, et al. Laparoendoscopic single-site surgery in urology: worldwide multi-institutional analysis of 1076 cases. *Eur Urol*. 2011;60(5):998-1005.
7. Autorino R, Cadeddu JA, Desai MM, et al. Laparoendoscopic single-site and natural orifice transluminal endoscopic surgery in urology: a critical analysis of the literature. *Eur Urol*. 2011;59(1):26-45.
8. Gettman MT, Lotan Y, Napper CA, et al. Transvaginal laparoscopic nephrectomy: development and feasibility in the porcine model. *Urology*. 2002;59:446-450.
9. Lima E, Rolanda C, Pêgo JM, et al. Transvesical endoscopic peritoneoscopy: a novel 5 mm port for intra-abdominal scarless surgery. *J Urol*. 2006;176:802-805.
10. Kaouk JH, Haber GP, Goel RK, et al. Pure natural orifice transluminal endoscopic surgery (NOTES) transvaginal nephrectomy. *Eur Urol*. 2010;57:723-726.
11. Schirmer BD, Dix J. Cost effectiveness of laparoscopic cholecystectomy. *J Laparoendosc Surg*. 1992;2:145-150.
12. Chow A, Purkayastha S, Dosanjh D, et al. Patient reported outcomes and their importance in the development of novel surgical techniques. *Surg Innov*. 2011 [Epub ahead of print].
13. Rane A, Autorino R. Robotic natural orifice transluminal endoscopic surgery and laparoendoscopic single-site surgery: current status. *Curr Opin Urol*. 2011;21(1):71-77.
14. Varadarajulu S, Tamhane A, Drelichman ER. Patient perception of natural orifice transluminal endoscopic surgery as a technique for cholecystectomy. *Gastrointest Endosc*. 2008;67(6):854-860.
15. Hagen ME, Wagner OJ, Christen D, et al. Cosmetic issues of abdominal surgery: results of an inquiry into possible grounds for a natural orifice transluminal endoscopic surgery (NOTES) approach. *Endoscopy*. 2008;40(7):581-583.
16. Peterson CY, Ramamoorthy S, Andrews B, et al. Women's positive perception of transvaginal NOTES surgery. *Surg Endosc*. 2009;23(8):1770-1774.
17. Swanson LL, Volckmann E, Hungness E, et al. Patient attitudes and expectations regarding natural orifice transluminal endoscopic surgery. *Surg Endosc*. 2009;23(7):1519-1525.

18. Strickland AD, Norwood MG, Behnia-Willison F, et al. Transvaginal natural orifice transluminal endoscopic surgery (NOTES): a survey of women's views on a new technique. *Surg Endosc*. 2010;24(10):2424-2431.
19. Olakkengil SA, Norwood MG, Strickland AD, et al. Perspectives of laparoscopic donors toward a new procedure: transvaginal donor nephrectomy. *J Laparoendosc Adv Surg Tech A*. 2010;20(10):803-806.
20. Rocchietto S, Scozzari G, Arezzo A, et al. Obese women's perception of bariatric trans-vaginal NOTES. *Obes Surg*. 2012;22(3):452-459.
21. Li W, Xu H, Wang ZK, et al. Natural orifice transluminal endoscopic surgery (NOTES): patients' perceptions and attitudes. *Dig Dis Sci*. 2011;56(8):2415-2422.
22. Thele F, Zygmunt M, Glitsch A, et al. How do gynecologists feel about transvaginal NOTES surgery? *Endoscopy*. 2008;40(7):576-580.
23. Volckmann ET, Hungness ES, Soper NJ, et al. Surgeon perceptions of natural orifice transluminal endoscopic surgery (NOTES). *J Gastrointest Surg*. 2009;13(8):1401-1410.
24. Lucas SM, Baber J, Sundaram CP. Determination of patient concerns in choosing surgery and preference for laparoendoscopic single-site surgery and assessment of satisfaction with postoperative cosmesis. *J Endourol*. 2011 [Epub ahead of print].
25. Olweny EO, Mir SA, Best SL, et al. Importance of cosmesis to patients undergoing renal surgery: a comparison of laparoendoscopic single-site (LESS), laparoscopic and open surgery. *BJU Int*. 2011 [Epub ahead of print].
26. Bencsath KP, Falk G, Morris-Stiff G, et al. Single-incision laparoscopic cholecystectomy: do patients care? *J Gastrointest Surg*. 2012;16(3):535-539.
27. Rao A, Kynaston J, MacDonald ER, et al. Patient preferences for surgical techniques: should we invest in new approaches? *Surg Endosc*. 2010;24(2):3016-3025.
28. Bucher P, Pugin F, Ostermann S, et al. Population perception of surgical safety and body image trauma: a plea for scarless surgery? *Surg Endosc*. 2011;25(2):408-415.
29. Bucher P, Ostermann S, Pugin F, et al. Female population perception of conventional laparoscopy, transumbilical LESS, and transvaginal NOTES for cholecystectomy. *Surg Endosc*. 2011;25(7):2308-2315.
30. Ross SB, Hernandez JM, Sperry S, et al. Public perception of LESS surgery and NOTES. *J Gastrointest Surg*. 2012;16(2):344-355.