Natural Orifice Transluminal Endoscopic Surgery (NOTES): Landscape of Current Experimental Applications in Gynecological Surgery

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The considerable interest in pushing the frontiers of less invasive surgery has led to the emergence of innovative minimally invasive approaches, such as Laparoendoscopic Single-site Surgery (LESS). Among this group of relatively new surgical techniques, Natural Orifice Transluminal Endoscopic Surgery (NOTES) is an experimental alternative to conventional surgery eliminating abdominal incisions and thus incision-related complications by combining endoscopic and laparoscopic techniques. In NOTES, the approach to pelvis and abdomen is performed by a flexible endoscope passed through a natural orifice, like mouth or vagina. In recent years, driven by the desire for less invasiveness, lower morbidity, better cosmesis and shorter hospitalization time, surgical research has been devoted to investigating NOTES for several clinical applications. In the Journal of Investigative Surgery, a recent interesting original research evaluated whether the surgical trauma due to vaginal wall incision to extract the specimen during transvaginal hybrid NOTES nephrectomy can result in sexual dysfunction and have traumatic psychological impacts [1]. According to this technique, after being removed, the kidney is extracted from the vagina, potentially resulting in surgical traumatic insult to sexual functioning, thus affecting the physical and psychological components of a couple’s sexuality. The authors employed the validated Golombok-Rust Inventory of Sexual Satisfaction (GRISS) questionnaire in order to evaluate the post-surgical sexual function, reporting similar total GRISS scores in pre- and post-operative periods. Notably, the GRISS questionnaire can evaluate sexual function not only in patients but also in their partner; we deem that this characteristic represents an advantage, giving a more complete multidimensional overview of couple’s sexual health, differently from other questionnaires, such as the Female Sexual Function Index (FSFI), which other authors previously employed in this setting [2]. Moreover, the authors analyzed whether some factors would have a statistically significant effect on post-surgical total score changes for couples: subgroup analyses showed that tumor stage, which correlates to tumor size, according to TNM classification for renal cancer [3], did not affect total score changes for both genders. We deem that this data is of interest considering the hypothetical vaginal trauma during mass extraction.

In gynecological surgery, the use of NOTES has been investigated, although publications on this field are yet limited; in particular, most of these studies are case series and are characterized by small sample size. Overall, they have been mainly focalized on the removal of annexes and uterus. In 2013, Yang et al. firstly treated seven patients affected by benign adnexal masses by performing a NOTES salpingooophorectomy through a 2-cm incision in the posterior vaginal fornix. All cases were successfully completed without need of converting to standard laparoscopic approach, with a mean operative time of 45 minutes [4]. Currently, only one study analyzed the feasibility of transvaginal NOTES myomectomy. In this case series, the minimally invasive approach succeeded in treating three patients affected by posterior wall myomas. However, the authors considered these procedures complex and potentially characterized by a greater surgical risk than those performed by conventional multi-port laparoscopy because of a relatively restricted vision [5].

In 2012, Su et al. reported the first performance of “hybrid” NOTES hysterectomy. Specifically, these authors performed a posterior colpotomy with a scalpel, amputated the cervix, and then completed the hysterectomy via NOTES. In this study, sixteen patients underwent this “hybrid” approach without needing of conversion to conventional laparoscopy. The mean uterine weight was 538.8 (± 102.9) g; mean operative time was 122.7 (± 17.6 minutes); mean blood loss was 379.4 (± 95.4) mL. No intraoperative or postoperative complications were observed [6]. More recently, Yang et al. performed a comparative evaluation between patients undergoing “hybrid” NOTES hysterectomy (n = 16) and patients undergoing single-port laparoscopic-assisted vaginal hysterectomy (n = 32). Notably, this academic group observed a statistically significant shorter operative time for the “hybrid” NOTES hysterectomy (70.6 versus 93.2 minutes, P < 0.001) [7].
The largest surgical series on complete NOTES hysterectomy have been published by Taiwanese researchers, who compared the surgical outcomes between this approach and laparoscopically assisted vaginal hysterectomy (LAVH). A total of 512 patients were recruited (n = 147 NOTES group; n = 365 LAVH group). Interestingly, the mean operative time, amount of blood loss, and postoperative hospital stay resulted significantly inferior in the NOTES group, regardless of uterine weight. Although there was no difference in the overall incidence of operative complications between the two groups, there were more complications in the LAVH group for uterine weight more than 500 g [8].

Very recently, Yang et al. reported the performance of robotic NOTES hysterectomy for the treatment of 13 patients affected by benign gynecological disease. From the results, there was no conversion to laparoscopic, laparotomic, or traditional multiport robotic hysterectomy. Median docking time was 15 min (range 5–25 min) and console time was 135 min (range 92–215 min); mean drop in hemoglobin on the first postoperative day was 0.67 (±0.7) g/dL. No postoperative complications occurred. For this reason, the robotic NOTES hysterectomy was judged by the authors a feasible and safe scarless and gasless surgical approach [9].

Together with robotic surgery, NOTES is considered to be the next-generation minimally invasive surgery; thus, numerous efforts in this area are being made in many countries. For example, a prospective multi-center observational study (GLESS registry; NCT04096872) is analyzing data (time of patient admission, operation, discharge, and follow-up) about clinical application of LESS and NOTES in gynecology. Eight gynecological conditions are being considered eligible: cervical cancer, endometrial cancer, endometrial lesion, adnexal lesion, ectopic pregnancy, infertility, pelvic obstructive disorder, and genital tract deformity. Results will be definitively obtained within October 2022.

Overall, we would underscore that an appropriate training in NOTES will be a key issue in future education and development of this surgical approach, similarly to that today happens for conventional laparoscopy, for which our research group dedicates an important effort [10]. Nevertheless, new studies on gynecological applications of NOTES are demanding to draw conclusion on the potential clinical indications for which adopting this technique. However, a longer follow-up period for a greater number of patients is needed to definitively evaluate feasibility, efficacy and safety of transvaginal NOTES in this setting.

Disclosure statement
No potential conflict of interest was reported by the author(s).

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