

# Transvaginal Approach for Nongynecologic Intraoperative Procedures

José F. Noguera<sup>1\*</sup>, Gonzalo Martín<sup>1</sup>, José M. Muñoz<sup>2</sup>, Antonio Melero<sup>3</sup>, Raúl Sánchez<sup>3</sup>,  
Javier Valdivia<sup>4</sup>, Marcos Bruna<sup>1</sup>, Antonio Salvador<sup>1</sup>, Cristóbal Zaragoza<sup>3</sup>

<sup>1</sup>Minimally Invasive Therapies Unit, Consorcio Hospital General Universitario de Valencia, Valencia, Spain

<sup>2</sup>Department of Surgery, Hospital Son Llàtzer, Palma, Spain

<sup>3</sup>Department of Surgery, Consorcio Hospital General Universitario de Valencia, Valencia, Spain

<sup>4</sup>Department of Surgery, Hospital Virgen de las Nieves, Granada, Spain

Email: \*[drifnoguera@hotmail.com](mailto:drifnoguera@hotmail.com)

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## Abstract

The minimally invasive surgery through natural orifices has revolutionized the laparoscopic surgery for abdominal procedures. The use of the vaginal approach is not new for gynecologists but it is a new concept for the non-gynecological laparoscopic surgeons. The use of this new approach has been used to perform some procedures and to extract specimens after a laparoscopic surgery, but we don't know exactly the number of procedures performed until today. There are few papers with clinical experience and a lot of philosophical papers about NOTES. Our aim is to know how and how often we are using this new approach for non-gynecological abdominal minimally invasive procedures. With the revision of the PubMed publications we obtained a total of 268 articles, of which 125 were included in the analysis (46.64%). Cholecystectomy was the procedure more usually performed: there is a large clinical experience with a total of 2432 transvaginal cholecystectomies. Bariatric surgery, colectomy and appendectomy have been other surgical procedures with some clinical experience in the use of the transvaginal approach. Analyzing the publications on transvaginal approach, we observed that the use of the vaginal route for non-gynecological abdominal surgery was not anecdotal, with accumulative experience of more than 3000 patients reported in published studies. The use of the vaginal route has shown its safety, obtaining some additional benefits such as the aesthetic and the faster functional recovery. Dyspareunia, one of the most feared, has not been reported in studies as a concern to consider.

## Keywords

Transvaginal Surgery, Endoscopic Surgery, Laparoscopy, Flexible Endoscopy

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\*Corresponding author.

## 1. Introduction

Minimally invasive surgery (MIS) has suffered one of its great revolutions in the last decade. The advent of new trends and concepts has brought us a new stage in the MIS. The use of the transvaginal route to perform a surgical procedure or to remove a surgical specimen is not new. In fact, culdoscopy and transvaginal extraction of surgical specimens has been performed before but we become aware of its importance with the arrival of the concept of Natural Orifice Transluminal Endoscopic Surgery (NOTES).

The emergence of NOTES has meant a revolution for all, the laparoscopic surgeons, endoscopists, industry and of course, for patients. Keeping in line with this transformation of MIS some techniques that were forgotten such as the minilaparoscopy, needlescopic surgery, culdolaparoscopy and suture techniques in flexible endoscopy have awakened. Although, from the first clinical application in 2007 to the present day there have been several applications of NOTES, it has been more a revolution in the field of design ideas and instrumentation than in the field of clinical applications. Few teams have implemented these techniques in their daily procedures. These approaches have been in the hands of selected teams who have combined their interest and expertise to support the industry that has given them the equipment needed to develop the technique [1]-[5].

We have learned soon that the transvaginal approach would be the most applied route by virtue of its clinical safety and easy access for opening and closing viscerotomy. The transgastric approach presented some problems due to the entry through the gastric wall and the prevention of peritoneal contamination. But, its main drawback was getting a secure closure, difficult procedure using only flexible endoscopy. The transvesical approach had the size limitation for the introduction of instrumentation and specimen extraction so it was considered as a way for support from the pelvis, in combination with other approaches. Regarding the transrectal approach, it soon proved to be an alternative for rectal and distal colonic procedures, not as a way to access the peritoneal cavity and to perform intraperitoneal procedures.

But the transvaginal approach showed safe with the previous experience of gynecological surgery. Thanks to this experience, we have learned that the general complication rate was low and with easy resolution as well as serious complications like rectal, bladder or vascular injury was extremely low [6]-[8]. Besides, the vaginal wall opening and closing was simple for surgeons with some experience in pelvic surgery.

The ease of exploration, cleaning, closure and solution of potential problems, has become the transvaginal approach the route of excellence. The point of entry through the vagina in the posterior fornix should be chosen carefully to avoid pelvic or uterine injury. The entry into the pelvis from the vagina can be supported directly with trocars 15 cm in length, thereby, facilitating the entry and withdrawal of several instruments and avoiding trauma to the vaginal wall. For this entry it is advisable to use a 3 - 5 mm optic from the navel to check the safety. After the procedure, the surgical specimen extraction can be done directly or protected with plastic bag. The closure after extraction is a directly comfortable and easy closure performed by the surgeon.

Currently we are using the vaginal access combined with conventional laparoscopy for the specimen removal avoiding the assistance laparotomy, or as accessory entryport to help in a laparoscopic approach [9]-[11]. Employing this access as a working channel we can introduce either the flexible endoscope, which carries the internal working channel, or rigid instrumentation. In some surgical procedures with transvaginal extraction the surgical technique does not differ significantly to laparoscopy (esplenectomy, adrenalectomy, sleeve gastrectomy...); but in colorectal surgery we are forced to change the modality of anastomosis. In right colectomy we are required to perform intracorporeal anastomosis and in left colectomy to do a transvaginal assistance.

Either way, we should be very judicious and cautious to indicate transvaginal instrumentation. A proper clinical investigation should be performed to rule out any pelvic and gynecological disease. A pelvic examination is mandatory to ensure the integrity of the functional anatomy and to review additional examinations for unsuspected alterations which discourage this approach. Although the most feared complication is dyspareunia it has not been reported with a significant increase in the general population. Other postoperative problems related to sexuality and fertilization would be more conditioned by some postoperative complications that the transvaginal approach itself.

The uneven spread of the transvaginal approach in surgical procedures creates a problem for us to know the real implementation of this approach. To know the extent of use of the transvaginal approach we have performed a comprehensive review and analysis of the literature.

## 2. Material and Methods

Since there has been an uneven implementation of the transvaginal approach and clinical application has been

shared by various surgical specialties, it is difficult to know the use that is being made of this NOTES approach in non-gynecological surgery. In order to know the acceptance that has had the transvaginal approach in non-gynecological abdominal surgery a comprehensive review through the PubMed database with the criteria in **Table 1** was performed.

From the resulting articles some originals were removed. Duplicated articles, opinion articles, articles that did not deal with surgical techniques, articles with some NOTES approach different to vaginal one and articles treating gynecological surgery, were eliminated of the search. We preserved the articles that provided information on the use of the vaginal approach in non-gynecological abdominal surgery. These papers were divided into four categories: experimental studies, case reports, prospective clinical series (more than 10 patients) and clinical trials (randomized clinical trials only). In turn they were divided in relation to the pathology and surgical technique which they were intended.

### 3. Results

We obtained a total of 268 articles, of which 125 met the criteria for inclusion in the analysis (46.64%). The category distribution is shown in **Table 2**. Among the articles we found two international registries [12] [13]; they have forced to remove some articles with reported cases to the registry and also independently published in papers with individual results.

**Table 1.** Search terms in PubMed. Term transvaginal as isolated and combined with the other terms.

Transvaginal
+Surgery
+Digestive surgery
+Natural orifice endoscopic surgery
+Adrenalectomy
+Appendectomy
+Bariatric surgery
+Cholecystectomy
+Colectomy
+Gastrectomy
+Liver resection
+Nephrectomy
+Splenectomy

**Table 2.** Distribution of articles in different categories of analysis.

	Experimental	Clinical cases	Case series	Clinical trials	Total studies	Total patients
Adrenalectomy	2	1	1	0	4	12
Appendectomy	1	4	3	0	8	84
Bariatric surgery	1	2	2	0	5	222
Cholecystectomy	12	15	26	3	56	2432
Colectomy	0	10	8	0	18	211
Gastrectomy	1	2	0	0	3	6
Liver resection	0	2	0	0	2	2
Nephrectomy	10	10	3	0	23	59
Splenectomy	0	3	0	0	3	3
Total	27	49	43	3	122	3031

We can observe that the *cholecystectomy* procedure has been the target for the development of the transvaginal approach in intraperitoneal surgery. In all records of NOTES surgery, cholecystectomy has brought more than 75% of the entries (93% in EuroNOTES, 85% in German and 74% in the Latin American registry). Transvaginal approach for cholecystectomy was performed in two ways: by direct approach without transmural abdominal support (rarely) or by 3 or 5 mm optical visual support placed in the navel to access safely through the posterior vaginal fornix (most cases). In relation to the instrumentation we can describe four different procedures. The pure NOTES: with two flexible endoscopes from the vagina or from the vagina and stomach. The hybrid NOTES: combining flexible and rigid endoscopy with a transvaginal or transmural access. The rigid NOTES, rigid instruments that combine straight, pre-curved and articulated forceps. The last procedure is the specimen removal through the vagina (NOSE-Natural Orifice Specimen Extraction) while the cholecystectomy procedure was performed using laparoscopic skills. In all clinical applications the vaginal closure was performed externally by direct absorbable suturing. The laparoscopic closure possibility exists but requires three transmural trocars therefore it has not been used in cholecystectomy.

In experimental studies the focus has been mainly on transgastric and transvaginal approaches, sometimes with transvesical support. Cholecystectomy has been 44.4% of surgical techniques addressed in the work with animals, closely followed by nephrectomy (37%). Experimentation in transgastric approaches mainly focused on creating a secure method of opening and closing of the stomach as well as the reproducibility of cholecystectomy from a supramesocolic route. In cases of transvaginal access, the focus was mainly on the reproducibility of surgical maneuvers using the flexible endoscope.

In terms of clinical application we found 15 publications of clinical cases: 26 clinical series but only 3 clinical trials. Clinical trials represent only 6.8% of the publications on transvaginal cholecystectomy in humans, but clinical series have included a large number of patients. So there is a large clinical experience with a total of 2432 transvaginal cholecystectomies performed. The safety and efficacy data emanating from all these studies show us the non-inferiority of transvaginal approach with respect to conventional laparoscopy. In all these papers the authors argue that we are in a transition phase from the laparoscopy to the pure NOTES needing a technological evolution that allows us to achieve secure access through natural orifice [14]-[70].

It seemed that the appendectomy was to be the second technique performed in the transvaginal approach but, surprisingly, *bariatric surgery* was the second most common after cholecystectomy. This broad experience, with a cumulative total of 222 patients, is due to the contribution of two clinical series: Buesing *et al.* with 200 patients, and Couillard *et al.*, 20 patients. The use of flexible endoscope has been anecdotal in these procedures, being in most cases the vaginal route used for instrumental assistance of a rigid laparoscopic procedure.

Sometimes the use of the vagina has been limited to extract the piece of tubular gastrectomy. Restrictive procedures have been used in natural orifice approaches, by virtue of its lower complexity than the malabsorptive techniques. Specifically, the gastric sleeve has been the most realized, as it is a feasible technique with endoscopic stapler that can be applied from the vagina [71]-[75].

More interesting has been the experience of the transvaginal approach in *colorectal surgery* although the overall number of patients enrolled was lower (211 patients). It is the experience of a greater number of working groups with more variety of procedures and the colorectal transvaginal approach opened the door to another promising approach, the transanal approach TAMIS (Trans Anal Minimally Invasive Surgery). Most experience in this type of surgery comes from case-series grouped in most studies of 10 to 20 patients, except in Park *et al.* series including 68 patients. It is notable that, as in bariatric surgery, prospective comparative studies have not been made. The transvaginal route was used in colorectal surgery primarily for extracting the specimen. In some cases there had been any surgical gesture from the vagina, as the section of the mesenteric vessels, colorectal section or assistance to the preparation of the anastomosis. In these procedures, the use of rigid instrumental from vaginal access is the standard, without experience in the use of the flexible endoscope.

The most common procedure was right hemicolectomy, being the standard procedure the intracorporeal anastomosis and transvaginal specimen extraction. All authors agree in emphasizing that the removal of assistance laparotomy is the great advantage of transvaginal assistance, eliminating the morbidity resulting from this laparotomy, mainly surgical wound infections and postoperative ventral hernias [76]-[92].

An *appendectomy* was the second procedure, after cholecystectomy, which has been treated with the intention of NOTES surgery as pure as possible. Only 8 articles were found dealing transvaginal appendectomy, of which 7 are cases and clinical series and only one of them is a prospective comparative study with 40 patients. Experimental studies have compared the transgastric and transvaginal approach with flexible endoscope, finding

that appendectomy is feasible in a porcine model with flexible endoscope, making it easier to access from the stomach than from the pelvis. In terms of clinical application, appendectomy was performed in 50 patients incidentally at laparoscopic hysterectomy with transvaginal assistance, without any significant incidents reported.

An appendectomy for acute appendicitis was made by transvaginal approach with minimal parietal support in 4 clinical studies (case reports and small series of less than 10 patients). In some cases the authors used the flexible endoscope and in others rigid instruments, with vaginal extraction and mini laparoscopy support from the abdominal wall in all of them. Data reported showed to be a safe approach and to offer a better postoperative comfort than conventional laparoscopy. The only prospective clinical study for appendectomy for acute appendicitis has been reported in 2012 by Roberts *et al.*, comparing 18 transvaginal appendectomies versus 22 laparoscopic approaches with a similar incidence of adverse events and one conversion to laparoscopic surgery in the transvaginal group. The transvaginal group showed a faster recovery and less postoperative pain [93]-[100].

Transvaginal *nephrectomy* has been the technique with more experimental publications. In 2002 was published the first experimental study in porcine model trying an exclusive transvaginal nephrectomy, followed by subsequent experimental contributions working with flexible endoscopes in isolation or combined with transgastric approach or parietal access. As we found for other techniques, rigid instrumental participation through the vagina and instrumental support through the abdominal wall were widely used to facilitate maneuverability and reduce surgical time. In some studies, the authors tested the use of a single-port device through the vagina.

At the clinical experience, nephrectomies were initiated with hybrid transvaginal approach. In most cases with the help of two or more parietal trocars and for benign causes, but showing also safety and reproducibility in cases of renal carcinoma. The rise of the single-port devices have conduced to some combined experiences of transumbilical single port and transvaginal access. But the most interesting clinical application of transvaginal approach is the surgery on the living donor kidney transplant. In the living donor we must look for the least invasive surgery while we preserve the extracted graft in the optimal conditions as in the conventional surgery. The transvaginal approach for nephrectomy and renal extraction has been very beneficial to the donor, with less pain and faster functional recovery, while preserving the quality of the graft, with the only slight increase in surgical time in the donor [101]-[123].

In the remaining surgical indications clinical experience has been limited. In 12 published articles we can obtained all the experience in transvaginal adrenalectomy (12), gastrectomy (2), splenectomy (3) and hepatectomy (2). This is an anecdotal application that employs in most cases the rigid instruments trough the vagina or a vaginal extraction of surgical specimens. In some articles the flexible endoscope was used, assessing a better vision than with rigid laparoscope, probably because the organs to be treated were in the supramesocolic space. In this situation, the flexible endoscope offered a better access with closer lighting and better access due to their mobility [124]-[134].

## 4. Discussion

When we exhaustively analyzed the publications on transvaginal approach, we observed that the use of the vaginal route for non-gynecological abdominal surgery was not anecdotal. With clinical experience of more than 3000 patients reported in published studies we can make some reflections on the vaginal approach.

The first is that the use of this route is not uncommon as it may seem at a first assessment. Although the most common techniques have been the cholecystectomy and the bariatric, colorectal and appendiceal surgery, the use of the transvaginal approach has reached to all the techniques in abdominal surgery, albeit in an anecdotal way, just to show that it was feasible.

The second of the reflections is that the use of the vaginal route has not been taxed with a general increase in intra or postoperative complications and has not moved the possible complications of the abdominal wall to the vagina or the pelvis. Dyspareunia, one of the most feared, has not been reported in studies as a concern to consider, given its zero or low incidence, although its appearance should be monitored in the ongoing studies. Endoscopic procedures performed with transvaginal assistance have been as safe and effective as conventional laparoscopy, obtaining some benefits such as the aesthetic and the faster functional recovery.

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