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Video Surgery through Single Port Access: an overview

Mario Morino, Alberto Arezzo

Digestive, Colorectal and Minimal Invasive Surgery
University of Turin, Italy

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It is at least 30 years now that one of the declared goals of surgery is the reduction of invasiveness of treatments (1). This has brought research in technology to define new techniques which proved safety and effectiveness and are today considered gold standards treatments. These are for instance laparoscopic cholecystectomy for symptomatic gallbladder stones and Transanal Endoscopic Surgery for adenomas of the upper and middle rectum.

More recently Natural Orifice Transluminal Endoscopic Surgery (NOTES) has been highlighted to the attention of lay literature and media, after first clinical reports. Concept and feasibility had been tested in animal experiments since 2004 (2), leading to the creation of new scientific societies and committees with the declared aim to regulate research activity, through sponsorships and registers, without reaching the goal completely. After less than three years, the race for the first cholecystectomy under NOTES conditions in a human being was having its course. Since then, many authors have reported various case collections, while many others presented consistent research activity in vitro or in vivo, but it looks evident that two different branches of research were being defined (3).

The first consists in what we would call Endoscopic Access Natural Orifice Surgery (EA-NOS) which

includes all procedures truly performed through natural orifices, having the goal to design new platforms for surgery to be brought within the human body to recreate surgical conditions under safety. The evident difficulties to obtain such an environment with guaranteed ease of use, safety and efficacy, reduced to a mere research activity the interest in this field, with few clinical applications described consisting of hybrid procedures, i.e. procedures which were performed basically under laparoscopic conditions with the help of flexible instruments inserted through natural orifices. In fact, a recent large metaanalysis of NOTES literature (4) focusing on various surgical intra-abdominal procedures, all ascribable to EA-NOS, concluded that no human studies were found satisfactory for the inclusion criteria, for scarce disposable evidence, minor safety and efficacy compared to laparotomic and laparoscopic alternatives. The recommendation that human procedures should first pass through hybrid NOTES surgery, under strict guidelines, and in apposite controlled registers was later supported, as known, by the revision of NOSCAR “white paper” (5). In fact, it is out of discussion that there is a need for a worldwide register, a standardization of the nomenclature, safety data to be used by ethical committees in order to authorize human trials, and implementation of the interface between medical soci-



eties, industry and regulatory offices. In this field, on behalf of the EURONOTES Foundation, we have promoted an european registry of NOTES procedures (www.euronotes.world.it) which preliminary results are now awaited.

The cooling of enthusiasm related to EA-NOS procedures has naturally forced surgeons to concentrate on techniques which could be more easily reproduced in clinical environments. This brought the interest towards what we would call Surgical Access Natural Orifice Surgery (SA-NOS) (3). In fact, an analysis of the literature would unveil that the vast majority of human studies can be ascribed to SA-NOS. A wider vision of what can be considered a SA-NOS approach, includes in this group not only transvaginal, thoroughly described in literature, but also trans-umbilical surgery. Although both approaches have the advantage of not being burdened by problems related to endoscopic defect's closure in terms of infection, safety, consistent technological research and time-consumption, there is no discussion that transumbelical techniques encountered more appreciation among surgeons. We have observed a rapid clinical diffusion driven by a technology development supported by all the different major surgical companies. Thus, it has to be said that single-port laparoscopic surgery is nothing new. It was 1992 when Marco Pelosi first described a laparoscopic appendectomy using a single umbilical puncture (6). Even multiport single-incision transumbilical laparoscopic cholecystectomy was first described by Giuseppe Navarra already in 1997 (7). Despite this, interest towards single-port surgery grew up only very recently. This might be on one side explained with the better establishment of laparoscopic techniques and skills over the years, but rises doubts about a possible industry driven interest.

There is no discussion that the technique has a number of drawbacks. The major one regards the concept of "triangulation" to which laparoscopic surgeons have grown accustomed in terms of both the instruments and scope, which is now lacking. Although this seems to be overshadowed by the increasing acceptability of in-line viewing, it has to be said that indus-

tries concentrate on developing and marketing a number of curved instrument with different characteristics with the aim of restoring standard triangulation as under laparoscopic environment. Nevertheless, personal experience gained by conducting a trial on a virtual reality simulator designed for the purpose, demonstrated that only very experienced surgeons performed surgical tasks with safety and effectiveness and requiring a short learning curve, while for all other surgeons technique acquisition was challenging.

Still a number of different concerns arise. The fundamental hypotheses that were at the base of single-port growing interest were that it could improve cosmesis, decrease post-operative pain and therefore probably allow an earlier return to work with in any case a better patient's satisfaction. None of these has been confirmed yet, if they will ever. It is also clear that those who advocate patients' preference as the main reason for proposing single-port techniques forget that patients' preference is deeply influenced by the assumption that these arguments in favor of single-port surgery are correct, despite there is no realistic certainty about it. Some of the major experts in the field of minimally invasive surgery and active researchers in the field of NOTES share the same skeptical opinion about a real benefit of single port techniques application. Dr Ratner for instance states in a recent interview that "...it is not clear to me wether single port laparoscopy would be beneficial compared to traditional laparoscopy" (8).

In any case we should never advocate for even slightly improved cosmetic value over safety, the principal concern. This has implications in both the intra-operative and the postoperative time. While it is recommended not to consider conversion to standard multitrocar laparoscopy a failure, it might be that, as it happened at the beginning of the diffusion of laparoscopy, an increased number of complications will be observed. In fact, as often in similar circumstances, only a minority of efforts has been dedicated to training programs and very few simulators are available yet. Moreover, it has been advocated that a larger periumbelical incision and consequent fascial defect



would imply a higher rate of incisional hernia. Although this is likely to happen, only time and data acquired will give us the answer.

For these reasons robust studies to show that there is indeed a difference without a significant compromise of safety should be awaited before a wide diffusion of these techniques. Studies that examine the efficacy of the multiple new devices on the market and

those under development may help to simplify the confusing landscape of new and novel products designed for this purpose. The significant amount of research and development in this growing field may in any case lead to a n improvement in our operating platform whereby new devices emerge that are completely different from the laparoscopic tools we use currently.

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Correspondance to:

MARIO MORINO

Digestive, Colorectal and Minimal Invasive Surgery, University of Turin, Italy.

e-mail: mario.morino@unito.it

Tel. +390116335679

Fax. +390116312548

