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GUEST EDITORIAL

How advances in tissue approximation technology and technique influence progress in minimally invasive therapy

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Laparoscopic surgery has been a real breakthrough in surgery, with the highest impact on general surgery but able to influence any other surgical specialty. All endoscopic surgical procedures have since been subsumed under the term ''Minimally Invasive Surgery'' or ''MIS''.

Certainly, the wide dissemination of MIS was partially caused by a change in the medical culture and philosophy and even in the psychology of physicians and patients when they think about treatment protocols to be proposed or undergone. Actually, these changes and the explosion of MIS would not have been possible without showing that not only minor or functional procedures were accomplished through such a new route, but even more advanced operations and cancer surgery were feasible, with safety and great benefits to our patients. A number of clinical trials and consensus statements witness the safety of minimally invasive procedures and the better postoperative quality of life that these procedures offer patients.

In general surgery, most of the advanced procedures require suturing skills to perform tissue approximation and anastomoses. In the mid-seventies of the last century mechanical stapling devices were introduced into clinical practice and since have become part of routine procedures. This new technology (not less revolutionary and important than laparoscopy) has made it possible to perform major thoracic and digestive procedures with better results, improved outcomes and sometimes less invasiveness. Two examples for this development are the closure of the bronchial stumps after lung resections, nowadays almost always performed by staplers with impressive reduction of postoperative air leakage, and the very low stapler division of the rectum in cancer patients followed by colo-rectal or colo-anal mechanical anastomosis with similarly impressive increase of sphincter-saving surgery.

The role that laparoscopic techniques play in the field of advanced and oncologic surgery today was made possible by the continuous improvement of suturing technologies and the development of stapling devices specially designed for laparoscopic or thoracoscopic use.

In this issue of MITAT, readers will find several reports and contributions on new developments and techniques in the field of tissue approximation, from newly designed standard stapling technology to robotic suturing. Some of these papers focus on the employment of superelastic alloy technology for suturing and fashioning anastomoses in the digestive tract: At the present time, this is one of the most promising and interesting technologies in the area of tissue connection. No further comment is required since the topic is extensively discussed in the original contributions.

The metanalysis on stapled versus hand-sewn anastomoses in the digestive tract deserves some more words. Much has been said and written about which of the two mentioned techniques used to construct visceral anastomoses is superior: the article by Koroljia presents the evidence.

In 2005 a new approach, born from the merging of flexible and rigid endoscopy, was introduced into clinical practice by Rao, who reported the first cases of transgastric appendectomies (1): Natural orifice translumenal endoscopic surgery – NOTES. The first published report on a transvaginal cholecystectomy by Marescaux (2) has further contributed to push surgeons and endoscopists to continue working in such a direction and tens of cases of NOTES

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procedures on humans were reported or published in the last year.

This is not the right place to discuss the principles and drawbacks of transvisceral endoscopic surgery; what is sure is that most likely the future of NOTES is not only closely related to the development of new endoscopes but also to the development of new technologies for advanced suturing.

As a matter of fact, a major technical challenge in NOTES is the need for adequate closure of the viscera opened to gain access to the abdominal cavity: Morbidity and mortality may increase in patients who develop peritonitis from either a gastric or colonic leak. Seaman et al. evaluated *in-vivo* several devices designed to accomplish a plication of the visceral walls: T bar, T bar with mesh bolster, star and basket. The authors found more promising the basket tissue anchors, which provided better plication with apposed muscularis propria and evidence of serosal fusion (3).

All major companies are developing technologies for tissue approximation in NOTES: The Eagle Claw (Olympus), the Swain system (Ethicon, Cincinnati, OH), and the G-prox (USGI Medical) are the systems currently being investigated in clinical trials (4).

For Oleynikov and Lehman NOTES needs tele-robotics and endo-cavitary robotics to overcome its limits: Thus, they developed wireless controlled mini-robots which are inserted into the peritoneal cavity through a small gastrotomy. The newly designed small robots have been used to perform *in-vivo* liver biopsy and could be used for more challenging tasks in the future (5).

At the present time NOTES techniques and technologies are in their infancy (6). We cannot know whether the future of NOTES will mirror that of present MIS. Most likely there will be a number of spin-off technologies from NOTES: From the development of new generation endoscopes to the development of new devices for endoscopic tissue approximation.

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