*Wiesław Tarnowski, Karolina Wawiernia

What's new in miniinvasive surgery?

Co nowego w chirurgii małoinwazyjnej?

Department of General, Oncologic and Digestive Tract Surgey, Centre of Postgraduate Medical Education, Warsaw
Head of Department: prof. Wiesław Tarnowski, MD, PhD

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Summary

Progress in minimally invasive surgery brings along new technologies and operational approaches/methods to be introduced into everyday clinical practice. Introduction of a "down-to-up" method undoubtedly constitutes such progress in rectal operations. It seems that this technic will add up new quality to rectal operations, in particular in case of low located tumors with difficult access, where anastomosis is performed at the distance of two to three centimeters from sphincters. It significantly reduces operational injuries, concurrently posing challenges to colorectal surgeons. Things look similar with regard to bariatric operations. Introduction into clinical use of new endoscopes results in development of new endoscopic methods and attempts to treat obesity endoscopically. This methods requires extreme endoscopist's skills and becomes an alternative to bariatric operations. Likewise, the attempts to use electrical stimulators or Magnetic Sphincter Augmetation in treatment of gastroesophageal reflux disease, are noteworthy. All of these things make minimally invasive surgery to be extremely dynamic and interesting and offering more and more technologically advanced solutions in treatment of chronic diseases.

Streszczenie

Rozwój chirurgii małoinwazyjnej przynosi nam coraz to nowe technologie i techniki operacyjne wprowadzane do codziennej praktyki klinicznej. Niewątpliwym postępem w operacjach odbytnicy jest wprowadzenie techniki „down-to-up", czyli usuwanie odbytnicy i mezorektum przez odbyt. Wydaje się, że ta technika wprowadzi nową jakość w operacjach odbytnicy, w szczególności w guzach nisko położonych, gdzie dostęp jest trudny, a zespolenie wykonywane jest na drugim, trzecim centymetrze od zwieraczy. Zmniejsza to w istotny sposób urazowość tej operacji, jednocześnie stawia kolejne wyzwanie przed chirurgami zajmującymi się chirurgią kolorektalną. Podobnie ma się sytuacja z operacjami bariatrycznymi. Wprowadzanie do użytku klinicznego nowych endoskopów powoduje rozwój technik endoskopowych i prób leczenia endoskopowego otyłości. Technika ta wymaga ogromnej zręczności od endoskopistów i staje się ciekawą alternatywą do operacji bariatrycznych. Podobnie warte uwagi są próby zastosowania stymulatorów elektrycznych czy magnetycznego zwieracza przełyku w leczeniu choroby refluksowej przełyku. Wszystko to razem powoduje, że chirurgia minimalnie inwazyjna jest niezwykle dynamiczna i ciekawa oraz oferuje pacjentom coraz bardziej zaawansowane technologicznie rozwiązania w leczeniu chorób przewlekłych.

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Address/adres:
*Wiesław Tarnowski
Department of General,
Oncologic and Digestive Tract Surgey
Centre of Postgraduate Medical Education
ul. Czerniakowska 231, 00-416 Warszawa
tel. (22) 621-71-73
tarnowskiwieslaw@me.com

RECTAL SURGERY 2015

The "Surgical Endoscopy" included an interesting paper, entitled "Transanal natural orifice transluminal endoscopic surgery (NOTES) rectal resection: "down-to-up" total mesorectal excision (TME) – short-term outcomes in the first 20 cases" by de Lacy et al. (1). The authors summarize short-term results of the "down-to-up" modified NOTES surgery in patients with rectal cancer. Twenty patients with diagnosis of malignancy confirmed in their material histopathology were enrolled for surgery. All surgeries were carried out in the Clinical Hospital of Barcelona in 2011-2012. Preoperative radiotherapy was used in 14 patients. The following included contraindications for laparoscopic surgeries: BMI > 35 kg/m^2, cT4 tumor stage, recurrence of cancer or general contraindications to create pneumoperitoneum. The surgery technique consists in creating pneumoperitoneum with the pressure of 12 mmHg in a typical manner (the authors used the Veress needle inserted through the navel), establishing

trocars: 12 mm (at the site of the removed Veress needle, for a videolaparoscope) and two ports in the lower quadrants of the abdomen: 5 mm at the site of the future protectionist ileostomy and 2 mm (the site of placing the drain through the skin integument). After the initial assessment of abdominal organs (adhesions, assessment of tumor invasion), the main part of the surgery was performed, rectum dissection from the peritoneal cavity. A multiport GeoPoint Path Transanal device was established and sealed from the rectum side, through it, after carbon dioxide insufflation to a pressure of 9 mmHg, a flexible 3D (3D EndoEye 5 mm Olympus KeyMed) endoscope was passed. Transmural mesorectal dissection of the rectum (using the TME technique) was started with purse string suturing the rectal mucosa approx. 3-4 cm from the bottom margin of the tumor. In the case of colorectal tumors (i.e. the distance from the anal verge smaller than 3 cm), rectal dissection was started just above the anal sphincter muscles. The surgical technique consisted in transmural, circular rectal intersection to the avascular zone, with mesorectal collection to a preparation, as far as to the presacral fascia (at the back), then laterally towards the front, with careful maneuvering at the front (vagina, prostate) – to a complete, circular rectal mobilization. The next step was to cut the peritoneum and to reach the peritoneal cavity. Then, using laparoscopy, the rectosigmoid junction was freed, vessels were closed with clips and transected. The bowel mesentery was separated using a LigaSure knife. After the dissection, satisfactorily long enough to perform the intestine anastomosis, the transrectal port was removed. In all cases, the preparation was removed transrectally. In all cases, the proximal cleavage of the preparation was performed outside. The rectosigmoid anastomosis was performed: manually in 13 patients, using a stapler in 7 (side-to-end/end-to end) with the assistance of laparoscopic tools and visualization. The tightness of the anastomosis was confirmed with an air test. Sixteen patients underwent protective strippable Brooke ileostomy in the right mesogastrium. All patients were left with a drain in the pelvic cavity, placed through the skin integument in the left mesogastrium. The endpoint of the examination was to compare the parameters of tumor purity (TME, the distal and the circumferential margin, the number of the lymph nodes obtained for histological examination) and the surgery safety. In the results, the authors emphasize that there was no need to convert from the hybrid (laparoscopic/endoscopic) technique to a laparoscopic or open surgery. Six patients required splenic flexure. Histopathological preparations confirmed distal and circumferential margins, at least 12 lymph nodes (average 16) in 80% of patients were recovered for testing. There were no complications in 16 out of 20 patients with at least one in 4 cases: postoperative residual urine in 2 patients, postoperative ileus in 1 patient, a high degree of water and electrolyte disturbances in 1 patient, as a result of ileostomy – all of them were treated conservatively, none requires surgical intervention. During follow-up visits (15 and 30 days after the surgery), there were no other new complications. In the discussion, the authors emphasize that the proposed type of surgery significantly improves the cosmetic effects of the surgery, reduces the risk of postoperative wound infection, hernia in the scar and provides faster recovery. The proposed technique is a natural consequence of the NOTES procedures with access through the vagina (intestinal resections with the removal of even large preparations) performed by the authors.

SURGERY – MINIMALLY INVASIVE ENDOSCOPY IN THE TREATMENT OF OBESITY IN 2015

The “Endoscopy” 47 (2015) issue included a paper by Lope-Nava et al. (2) on the feasibility of endoscopic gastroplasty in the treatment of obesity. The authors, in their prospective study, decided to assess the efficacy and safety of the treatment in selected patients. They emphasize that laparoscopic surgeries bypassing the gastrointestinal tract and radical sleeve gastrectomy have been considered the gold standard in the treatment of obesity, but they carry the risk of surgery and intraperitoneal access, and the changes are irreversible. Earlier studies showed that the use of endoscopic techniques for reducing the capacity of the stomach were safe, feasible and associated with changes of eating behaviors and weight loss. All of the analyzed procedures were carried out at the Madrid-Sanchinarro University Hospital. Patients with a BMI of 30 to 49 kg/m^2, treated for an eating disorder for at least one year by a multidisciplinary team of physicians – nurses were included in the study. With the surgery Patients after a preliminary assessment with a gastro-camera which demonstrated potential sources of bleeding in the upper gastrointestinal tract (e.g. acute gastritis, ulcers) or preneoplastic changes, coagulation disorders, or psychological disorders were disqualified. The surgery requires a specially-designed, flexible, two-channel endoscope with an integrated suturing element (sutures were placed through the entire thickness of the wall of the stomach from the pylorus to the bottom of the stomach). Patients after the surgery were laid on the left side, under general anesthesia, with endotracheal intubation. At the beginning of the procedure, argon coagulation was performed for determining locations for sutures. Suturing started from the body of the stomach in the direction around the antrum and the fundus, from the front wall, through the greater curvature of the stomach, to the rear wall. Before the suture was finished off, approx. 3-6 sutures were placed (6-8 times towards the bottom). The aim of the procedure was to reduce the volume of the stomach with the formation of a tunnel along the lesser curve. After the procedure, endoscopic follow-up followed. Follow-up assessment of X-rays with a contrast agent soluble in water was performed: 24 hours, 3 months and 6 months post-procedure. Post-procedure recommendations included: 1-day observation of patients in the center, liquid diet from 12 hours to two weeks after the procedure, pain medications upon patients’ request. Aftercare included

dietary and psychological care. Results were assessed in 1-, 3- and 6-month observations after the surgery. In the group of the 20 patients who underwent the procedure: no significant differences in the morphology of gastric contrast examination were found between day 1 after the procedure and 3 and 6 months after the procedure. There were no adverse events, apart from intra-procedure bleeding in two patients – effectively taken care of with the use of endoscopic injection. The average weight loss was 8.2 ± 2.5 kg in the first month, 13.6 ± 4.8 kg three months after the surgery and 19.3 ± 8.9 kg 6 months after the surgery, with the average BMI, respectively, initial 38.5 ± 4.8, 35.6 ± 4.7 in the first month; 33.7 ± 4.7 in the third month and 31.9 ± 4.9 kg/m^2 six months after the surgery. In the discussion, the authors emphasize that there is still little reliable data on long-term follow-up. According to the authors, endoscopic gastroplasty seems to be another tool in the surgical treatment of obesity which will expand the group of patients that can be qualified for this type of treatment, specifically to be considered in patients with contraindications to surgery (prior to the creation of pneumoperitoneum), and those reluctant to undergoing more invasive surgical treatments. It is a bridge between the purely endoscopic techniques, without permanent restrictions (balloon) and surgeries.

SURGERY IN THE GASTROESOPHAGEAL REFLUX DISEASE 2015

In the last year, there were interesting studies supplementary to the classic treatment of the operating reflux disease – laparoscopic surgeries and comparing the conventional laparoscopy and robotic treatment. Short summaries are given below.

The "Surgery" 157 (2015) published an article by Rodriguez et al. (3) assessing the lower esophageal sphincter (LES) electrical stimulation (LES-EST) for the treatment of the gastroesophageal reflux disease. The study was conducted prospectively, in one center, to assess the quality and safety of the method. Twenty one patients aged between 21 and 65, with a history of heartburn and/or regurgitation after at least 6 months of continuous pharmacological treatment were enrolled. All of the patients scored more than 20 points in the survey of quality of life associated with disease, they also showed improvement after two weeks of therapy with proton pump inhibitors, up to 10 point. All of the patients, in the process of classification for the treatment, underwent 24-hour pH monitoring, manometry and endoscopy of the upper gastrointestinal tract. The following patients were excluded: patient with esophagitis (Los Angeles grades C and D), Barrett's esophagus, dysplasia foci, hiatal hernia greater than 3 cm in diameter, BMI exceeding 35 kg/m^2, poorly controlled type II diabetes mellitus. The system used for the electrical stimulation of the lower esophageal sphincter consists of 3 components: a bipolar, electric stimulating head, an implantable pulse generator and an external programmer. The first two are integrated and designed to be implanted in the muscle lamina propria in the vicinity of the lower esophageal sphincter. The external stimulator is used for programming a specific mode of stimulation. The stimulating set generates 251 with the frequency of 20 Hz in 30-minute sessions whose parameters can be modified, depending on the patient. The device has a sensor differentiating body position (vertical, horizontal) and its operations can be modified, which is particularly important in patients with nocturnal reflux episodes. The procedure of the device implantation requires laparoscopic access (the EndoStim LES Stimulation System). After inserting 4-5 trocars, at least one 10 mm, the front surface of the abdominal esophagus was exposed and, with the intersection of the surrounding adipose tissue and the hepato-gastro ligament, to give a free space of the esophagus with the dimensions of 30 x 10 mm. Such an access minimizes the risk of damage to the phrenoesophageal fibers and the vagus nerve. Two electrodes were implanted in the esophagus along the long axis with at least 10 mm spaces between them and secured in positions with clips on the proximal ends of the electrodes and sutures on their distal ends. The upper gastrointestinal tract endoscopy was performed during the surgery in order to confirm the correct orientation of the electrodes (to exclude perforations, the presence of the needle in the esophagus). No surgeries were performer were performer to repair hiatal hernia. After the surgery, at the ward, proper operation of the electrodes was confirmed. Pulse generator was placed in a pocket formed in the subcutaneous tissue on the left side of the patient's body. After the patient wake-up and follow-up (at least 12 hours) the device parameterization was performed. In order to exclude the effect of the device on the heart, electrocardiography was monitored during operation. The stimulation control included a 24-hour esophageal pH-metry performed after an at least 5-day break in the treatment with proton pump inhibitors. Out of the 25 patients with the device implanted 22 underwent the 24-hour esophageal pH-metry 12 months after the surgery. The results are as follows: implantation was performed successfully in 25 patients, the two-year follow-up period was completed by 23 patients. After two years, a considerable improvement of quality of life was noted, as related to the gastroesophageal reflux disease and compared to the baseline results obtained over the time of the treatment and without treatment with proton pump inhibitors.

Sixteen out of 21 patients abandoned drug therapy, 2 regularly used proton pump inhibitors (PPI) and 5 used them occasionally. A significant improvement in quality of sleep was found, reducing the number of episodes of heartburn and regurgitation. At the time of qualifying patients, 92% reported poor quality of life without pharmacological treatment and 71% with treatment using PPIs, as compared to 0% of patients dissatisfied during follow-ups in the 24th month after implantation of the device. There were no complica-

tions related to the type of therapy or device, as well as symptoms of dysphagia during the LES-EST therapy. In the discussion, the authors emphasize that LES-EST is safe and effective in treating patients with the gastroesophageal reflux disease at a two-year follow up. The use of the therapy was not associated with other adverse gastrointestinal symptoms.

Another method of treating the GERD, alternative to fundoplication, in a suitably qualified group of patients, is the implantation of a magnetic esophageal sphincter.

This is another paper by Lipharn et al. (4), assessing the safety and efficacy of the Magnetic Sphincter Augmetation – MSA for the treatment of the gastroesophageal reflux disease – currently evaluating the results in a group of 1,000 patients. With the detailed interview and prospective follow-up the researchers were able to assess the effects of the device as well as to distinguish side effects dependent on the device itself from those arising from a typical recovery period after esophagus interventions. The study was conducted in 2007-2013, in many centers. The average time of implantation of the device was 274 days (min. 2-max. 2302 days), the total number of 111 adverse events was reported in 82 patients. The overall percentage of adverse events was 0.1% in the intraoperative/postoperative period (one patient reported acute respiratory failure after implantation of the device, the researchers did not associate this fact directly with the device), 1.3% of hospital readmissions (the most common reasons are: swallowing disorders, pain, nausea and vomiting in the postoperative period), 5.5% extensions of the esophagus (dysphagia symptoms occurred within a period shorter than 90 days after the surgery, two patients had esophageal candidiasis after treatment with antifungal and widening the esophagus – as in other cases – there were no further complications), 3.4% resurgeries with the removal of the device (the most common cause of dysphagia) and the erosion of the device in 0.1% of patients. In no case, the decision to remove the device was not urgent, all devices were removed in a laparoscopic manner, without conversion to laparotomy and other complications. In 10 of 36 patients with the device removed, laparoscopic fundoplication was performed simultaneously or later. There were no cases of migration of the device. In the discussion, the authors emphasize that due to long, exceeding 6 years, periods of follow-up, knowledge on the surgery and its safety is much wider. The data collected on the high degree of safety in conjunction with the vast improvement of the general condition (total or partial), elimination of the need for drug treatment and a high degree of reducing the exposure time of the esophagus to acid, as confirmed in the pH-metry, confirm that implantation of the magnetic esophageal sphincter is a very effective and safe procedure to treat the gastroesophageal reflux disease. Comparison of the MSA as well as electrical stimulation of the lower esophageal sphincter and laparoscopic fundoplication is limited, due to the varying classifications for the treatments, i.e. patients with large hernia hiatal are qualified for a laparoscopic fundoplication and the same is a contraindication for the MSA/LES-EST. Despite the fact that both procedures are laparoscopic, due to reducing the invasiveness of the MSA, the following complications were not reported: damage to the spleen, perforation of the esophagus, liver damage, intraperitoneal bleeding, pneumothorax, subdiaphragmatic abscess, perforation of the small intestine or rare hematoma occurring during a laparoscopic fundoplication. In terms of narrowing of the esophagus after antireflux surgeries (the MSA and fundoplication), no clear standards have been established for when to perform an extension (extension percentage after the MSA is 5.6 vs. 6.4% after a laparoscopic fundoplication).

In the current year, a paper was published in the "Journal of Surgical Oncology" comparing the classic laparoscopic surgeries and those robot-assisted and used for the treatment of the gastroesophageal reflux disease by Tolboom et al. (5). Conclusions of a study conducted retrospectively by the authors stated that the main cause of the GERD is a mechanical disorder of the gastro-esophageal reflux, allowing exposure of the esophagus to the stomach acid, and qualifications for a particular kind of treatment should always try to determine the cause of the disease – generally known facts. Surgeries are only indicated in patients with objectively-confirmed reflux disease and they are an alternative to drug therapy. The Laparoscopic Toupet Fundoplication is the preferred antireflux procedure in patients with a small hiatal hernia type I or with no evidence of hernia. No evidence was showed for the validity of the use of plastic mesh on the hiatal area and its branches. It was impossible to demonstrate the superiority of the use of the da Vinci surgery system in the original surgical treatment of the gastroesophageal reflux disease, the authors state that the justification for its use occurs in the case of reoperating the gastroesophageal reflux disease, or in patients being considered for primary treatment with a diagnosis of large or giant hiatal hernia.

ROBOTIC SURGERY 2015

Another long paper comparing the laparoscopic treatment and the robotic colorectal surgery by Tam et al. (6) was published in the "Surgical Endoscopy". The authors retrospectively compare colorectal surgeries with a minimally invasive access basing on data from the regional base of the Michigan Surgical Quality Colaborative from 2012-2014. The analysis excluded: patients under 18 years of age, NYHA classification with more than 4 surgeries with indications of trauma and emergency and pregnant patients. There have been 5781 minimally invasive colorectal surgeries reported, where: 26.1% were laparoscopic, 14.1% were laparoscopic and assisted manually and 7.7% were robotic. The authors point out that the number of robotic surgeries has grown in recent years, particularly

with regard to rectal cancer (which was the indication for 39.5% of robotic surgeries, as compared to 7.2% in the case of laparoscopic surgeries). The results stated: higher BMI in patients undergoing laparoscopy, more patients in the ASA II robotic group. Within the minor pelvis surgeries: 40% of procedures were performed using a robot, 24% were laparoscopic and 24% were laparoscopic and manually-assisted. There was a statistically lower percentage of conversion in the group of robotic surgeries (9.0% for colon surgeries vs. 16.9% for laparoscopic surgeries, 7% for rectal surgeries in the robot group vs. 21.2% in the laparoscopic group). In both locations (the colon, the rectum) operative time was shorter in the laparoscopic group. A significantly shorter period of hospitalization was recorded in the robotic group (4.0 days), as compared to 4.41 days in the laparoscopic group and 4.44 days in the manually-assisted laparoscopic group, there were no statistically significant differences neither in the case of colon nor in the case of the rectum. Considering the differences in the early postoperative adverse events (statistically insignificant) showed a greater risk of systemic infections in the laparoscopic group and in the robotic group the risk was associated with acute renal failure, cardiac disorders (including death). In their conclusions, the authors emphasize that due to the large, multi-center analysis, without a doubt, it was found that robotic operations are safe and feasible, with special emphasis on the procedure in the area of the minor pelvis. They are also associated with a statistically lower risk of conversion to open surgery than laparoscopic procedures.

MINIMALLY INVASIVE TREATMENT OF FECAL INCONTINENCE

Summing up the achievements of the minimally invasive surgery, it is worth to take a look at the publication by Hull et al. in the "Diseases of the Colon and Rectum", on sacral nerve stimulation for chronic fecal incontinence (7). Hull et al. proposed a minimally invasive solution, relevant for a properly selected group of patients, involving the implantation of electrodes for neurostimulation in the area of the sacral nerve. The study was carried out prospectively, its undeniable advantage is the relatively large group of patients (120) and the long period of follow-up. The study was conducted in 2002-2012, in clinical centers in Canada, the United States of America and in Australia. Patients with chronic incontinence (defined as at least 2 episodes of incontinence per week lasting at least 6 months) who have not achieved a satisfactory result of conservative treatment and/or who could not receive other types of therapy were qualified. The patients were required to write logs of the bowel movements. After implanting a test device and a 14-day follow-up, patients with at least 50% improvement, as compared to the baseline continence per week, were qualified for permanent implantation. The patients who underwent implantation were included in a follow-up program, including visits in the 3rd, 6th month after the surgery, and at least once a year later on. The study included 120 patients, 76 (63%) were subjected to follow-up for at least five years. The number of incontinence episodes per week during the follow-up period decreased from 9.1 to 1.7 in the 5th year in 89% of patients, which means at least 50% improvement in the quality of life and 36% of patients were able to achieve complete continence. 35.5% of patients required intervention within the scope of the device issues (revision, displacement or removal) due to symptoms (the most common: pain at the site of implantation, decreased effectiveness of stimulation, paresthesia, battery depletion, displacement of the device). According to the authors, the level is satisfactory – but still requires improvement.

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