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AN UPDATE OF DIAGNOSIS AND TREATMENT OF ANASTOMOTIC COMPLICATIONS AFTER RECTAL SURGERY

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INTRODUCTION

Colorectal cancer (CRC) represents the third most common neoplasm and the fourth cause of death for cancer: 1,4 million of new cases and 694.000 deaths occurred in 2012 in the world. Worldwide incidence rates of CRC vary widely: incidence rate is 10-fold lower in African and Asian countries than in the US and Europe, with more deaths (52%) in less developed regions of the world, reflecting poorer prognosis in these regions [Ferlay]. Rectal cancer accounts for about 35% of all CRC [Stintzing]. Due to its anatomical and functional features, rectal cancer treatment is more challenging than colon cancer one, and best results can be achieved with a multidisciplinary approach. Surgery remains the most effective therapy and the only one can cure a patient with rectal cancer, but it's difficult, technically demanding and affected by a considerable rate of complications, that should be early recognized and treated.

Complications in rectal surgery can be divided in two groups: anastomotic (dehiscence, bleeding and stricture) and functional (sexual, urinary and continence dysfunction). In the first group dehiscence and bleeding usually occur early in the post operative course, while stricture represents a delayed complication. Functional disorders usually occur early, may be transient, improving or completely disappearing within some months, or may be permanent, heavily affecting patient's quality of life. This lecture is only focused on anastomotic complications, because functional disorders are a wide topic probably requiring a dedicated lecture.

Before starting a detailed analysis of each complication I'd like to spend some words on laparoscopic rectal surgery. A remarkable number of colorectal surgeons still believes that laparoscopic rectal surgery is dangerous, because it does not allow to perform a precise mesorectal excision and is affected by more complications. Evidence from current literature is against this belief. Safety of laparoscopic total mesorectal excision, both from an oncological and surgical point of view, has been clearly shown by COLOR II trial, a multicentre RCT that enrolled more than 1000 patients comparing open vs laparoscopic anterior rectal resection [van der Pas]. Morbidity and short term (within 28 days) mortality rates were similar in both groups, as well as circumferential margin positivity rate. A metanalysis of randomized and non randomized trials did not found statistically significant differences in complications rate after open or laparoscopic rectal resection, suggesting a slight advantage in favor of laparoscopy [Arezzo]. Considering the good level of evidence of these papers, we have to talk about complications in rectal surgery regardless of laparoscopic of open technique, because this aspect is probably irrelevant.

LEAKAGE

Anastomotic leakage (AL) after anterior resection of the rectum should be defined as a communication between the intra and extraluminal compartments owing to a defect of the integrity of the intestinal wall at the anastomosis between the colon and rectum or the colon and anus. Because of its similar clinical impact, a leakage originating from the suture or staple line of a neorectal reservoir (e.g. J-pouch or transverse coloplasty) should also be considered as an anastomotic leakage. Furthermore a pelvic abscess in the proximity of the anastomosis should be considered an anastomotic leakage. This is the definition provided by the International Study Group of Rectal Cancer in 2010, based on an exhaustive synthesis of current literature [Rahbari]. Authors also suggested a clinical grading system dividing leakages in grade A (requiring no active therapeutic intervention), Grade B (requiring active therapeutic intervention but manageable without relaparotomy) and grade C (requiring re-laparotomy). AL rate varies from 5 to 19% [Mc Dermott], the lowest the anastomosis, the higher the risk. Besides anatomical site, there are many other factors influencing leak rate, related to the surgeon, to the patient and to the disease.

The most important factor influencing anastomotic healing is blood supply. If a cancer resection is being performed, it may be desirable to ligate the inferior mesenteric artery (IMA) at its origin, but there is some controversy regarding the necessity of ligating the IMA flush to the aorta (high tie) when compared with preservation of the left colic branch (low tie). Benefits of a high tie have not been uniformly seen, and there is ongoing controversy about the oncological benefits of this technique. Irrespective of oncological reasons, a high tie is sometimes compulsory in order to obtain a complete mobilization of the descending colon to perform a tension free anastomosis. In 1995, Hall and coworkers [Hall] measured the partial tension of oxygen (ptO2) of the left colon before and after ligation of the IMA in 62 patients who underwent anterior resection. After IMA ligation, the ptO2 was significantly reduced in the sigmoid colon when compared with the left or transverse colon, irrespective of a high tie or a low tie. These data suggest that it is the site of transection and not the site of arterial ligation that affects the integrity of the anastomotic blood supply. Sigmoid colon should always be resected, irrespective of the level of IMA ligation, and consequently a complete mobilization of the splenic flexure should always be performed in order to obtain a tension free extraperitoneal anastomosis. Moreover, Matsuda at al recently published a RCT showing that the level of ligation of the IMA in patients with rectal cancer did not affect defaecatory function or the incidence of postoperative complications [Matsuda].

The importance of lack of tension on the integrity of an intestinal anastomosis is well known from more than 100 years [Howes]. Shikata et al published in 1986 an experimental work on dogs showing how the submucosa of the small bowel maintained a better blood flow, even if under tension, than the submucosa of the colon [Shikata]. It probably depends on the higher laxity of the mesentery compared to the mesocolon, underlining how much a colo-rectal or colo-anal anastomosis integrity is threatened by an excessive tension. In order to obtain a tension free anastomosis, especially for very low resections, it is useful to ligate the inferior mesenteric vein just lateral to the ligament of Treitz (so called “division of convenience”). In addition, the retroperitoneal attachments near the tail of the pancreas should be completely freed, taking great care in preserving marginal blood supply [Davis].

Since 1979 stapling devices has been introduced in the practice of surgery of the digestive tract [Ravitc] and since 1990 are widely used in performing transanal colo-rectal mechanical anastomoses [Griffen]. It is sometimes questioned if hand sewn or stapled technique may influence the outcome of the anastomosis. A Cochrane Systematic Review of RCTs published in 2012 [Neutzling] concluded that there are no differences between stapled and hand sewn colo-rectal anastomosis in terms of mortality, overall dehiscence, clinical anastomotic dehiscence, radiological anastomotic dehiscence, anastomotic haemorrhage, reoperation, wound infection, anastomosis duration and hospital stay. Stapled

anastomosis has a little bit higher risk of stricture. If a surgeon chooses to perform a hand sewn anastomosis probably the best way to do it is a single layer running suture with monofilament absorbable wire [Law].
In very low rectal resection, surgeons can perform a straight colo-anal anastomosis (SCA) or a colo-anal anastomosis with a colonic J pouch (CJP). Irrespective of functional outcomes, a Cochrane Review published in 2008 has shown no statistically significant differences between SCA or CJP in terms of leak rate, wound infection and pneumonia/chest infection [Brown].
Intraoperative factors may influence anastomotic healing. There are many retrospective studies showing that excessive blood loss or blood transfusions and prolonged operative times are associated with a higher risk of anastomotic failure. A recent metanalysis indentified blood loss, intra operative transfusion and duration of surgery more than 4 hours as strong predictors of dehiscence [Mc Dermott].
Oxygen supplementation may prevent anastomotic leakage in rectal surgery. In 2006 Garcia Botello et al [Garcia Botello] investigated the effect of hyperoxia on intramucosal pH and carbon dioxide pressure of colorectal anastomosis, showing a significant difference in patients who received 80% vs 30% fraction inspired oxygen during and 6 hours after the operation. A small RCT [Schietroma] and a metanalysis [Brar] showed how hyperoxia can reduce AL rate and mortality, without oxygen related side effects.

Fluid restriction, even if related to less cardiac and pulmonary complication, does not seem to reduce AL rate in digestive surgery. 2 RCTs including only patients who underwent colo-rectal surgery failed to show a statistically significant difference in AL rate as well as in hospital stay [Holte, Abraham-Nordling].

May surgeon's experience influence AL rate? Probably yes, even if a metanalysis of 19 retrospective studies comparing colo-rectal resections performed by expert surgeons or trainees, showed a significantly lower rate of AL in the trainees' group [Kelly]. It's a strange finding, probably due to a selection bias of the patients included, but authors write that trainees pay much more attention and precision in what they do due to their small experience, this way influencing the outcome.

Many factors related to the patients increase AL rate. Even it is impossible to precisely quantify the risk, surgeons have to be aware that these factors can strongly influence the outcome of the operation. Male sex [Lee, Bertelsen], age [Jung, Damhuis], American Society of Anesthesiology score [Bakker], diabetes mellitus [Hu, Lin], pulmonary, cardiovascular [Warshkow] and kidney diseases [Krysa], smoking [Richards, Kim], obesity [Benoist, Kartheuser], alcohol consumption [Sorensen] and malnutrition [Kang] are predictive factors of anastomotic leakage.

A third group of important factors influencing anastomotic healing includes disease-related factors. Every surgeon knows how an anastomosis performed under emergent conditions has a higher leak rate [Boccola], reaching more than 40% in a wide series [Choi].

Immunomodulators increase the risk of AL: a literature survey [Eriksen] found a leak rate of 6.8% in the corticosteroid group compared with 3.3% in patients not treated with corticosteroid, but the duration and dose of treatment were heterogeneous. Ferrante et al [Ferrante] showed an independent negative role for preoperative use of a moderate-to-high daily dose of corticosteroids (equivalent or more than 20 mg metylprednisolone for more than 2 months). There is evidence from experimental studies that immunosuppressants agents (mycophenolate mofetil [Zeeh], ciclosporin [Scaffer], tacrolimus [Petri] and everolimus [van der Vliet]) increase AL rates, while azathioprine, infliximab and TNF alpha do not [Subramanian]. Bevacizumab, a monoclonal antibody anti Vascular Endothelial Growth Factor Receptor, reduces neovascularization and healing. Manufacturers recommend stopping treatment at least 28 days before surgery, not restarting for at least 28 days afterwards and only when the wound has healed [Genetech]
Anastomotic site strongly influences leak rate, the risk increasing the closer the anastomosis is to the anal verge. Reported dehiscence rates varies from 5.6% [Law] to 15.9% [Sorensen] in many important series,

reaching 24% for anastomosis located below 6 cm from the anal verge [Mathiessen], irrespective of neoadjuvant therapy. The only exception to this rule is the hand-sewn colo-anal anastomosis following a perineal proctectomy for rectal prolapse. Leak rates are extremely lower (less than 2%) [Altomare] in comparison to hand sewn colo-anal anastomosis performed after low anterior resections for cancer. This finding suggests how anastomotic leakage is caused by a wide range of factors, probably including abdominal wall incision and mesorectal excision.

Neoadjiuvant Short Course Radiotherapy (5 x 5 Gy and immediate surgery, SCRT) and Long Course Chemo-radiotherapy (45-50 Gy, 1.8-2 Gy per fraction + 5-Fu and leucovorin or capecytabine, 6-8 weeks interval to surgery, LCCRT) were reported to be an important risk factor for anastomotic leakage in many wide retrospective series [Eriksen, Mathiessen, Warschkov]. Park [Park] computed, in a retrospective analysis on 1609 patients, a Hazard Ratio for AL of 3.851 for male patients treated with LCCRT and of 3.471 for tumors located less than 7 cm from the anal verge treated with LCCRT. Prospective studies including RCTs did not confirm these results, finding a comparable risk of AL between patients who underwent neoadjuvant treatment and who did not. The Medical Research Council (MRC) CR07 RCT [Sebag] and the Dutch Total Mesorectal Excision (TME) trial [Marijnen] found no significant differences in AL rate between patients treated or not with SCRT, as well as Chang [Chang] in a similar prospective study on LCCRT. Even if there is a strong evidence that neoadjiuvant treatment does not jeopardize anastomotic healing, it's important to remember that AL is not the only complication partially ascribable to neoadjiuvant treatment: incidence of serious anterior resection syndrome is 30% after radiotherapy and surgery compared to 10% after surgery alone [Dahlberg, Lundby] and SCRT strongly impair sexual function [Marijnen, Parc]. The Polish [Bujko, Pietrzak] and the Australian [Ngan] study found no differences in terms of sphincter preservation, postoperative complications, late side effects, local recurrence rate, survival and anorectal function between SCRT and LCCRT. Acute side effects were significantly higher (3% vs 18% and 2% vs 28% respectively) in LCCRT group, probably because with 5 x 5 Gy and immediate surgery, the main organ at risk (rectum) is removed before the occurrence of acute side effects. This is the same reason why, with increased duration of rest period, long-term outcomes remain similar despite better pathological response. A few days after radiation, nonviable cancer cells look morphologically intact; no downstaging is seen, but only a slight tumour shrinkage. After 6-8 weeks nonviable cancer cells undergo lysis: downstaging occurs with large tumour shrinkage.
Surgical and medical oncologists must be careful in selecting patients who really can benefit from SCRT or LCCRT treatment. The Mercury study showed how, if surgery is performed according to the principle of the TME, only a restricted group of patients affected by a T3 rectal cancer has a real benefit in terms of local recurrence [Taylor].

NCCN guidelines [Benson] recommend neoadjuvant treatment for all cT3-4 tumors up to 12 cm from the anal verge. ESMO guidelines [Glimelius] for all tumors located up to 10 cm from the anal verge with threatened mesorectal fascia or cT4 and for bulky low-lying T2 tumors. The Royal Marsden Hospital [Chand] proposed to employ neoadjuvant treatment only for tumors threatening mesorectal fascia or T4. Considering evidence from literature, ESMO guidelines are probably well balanced. Twelve years results of the Dutch trial [van Gijn] confirmed there were no differences in survival between the 2 arms, but in SCRT arm more non-cancer related deaths and less cancer related deaths occurred, with a number needed to treat of 17. This study taught us that radiotherapy saves lives and takes lives: neoadjuvant radiotherapy must be administered only in patients who really can benefit from it.
Focusing on neoadjuvant radiotherapy, the main outcome everyone looks at is local reccurrence. AL has a negative prognostic impact on local recurrence after restorative resection of rectal cancer, with an association between leakage and reduced long-term cancer specific survival [Mirnezami]. AL is a fearsome complication in rectal surgery, impairing both short and long term outcomes. Sometimes it may become life threatening and must be promptly diagnosed and treated.

In some cases it can be prevented, first of all by a correct selection of patients and by a precise surgical technique. There are some measures adopted by the majority of surgeons that are (or only considered) able to be effective in preventing AL.

Mechanical bowel preparation (MBP), once thought to be essential to the success of a colorectal resection, has increasingly become irrelevant in modern surgery, although still widely practiced. A systematic review [Guenega] including over 5000 patients found no evidence that patients benefit from MBP (either orally or by enema). Despite this strong evidence, many surgeons still prepare the colon before rectal anterior resections, because of facilitation of intraoperative endoscopy and stapler insertion. Moreover, in event of an ileostomy creation to protect an high risk colo-rectal anastomosis, a clean colon allows to avoid the passage of residual stool through the anastomosis.

The effectiveness of perioperative intravenous antibiotics is widely established in colorectal surgery [Association]. Prophylactic dose is ideally given in advance of skin incision (ideally 30-60 min beforehand to achieve steady-state pharmacokinetics) [Nelson]. A recent metanalysis of 8 RCTs [Roos] reported that the combination of preoperative selective intestinal decontamination with oral antibiotics and perioperative intravenous antibiotics reduces surgical-site infections and may lower AL rates.

Routine use of drainage in intra or extra-peritoneal anastomoses has been debated. Many surgeons always put a drainage next to an extra-peritoneal anastomosis, in order to evacuate from the presacral space any infected collection threatening anastomosis integrity. 2 metanalysis of RCTs [Jesus, Petrowskj] found no advantages in routine use of drainage, both for intra and extra-peritoneal anastomoses. A recent metanalysis including RCTs and non RCTs [Rondelli] showed a significant reduction in AL rate in patients with a pelvic drainage after rectal anterior resection. This finding comes from a pooled analysis of all studies included, but if only RCTs are taken in consideration, there are no differences between the two groups. In summary, despite lack of evidence, routine use of pelvic drainage is still diffused and under debate.

Air leak test, easily performed filling the pelvis with saline and inflating the large bowel trans-anally with air, may reduce AL rate. In an old RCT [Beard], clinically relevant AL rate was 4% in patients who underwent air leak testing versus 14% in those who did not. Ricciardi et al [Ricciardi] collected data of 998 patients of whom 895 had an air leak test. Postoperative leaks occurred in 7.7% of anastomoses that tested positive, in 3.8% of those that tested negative and in 8.1% of those that were not tested (P<.03). Furthermore, the anastomotic leak rate was 12.1% when an anastomosis that initially showed positive results was only sutured, compared with 0% when they were completely redone or were diverted proximally.

Intraoperative Flexible Sigmoidoscopy (IOFS) following anterior rectal resection has been used with the aim of confirming that the lesion or disease process has been removed, checking the anastomosis s complete, performing an air test and identifying any bleeding from the anastomosis. Kamal et al [Kamal] published in 2014 a series of 415 colo-rectal anastomoses checked with IOFS, identifying abnormalities in 17 cases, bleeding in 1 case and staple misfiring in 1 case. AL rate was 2.1% and no bleeding occurred after revision of the anastomosis. There are other papers reporting good results in AL prevention with IOFS (AL rate: 1.4% [Ishihara], 5.4% [Lanthaler], 0 [Li], 1,2% [Shamiye]) and some authors advocate its routinary use in rectal surgery.

One of the most simple and effective intervention to reduce anastomotic failure rate is the use of a protective stoma to divert fecal stream. It was not clear if a diverting stoma could really reduce the incidence or only the clinical relevance of an anastomotic leakage. A Cochrane Review including 6 RCTs on rectal surgery concluded that a protective stoma, both ileo or colo, significantly reduce the incidence of anastomotic leak (RR, 0.33; 95% CI, 0.21–0.53), as well as the need for urgent reoperation (RR, 0.23; 95% CI, 0.12–0.42). It is not known if a loop colostomy is better than a loop ileostomy or vice versa. The most recent metanalysis on this topic [Chen] is slight in favor of loop ileostomy because of a lower stoma prolapse and wound infection.

Clinical manifestations of AL maybe difficult to discriminate, especially in the early stages

of leakage. Clinicians must be alert to recognize subtle signs, like atrial fibrillation, inflammatory index excessive increase and aspecific slow recovery after surgery [Sutton]. Delayed diagnosis of AL is associated with poorer outcomes, including higher cancer recurrence [Mirnezami] and mortality [Alves]. Clinical signs of AL before the fifth postoperative day are uncommon, most studies describing a mean between 8 and 12 days for AL to become clinically apparent [Hyman, Komen]. Little is known about the value of physical examination in relation to colo-rectal AL, except that digital rectal examination has at least the same prognostic value for low anastomosis as contrast enema prior to stoma reversal [Daams]. Laboratory test are useful in early diagnosis of AL. White blood cells count (WBC) and C-reactive protein (CRP) are the most commonly monitored inflammatory markers in the post operative period. A recent meta-analysis of 7 retrospective studies showed that CRP levels of over 172, 124 and 144 mg/l were predictive for AL for postoperative days 3, 4 and 5 respectively (negative predictive value 97%). Two recent prospective studies failed to show a real usefulness of serum procalcitonin level increase in predicting AL, except that in combination with CRP for major leakages [Garcia Granero, Giaccaglia]. These studies suggest that very high levels of CRP and procalcitonin are sensitive markers of severe AL, while WBC is less useful.

Imaging is commonly used to confirm a suspected leakage. It can be very helpful, but sometimes, if negative, can delay the diagnosis. The most common technique is CT scan with or without endoluminal contrast and water soluble contrast enema. Sensitivity varies from 30% to 57% for CT scan and from 20% to 88% for contrast enema. Explanations for high false-negative rates include timing of the investigations when imaging is performed before there is radiological evidence of anastomotic dehiscence, quality of the technique used, and the radiologist's experience. In summary, if the suspicion of AL is high, a negative imaging must not delay the treatment, that can require a local procedure or a relaparotomy.

Treatment for a simple leak with no extra-luminal collection or stenosis can be successfully managed without stoma creation by flexible endoscopy, placing an Over the Scope Clip (OTSC®). The OTSC® system consists of a nitinol clip loaded at the tip of the endoscope that can capture a large amount of tissue and compress the lesion until healed. Arezzo et al published a series of 14 colo-rectal AL with complete healing in 12/14 patients and need of further surgery in only 1 case [Arezzo]. Flexible endoscopy also offers a valid alternative to surgery for treating solitary extra-luminal pelvic abscesses with endoscopic vacuum assisted closure therapy (Endo-SPONGE®). This is a minimally invasive method for continuous and effective drainage of the perianastomotic abscess and fistula in the pelvic region in combination with debridement and consecutive mechanical closure of the leakage. The basic feature of this method is the placement of an open-cell sponge into the abscess cavity of the anastomotic leakage by means of a flexible endoscope. An evacuation tube fixed to the sponge exits trans-anally and is connected to a vacuum system. Weidenhagen et al obtained a complete healing in 28 out of 29 cases and none of the patients reported an increase in discomfort due to the foreign body during the treatment intervals [Weidenhagen].

If signs of generalized sepsis occur, a reoperation must be considered, in order to avoid life threatening situations. A Hartmann procedure or a redo anastomosis with protective stoma are probably the best options and should not be delayed [Sabbagh].

BLEEDING

Anastomotic bleeding is a rare complication in rectal surgery. Martinez Serrano et al published a series of 1389 colorectal procedures: clinically relevant bleeding from stapled colorectal anastomosis occurred in 7 patients (0.5%) and spontaneously resolved in 6 out of 7 patients [Martinez Serrano]. The median time from primary surgery to anastomotic bleeding was 6.5 h and varied from 30 min to 9 days after surgery. That's why, even if some authors suggest routine use of intra-operative sigmoidoscopy to prevent post-operative bleeding, a clear evidence of the effectiveness of the procedure is still lacking [Kamal, Shamiye]. The location of the tumor is an independent risk factor for bleeding, with a 3 times higher risk for tumors below 7 cm from the anal verge [Ma].

Anastomotic bleeding is usually minor and self-limited. Most of cases can be managed conservatively, with intravenous administration of coagulant medicine, blood transfusion and irrigation of cold epinephrine solution on the anastomosis or rectoclysis through trans-anal intubation. Sometimes endoscopic management is necessary and can be performed without bowel preparation. During the procedure, the endoscopy is inserted 5 to 10 cm above the anal verge through the anus to observe the integrity of the anastomosis. If there is anastomotic bleeding, including active bleeding or presence of the clot, irrigation is applied to wash away the blood staining. After the clear view is obtained, one or more of the following interventions are taken to manage the bleeding: irrigation of coagulant, electrocautery or titanium clipping. Surgical management is only indicated if there are difficulties in insertion of the endoscope or in case of failure of the managements. Depending on the position and amount of the anastomotic bleeding, either surgical exploration or transanal sutures under direct vision is chosen [Ma].

STRICTURE

Colo-rectal anastomosis stricture is a well known complication, but its real incidence is difficult to establish due to the lack of a clear definition. Griffen and Knight [Griffen], in the paper describing the double stapled technique, reported a stricture rate of 1.7%. Ambrosetti et al, with a definition purely based on symptoms, identified a stricture rate of 32% of colo-rectal double stapled anastomosis, but only in 18% of cases a dilatation was required. Bannura et al defined stenosis as the inability to pass a rigid sigmoidoscope through the anastomosis and reported a stricture rate of 21.1%. In the work of Hayden, stricture was the most common complication after rectal anterior resection, occurring in 72.3% of cases [Hayden]. As previously discussed, a Cochrane Review in 2012 reported a stricture rate of 8% for stapled versus 2% for hand-sewn colo-rectal anastomosis, with an Odds Ratio of 3.59 (95% CI: 2.02-6.35) [Neutzling].

Most strictures can be managed with conservative treatment. Finger or Hegar dilators can be useful tools to treat a low anastomotic stricture. Werre et al [Werre] reported a success rate of 80% using Hegar dilators over a series of sessions. Endoscopic balloon dilation has been used as a first treatment modality for benign colorectal strictures. Despite its simplicity and immediate efficacy in up to 90% of cases [Araujo, Di, Suchan], this technique requires several treatment sessions and is associated with a significant rate of recurrent benign stenosis. Predictors of a successful outcome include: a relatively narrow stenosis (<10 mm) and a short segment stricture (<4 cm). Poor predictors include: numerous strictures, complete obstruction, associated fistulas within the stricture, active inflammation around the stricture, recent surgery, a tight angulation, previous radiotherapy, local recurrence of malignancy and a prior large anastomotic dehiscence [Lemberg]. High success and low risk rates make endoscopic balloon dilatation the treatment of choice to

avoid high risk of reoperation in patient with benign anstomotic strictures.

Fully covered Self Expandable Metal Stents can be a further option in patients refractory to balloon dilation. Unlike uncovered stents, fully covered SEMS has several advantages in the management of benign strictures. These fully covered SEMS have limited local tissue reaction; thus, they are used in benign conditions such as colonic strictures, fistulas, perforation, and leaks in the digestive tract [Tsereteli, Forshaw]. Clinical success varies from 56% to 81%, with spontaneous migration rates between 19% and 63% [Vanbierlievt, Lamazza, Caruso]. In patients with leakage and stricture, endoscopic stenting with covered stents has many potentials leading to healing of the leakage in most cases [Abbas, Rayhanabad].
Biodegradable stents (polydiosanone semicrystalline, biodegradable polymer, which degrades by random hydrolysis and at low pH) have been recently used in patients refractory to mechanical or ballon dilatation. The overall success rate was 45% in a recent paper and authors concluded that treatment using biodegradable stents in the management of refractory anastomotic colo-rectal stricture is very safe [Repici].

Further minimally invasive options are a combined technique of endoscopic electroincision using the tip of a polypectomy snare or papillotome and balloon dilatation (success rate 86.1% in a series of 36 patients [Truong]) and a novel hybrid technique using Transanal Endoscopic Microsurgery (TEM) combined with balloon dilation [Wolthuis] or laser ablation [Kato].
There are few cases refractory to minimally invasive treatment requiring surgery. Options may be circular and linear stapler re-resection of the stricture [Nissotakis] or redo anastomosis. If this is not possible a permanent stoma must be considered.

Rectal surgery is challenging and technically demanding. Accurate selection of patients and precise technique are the best means to reduce complications rate. Nevertheless complications are not completely avoidable and can threaten patient's life and quality of life. Early diagnosis is the best way to reduce morbidity and mortality, because an early identified complication can be managed with a wide spectrum of conservative or minimally invasive options. On the other hand, the availability of different treatment modalities must not delay a reoperation whenever required, in order to achieve the best outcome.

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