

Benign Rectal Strictures: A Review Article



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The aim of this review article is to assess the various etiologies and different management techniques for benign rectal strictures. A systematic review was performed using PubMed central using the keywords that included ‘benign’, ‘stricture or strictures’, and ‘rectum, rectal, or anorectal’. Retrospective studies, prospective studies, case series, and case reports describing etiology or management of benign rectal strictures were included in this review article. A total of 730 cases of benign rectal strictures were identified in 79 articles. Anastomotic stricture was the most common cause of benign rectal strictures. Different techniques were used to manage benign rectal strictures including Hegar dilation, balloon dilation, stent placement, microsurgery, or other surgical techniques. The initial technique used for management was dependent on the provider as there are no clear guidelines for management of benign rectal strictures.

INTRODUCTION

Benign rectal strictures can be iatrogenic after a major colorectal surgery or spontaneous due to medical conditions. The most common cause of benign rectal strictures are anastomotic strictures. Rectal strictures behave differently from colonic strictures due to rectum’s anatomical relation with the anal canal, proximity to pelvic organs, and unique blood supply. Different management techniques such as surgical repair, endoscopic balloon dilation, rectal stent placement, medical treatment alone, or a combination of

treatments have been used to treat benign rectal strictures. In this article, we describe the etiologies and management of benign rectal strictures.

Methods

A PubMed Central search was carried out, using the search term (benign) AND (stricture or strictures) AND (rectum or rectal or anorectal). Only articles that described strictures known to be benign at the time of diagnosis were included. Retrospective studies, prospective studies, case series, and case reports were included. Content from references found in the articles were included if deemed relevant. In total, 79 articles are included in this review article.

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Clinical Presentation

Rectal strictures can present with minor symptoms to progressive constipation and on occasion, obstipation. Symptoms include left lower quadrant abdominal pain, increased frequency of bowel movements, difficulty in defecation, feeling of inadequate evacuation, pencil-thin stools, anal pain, and fecal urgency. Stenosis is often defined as inability to pass a 12mm diameter sigmoidoscope¹ or narrowing to less than one-finger breadth by digital rectal examination.²

Etiology of Rectal Strictures

Anastomotic strictures are the most common cause of benign rectal strictures. Non-operative etiologies of rectal strictures include inflammatory bowel disease, rectal ischemia, sexually transmitted disease, radiation, endometriosis, pelvic actinomycosis, chronic suppository usage, and solitary rectal ulcer.³⁻¹⁷ Few cases of strictures have been reported after submucosal endoscopic dissection.¹⁸

Anastomotic Rectal Strictures

Post-operative anastomotic strictures develop in 3 to 30% of patients undergoing colorectal resection.^{3,19-22} Anastomotic rectal strictures are predominantly seen following resection of rectal cancer with colorectal or coloanal anastomosis (with residual rectal cuff). Other surgeries that can lead to anastomotic rectal strictures include hemorrhoidectomy and colorectal resection for extensive diverticular disease.^{1,22} Rectal strictures are more likely to form after stapled anastomosis compared to hand-sewn anastomosis.²²⁻²⁷ Ischemia, post-operative anastomotic leakage, and post-operative radiation are major risk factors for development of anastomotic strictures.^{2,19,22,28,29} Other contributing factors include obesity, incomplete “doughnut” construction, low-lying anastomosis, and post-operative infection.^{19,30} Temporary diverting ileostomy or colostomy may contribute to anastomotic strictures due to absence of dilation of anastomosis by fecal stream.³¹⁻³³

Inflammatory Bowel Disease (IBD)

Anorectal strictures are more commonly seen in Crohn’s disease but can also be seen in ulcerative colitis. They are frequently present with fistulizing

disease and proctitis.^{8,34} Rectal stricture in ulcerative colitis may portend development of cancer. The pathophysiology remains speculative since both inflammatory and fibrotic components frequently occur in anorectal strictures in patients with inflammatory bowel disease. The presence of anorectal strictures in Crohn’s disease is a predictor of poor outcomes.⁹

Miscellaneous Etiologies of Rectal Strictures

Radiation Induced Rectal Strictures

Rectal stricture is a rare complication of pelvic irradiation. Chronic radiation proctitis has been reported in up to 20% of patients receiving radiation of the pelvis, and rectal stricture occurs in about 1 to 15% of these cases.³⁵ Radiation causes histologic alterations such as obliterative endarteritis, tissue ischemia and necrosis leading to submucosal collagen deposition. These changes result in transmural fibrosis and formation of rectal strictures.²

Infectious Rectal Strictures

Sexually transmitted infections (STIs) due to anal intercourse have been reported to cause rectal strictures in both HIV and non-HIV patients. Lymphogranuloma venereum caused by chlamydia trachomatis is the most frequently reported sexually transmitted infection to cause rectal strictures.⁵ A case report implicating HSV-2 as the cause of benign rectal stricture has been reported.⁴ These strictures can occur in HIV patients even with CD4 counts > 200 x 10⁶/L. Biopsies with histological evaluation using special stains and serology is used to confirm diagnosis.⁵ Rare cases of rectal strictures due to actinomycosis infection have also been reported due to contiguous spread from intra-uterine devices.^{10,17}

Foreign Body Strictures

Benign rectal strictures can develop due to reactive inflammation and fibrosis around a foreign body.⁶ Strictures can develop following rectal administration of cation binding resins such as sodium polystyrene sulfonate or calcium polystyrene sulfonate and are usually diagnosed by presence of characteristic crystals on histology.³⁶ Chronic suppository usage is also noted to cause

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anorectal stenosis and strictures due to chronic reactive inflammation.^{11,12}

Endometriosis

Endometriosis should be suspected in women presenting with rectal stricture at a young age without any other explanation for the stricture. These patients generally have menstrual irregularity and cyclic abdominal pain that worsens during menstruation. The presence of ectopic endometrial tissue in the muscularis propria and subserosa or mesentery is thought to be the cause of the stricture.⁷

Solitary Rectal Ulcer Syndrome

Solitary rectal ulcer Syndrome is a benign disease that is often missed as a cause of rectal bleeding. It is thought to occur due to chronic hypoperfusion leading to ischemic injury to the rectal mucosa. Rarely, it can lead to stenosis or stricture of the

rectum. Symptoms generally include chronic constipation, abdominal pain, rectal bleeding, and mucosal discharge.^{14,37}

Ischemic Rectal Stricture

Ischemic proctitis is rare because the rectum has abundant blood supply and rich collaterals. A stricture due to ischemic proctitis develops due to acute compromise in blood flow usually in the setting of hypovolemic shock in patients with inadequate collateral circulation around the rectum.³⁸

Complication of Submucosal Dissection

Endoscopic submucosal dissection is widely used as a minimally invasive treatment for colorectal neoplasms. It can help avoid surgical treatments that can result in anal dysfunction and the need for permanent colostomy. Although rare, endoscopic submucosal dissection can result in the formation

Table 1. Etiologies of Benign Rectal Strictures

Etiology of Stricture	Number of Cases [730]	% of Total Cases
Anastomotic Stricture	540	73.97%
Inflammatory Bowel Disease	146	20.00%
Complication of Endoscopic Submucosal Dissection	18	2.46%
Chronic Suppository Use / Foreign Body	11	1.50%
Rectal Ischemia	5	<1%
Pelvic Actinomycosis Infection	4	<1%
Sexually Transmitted Diseases	2	<1%
Rectal Endometriosis	1	<1%
Radiation Induced	1	<1%
Solitary Rectal Ulcer	1	<1%
Idiopathic	1	<1%

Table 2. Cumulative Success Rate of Modalities for Treatment of Benign Rectal Strictures Based on Our Literature Review

Modality of Treatment	Number of Cases	Successful	Unsuccessful	% Success Rate
Hegar Dilators	73	41	32	56.1%
Balloon Dilation	364	282	82	77.5%
Self-Expanding Metal Stent	54	37	17	68.5%
Biodegradable Stent	18	12	6	66.7%

of a stricture when the lesion being resected is large and extends into the lower rectum.¹⁸

Medical Management of Strictures

Management of benign rectal stricture depends on the etiology and often requires endoscopic or surgical intervention. Infectious strictures due to chlamydia or actinomycoses heal well with antibiotic treatment.^{4,5} Rectal strictures due to inflammatory bowel disease have a healing rate of 59% with anti-tumor necrosis factor- agents with or without immunomodulators.⁹ It is important to biopsy strictures occurring after surgical resection of colorectal cancer and strictures related to IBD to rule out cancer.⁹ Stool softeners and laxatives are often needed, with high fiber diet even after resolution of stricture.²²

Specific Management of Strictures

Treatment of benign rectal strictures can be difficult and usually requires multiple modalities. These include dilation with Hegar or bougie dilators, endoscopic interventions (balloon dilation, stent placement), or surgical treatment. Case reports, small case series, and retrospective studies comprise most of the published literature. Consequently, novel methods may have to be used keeping in mind maximum benefit and safety of the patient. Mechanical dilation or endoscopic methods are attempted first, as surgical treatment is difficult and has high risk of end-colostomy.

Dilation by Hegar Dilators

Hegar dilators, often used by surgeons in the initial management of benign rectal strictures, are least invasive and most cost-effective mode of treatment. Dilation is usually started with 14-20 French dilators and is gradually increase up to a maximum of 60 French dilators.^{29,39} Based on our review of literature, Hegar dilators were effective in 56.1% of the cases (Table 2).

Endoscopic Balloon Dilation

For a majority of the cases, endoscopic balloon dilation is considered the first line of treatment. It can be performed using through the scope hydrostatic or combined endoscopic-fluoroscopic pneumatic balloon dilators.^{22,24,40,41} Dilation under fluoroscopic guidance allows for better visualization and control

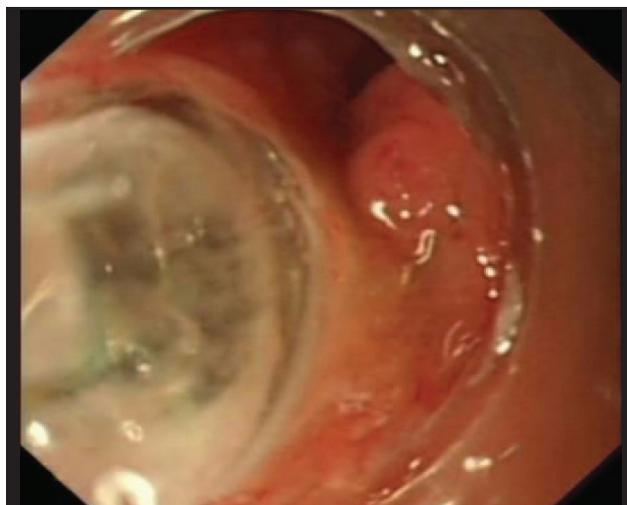


Figure 1. Balloon Dilation of Anastomotic Rectal Stricture⁵⁴



Figure 2. Endoscopic View of Deployed Metal Stent⁶⁷

over the process and ability to increase the balloon diameter as needed.⁴⁰ Based on our review, balloon dilation has an overall success rate of 77.5% (Table 2). Dilation is considered successful when a 13mm colonoscope can be passed easily through the stricture with resolution of symptoms.²⁴ Recurrence of symptoms occurred in 60% of cases after one dilation session. Consequently, on average two to three dilation sessions are required to achieve successful results.⁴²⁻⁴⁷ More dilation sessions are generally required for low lying rectal strictures.¹⁸ If successful results are not achieved in five or more dilation sessions, alternative methods should be pursued.⁴⁸ There are no guidelines for time

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intervals between dilation sessions and is typically four weeks or more.⁴⁰ In high-grade strictures, with a lumen < 7 mm, argon plasma coagulation or laser can be used to make a small incision that allows the endoscope to pass through the stricture for balloon dilation.^{22,49} Endoscopic balloon dilation is especially effective for shorter strictures, usually < 2 cm in length with low complication rates.^{50–52} Perforation is reported in about 1.1% of cases and abscess is reported in 0.2% of cases.⁵³

Stent Placement for Rectal Strictures

Stent placement is usually the next option for treatment of rectal strictures that do not resolve with endoscopic balloon dilation. They are usually used for strictures longer than 2 cm.^{55,56} Most of the published literature on stents are case reports and case series. Three different types of stents have been used for rectal strictures: fully covered self-expanding metal stents, uncovered metal stents, and biodegradable stents.^{4,56–60} Uncovered metal stents are rarely used due to risk of mucosal hyperplasia leading to re-occlusion. Additionally, uncovered stents cannot be removed via endoscopic method, resulting in the need for surgery.⁵⁵

Fully covered self-expanding metal stents are most frequently used due to low tissue ingrowth and ease of removal.⁶¹ Based on our review, the success rate of fully covered self-expanding metal stents was 68.5% (Table 2). Migration of the stent was the most common complication and was reported in 31% of the cases. In some cases, migration occurs after stricture has sufficiently dilated.⁶² In a case series of four patients, migration was avoided with “upside-down” deployment of fully covered self-expanding metal stents.⁶¹ Rare complications such as stent fracture, coloenteric fistula, and perforation have been reported.^{56,62,63} Less serious complications of rectal stent placement include abdominal pain, rectal pain, and tenesmus.^{60,61} It is unclear as to how long metal stents should be left

in place, and removal has been reported as early as four weeks to as late as 30 months.^{57,62}

Biodegradable stents have been predominantly used for esophageal strictures.^{56,64,65} They are more flexible, do not have to be removed as they usually self-disintegrate, and have a mean patency of 4 months.^{56,66} Since they tend to be wider and longer, they are poorly tolerated in strictures closer to the anus. Based on our review, the success rate of biodegradable stents was 66.7% (Table 2). Migration was the most common complication, occurring in 27% of cases. Acute intestinal obstruction due to stent migration occurred in one case and required emergent surgical intervention.⁵⁵

Surgery for Rectal Strictures

Surgery is the last resort for treatment of benign rectal strictures since there is a high risk of end-colostomy and creation of permanent stoma. About 28% of patients have refractory strictures requiring surgical correction.⁶⁸ Several minimally invasive surgical options have been reported for refractory benign rectal strictures, especially involving the lower rectum. These include transanal minimally invasive surgery (TAMIS), transanal endoscopic microsurgery (TEM), laparoscopic stricturoplasty using transanal radial linear cutter, and transanal stapler resection of stricture.^{69–78} Resection with re-anastomosis is more successful in upper rectal strictures (>10 cm from anal verge), although coloanal anastomosis for mid and lower rectal strictures (within 10 cm of anal verge) have also shown satisfactory long-term functional results.^{68,79} Some recalcitrant rectal strictures in Crohn’s disease may need proctectomy and creation of a stoma.⁸

CONCLUSION

Benign rectal strictures are a common complication of rectal anastomotic surgeries but can also be caused by other etiologies such as Crohn’s disease, ischemia, infection, complication of endoscopic submucosal dissection, endometriosis, and chronic suppository usage. Management of rectal strictures is based on underlying etiology and may include both endoscopic and/or surgical interventions. This article provides guidance for the treatment of benign rectal strictures in different clinical scenarios. ■

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References

- Petersen S, Hellmich G, Schumann D, Schuster A, Ludwig K. Early rectal stenosis following stapled rectal mucosectomy for hemorrhoids. *BMC Surg*. 2004;4:6. Published 2004 May 21.
- Karanikas M, Touzopoulos P, Mitrakas A, et al. Benign post-radiation rectal stricture treated with endoscopic balloon dilation and intralesional triamcinolone injection. *Case Rep Gastroenterol*. 2012;6(3):583-589.
- Idrees S, Naseer S, Hartmann E, et al. Treatment of benign rectal strictures with proctoplasty. *Am Surg*. 2015;81(3):E134-E135.
- Pérez Sánchez LE, Hernández Barroso M, Hernández Hernández G. Rectal inflammatory stenosis secondary to Chlamydia trachomatis: a case report. *Rev Esp Enferm Dig*. 2017;109(9):668.
- Pinsk I, Saloojee N, Friedlich M. Lymphogranuloma venereum as a cause of rectal stricture. *Can J Surg*. 2007;50(6):E31-E32.
- Elmoghrabi A, Mohamed M, Wong K, McCann M. Proctalgia and colorectal stricture as the result of a 2-year transit of a retained rectal chicken bone: a case presentation and review of the literature. *BMJ Case Rep*. 2016;2016:bcr-2016-215913. Published 2016 Jun 20.
- Katsikogiannis N, Tsaroucha A, Dimakis K, Sivridis E, Simopoulos C. Rectal endometriosis causing colonic obstruction and concurrent endometriosis of the appendix: a case report. *J Med Case Rep*. 2011;5:320. Published 2011 Jul 20.
- Linares L, Moreira LF, Andrews H, Allan RN, Alexander-Williams J, Keighley MR. Natural history and treatment of anorectal strictures complicating Crohn's disease. *Br J Surg*. 1988;75(7):653-655.
- Brochard C, Siproudhis L, Wallenhorst T, et al. Anorectal stricture in 102 patients with Crohn's disease: natural history in the era of biologics. *Aliment Pharmacol Ther*. 2014;40(7):796-803.
- Ratliff DA, Carr N, Cochrane JP. Rectal stricture due to actinomycosis. *Br J Surg*. 1986;73(7):589-590.
- Van Gossum A, Zalzman M, Adler M, Peny MO, Houben JJ, Cremer M. Anorectal stenosis in patients with prolonged use of suppositories containing paracetamol and acetylsalicylic acid. *Dig Dis Sci*. 1993;38(11):1970-1977.
- Tannouri F, Lalmand B, Zalzman M, et al. Role of the double-contrast barium enema in rectal stenosis due to suppositories containing paracetamol and acetylsalicylic acid. *Eur Radiol*. 1998;8(7):1217-1220.
- Agrawal V, Joshi MK, Jain BK, Gupta A. Unusual rectal stricture. *Trop Gastroenterol*. 2008;29(1):44-45.
- Gruber M, Füglistaler I, Zettel A, Fox M, Manz M. An Unusual Cause of Rectal Stenosis. *Case Rep Gastroenterol*. 2016;10(2):406-409. Published 2016 Aug 9.
- Mata A, Galindo A, Díaz J, Marijuan JL, Aguilera MJ. Estenosis ano-rectal completa por supositorios de paracetamol y salicilamida [Complete anorectal stenosis due to paracetamol and salicylamide suppositories]. *Rev Esp Enferm Dig*. 1995;87(6):463-464.
- Haj M, Nasser G, Loberant N, Cohen I, Nesser E, Eitan A. Pelvic actinomycosis presenting as ureteric and rectal stricture. *Dig Surg*. 2000;17(4):414-417.
- Spickett GP, Kipping RA. Pelvic actinomycosis presenting with rectal stricture. *J R Soc Med*. 1985;78(8):674-676.
- Sako T, Toyonaga T, Nakano Y, et al. Endoscopic submucosal dissection involving the anal canal presents a risk factor for postoperative stricture. *Surg Endosc*. 2021;35(3):1307-1316.
- Nepal P, Mori S, Kita Y, et al. Radial incision and cutting method using a transanal approach for treatment of anastomotic strictures following rectal cancer surgery: a case report. *World J Surg Oncol*. 2019;17(1):48. Published 2019 Mar 14.
- Xinopoulos D, Kypreos D, Bassioulas SP, et al. Comparative study of balloon and metal olive dilators for endoscopic management of benign anastomotic rectal strictures: clinical and cost-effectiveness outcomes. *Surg Endosc*. 2011;25(3):756-763.
- Albertsmeier M, Rittler P, Hoffmann RT, Spelsberg F. Treatment of a completely obstructed colonic anastomotic stricture using a CT-guided endoscopic rendezvous technique. *Endoscopy*. 2011;43 Suppl 2 UCTN:E5-E6.
- Suchan KL, Muldner A, Manegold BC. Endoscopic treatment of postoperative colorectal anastomotic strictures. *Surg Endosc*. 2003;17(7):1110-1113.
- Araujo SE, Costa AF. Efficacy and safety of endoscopic balloon dilation of benign anastomotic strictures after oncologic anterior resection: report on 24 cases. *Surg Laparosc Endosc Percutan Tech*. 2008;18(6):565-568.
- Ambrosetti P, Francis K, De Peyer R, Frossard JL. Colorectal anastomotic stenosis after elective laparoscopic sigmoidectomy for diverticular disease: a prospective evaluation of 68 patients. *Dis Colon Rectum*. 2008;51(9):1345-1349.
- Luchtefeld MA, Milsom JW, Senagore A, Surrell JA, Mazier WP. Colorectal anastomotic stenosis. Results of a survey of the ASCRS membership. *Dis Colon Rectum*. 1989;32(9):733-736.
- MacRae HM, McLeod RS. Handsewn vs. stapled anastomoses in colon and rectal surgery: a meta-analysis. *Dis Colon Rectum*. 1998;41(2):180-189.
- Brennan SS, Pickford IR, Evans M, Pollock AV. Staples or sutures for colonic anastomoses--a controlled clinical trial. *Br J Surg*. 1982;69(12):722-724.
- Zhang B, Zhuo GZ, Tian L, et al. Zhonghua Wei Chang Wai Ke Za Zhi. 2019;22(8):755-761.
- Lee SY, Kim CH, Kim YJ, Kim HR. Anastomotic stricture after ultralow anterior resection or intersphincteric resection for very low-lying rectal cancer. *Surg Endosc*. 2018;32(2):660-666.
- Sun X, Qiu H, Wu B, Lin G, Shi H, Xiao Y. Zhonghua Wei Chang Wai Ke Za Zhi. 2018;21(6):666-672.
- Virgilio C, Cosentino S, Favara C, Russo V, Russo A. Endoscopic treatment of postoperative colonic strictures using an achalasia dilator: short-term and long-term results. *Endoscopy*. 1995;27(3):219-222.
- Graffner H, Fredlund P, Olsson SA, Oscarson J, Petersson BG. Protective colostomy in low anterior resection of the rectum using the EEA stapling instrument. A randomized study. *Dis Colon Rectum*. 1983;26(2):87-90.
- Waxman BP, Ramsay AH. The effect of stapler diameter and proximal colostomy on narrowing at experimental circular stapled large bowel anastomoses. *Aust N Z J Surg*. 1986;56(10):797-801.
- Fields S, Rosainz L, Korelitz BI, Panagopoulos G, Schneider J. Rectal strictures in Crohn's disease and coexisting perirectal complications. *Inflamm Bowel Dis*. 2008;14(1):29-31.
- Theis VS, Sripadam R, Ramani V, Lal S. Chronic radiation enteritis. *Clin Oncol (R Coll Radiol)*. 2010;22(1):70-83.
- Marginean EC. The Ever-Changing Landscape of Drug-Induced Injury of the Lower Gastrointestinal Tract. *Arch Pathol Lab Med*. 2016;140(8):748-758.
- Over H, Ulker A, Baysal C, Dağlı U. Endoscopic balloon dilation of strictures complicating solitary rectal ulcer syndrome. *Endoscopy*. 1997;29(5):427-429.
- Iida T, Ohkubo Y, Kubo T, et al. A case of a rectal stricture related to ischemic proctitis following rupture of an aortic aneurysm. *Endosc Int Open*. 2018;6(2):E186-E189.
- Kashkooli SB, Samanta S, Rouhani M, Akbarzadeh S, Saibil F. Bougie dilators: simple, safe and cost-effective treatment for Crohn's-related fibrotic anal strictures. *Can J Surg*. 2015;58(5):347-348.
- De Lange EE, Shaffer HA Jr. Rectal strictures: treatment with fluoroscopically guided balloon dilation. *Radiology*. 1991;178(2):475-479.
- Venkatesh KS, Ramanujam PS, McGee S. Hydrostatic balloon dilatation of benign colonic anastomotic strictures. *Dis Colon Rectum*. 1992;35(8):789-791.

42. Saxena P, Azola A, Kumbhari V, Kalloo AN, Khashab MA. EUS-guided rendezvous and reversal of complete rectal anastomotic stenosis after Hartmann's reversal. *Gastrointest Endosc*. 2015;81(2):467-468.
43. Barker JA, Hill J. Incidence, treatment and outcome of rectal stenosis following transanal endoscopic microsurgery. *Tech Coloproctol*. 2011;15(3):281-284.
44. Placer C, Urdapilleta G, Markinez I, et al. Estenosis anastomóticas benignas en la cirugía radical del cáncer de recto. Resultados del tratamiento con dilatación hidrostática [Benign anastomotic strictures after oncologic rectal cancer surgery. Results of treatment with hydrostatic dilation]. *Cir Esp*. 2010;87(4):239-243.
45. Johansson C. Endoscopic dilation of rectal strictures: a prospective study of 18 cases. *Dis Colon Rectum*. 1996;39(4):423-428.
46. Campbell DM, Geraghty JG, McBride K, Murphy JJ, MacErlean D. Radiologically controlled balloon dilatation of rectal strictures. *Clin Radiol*. 1991;44(2):77-78.
47. Di Giorgio P, De Luca L, Rivellini G, Sorrentino E, D'amore E, De Luca B. Endoscopic dilation of benign colorectal anastomotic stricture after low anterior resection: A prospective comparison study of two balloon types. *Gastrointest Endosc*. 2004;60(3):347-350.
48. Skredren K, Wiig JN, Myrvold HE. Balloon dilation of rectal strictures. *Acta Chir Scand*. 1987;153(10):615-617.
49. Reddy RA, Venkatasubramanian AK, Khurshed A, Latimer J, Tabaqchali MA. Dual interventional approach of endoscopic reboring in completely stenosed rectal anastomosis using radiology guidance: a novel technique. *Colorectal Dis*. 2009;11(1):49-52.
50. Milsom JW, Mazier WP. Classification and management of post-surgical anal stenosis. *Surg Gynecol Obstet*. 1986;163(1):60-64.
51. Garcea G, Sutton CD, Lloyd TD, Jameson J, Scott A, Kelly MJ. Management of benign rectal strictures: a review of present therapeutic procedures. *Dis Colon Rectum*. 2003;46(11):1451-1460.
52. Ravo B, Amato A, Bianco V, et al. Complications after stapled hemorrhoidectomy: can they be prevented? *Tech Coloproctol*. 2002;6(2):83-88.
53. Ragg J, Garimella V, Cast J, Hunter IA, Hartley JE. Balloon dilatation of benign rectal anastomotic strictures -- a review. *Dig Surg*. 2012;29(4):287-291.
54. Yuan X, Liu W, Ye L, Wu M, Hu B. Combination of endoscopic incision and balloon dilation for treatment of a completely obstructed anastomotic stenosis following colorectal resection: A case report. *Medicine (Baltimore)*. 2019;98(26):e16292.
55. Lamazza A, Fiori E, Sterpetti AV, Schillaci A, Scoglio D, Lezoche E. Self-expandable metal stents in the treatment of benign anastomotic stricture after rectal resection for cancer. *Colorectal Dis*. 2014;16(4):O150-O153.
56. Repici A, Pagano N, Rando G, et al. A retrospective analysis of early and late outcome of biodegradable stent placement in the management of refractory anastomotic colorectal strictures. *Surg Endosc*. 2013;27(7):2487-2491.
57. Gornals JB, Albines G, Trenti L, Mast R, Frago R. EUS-guided recanalization of a complete rectal anastomotic stenosis by use of a lumen-apposing metal stent. *Gastrointest Endosc*. 2015;82(4):752.
58. Oztas E, Saygili F, Ulas M, Disibeyaz S. Endoscopic Treatment of the Coloanal Anastomotic Dehiscence and Stricture: Stenting Via Rendezvous Technique. *Surg Laparosc Endosc Percutan Tech*. 2018;28(5):e88-e90.
59. Law WL, Choi HK, Chu KW, Tung HM. Radiation stricture of rectosigmoid treated with self-expanding metallic stent. *Surg Endosc*. 2002;16(7):1106-1107.
60. Cereatti F, Fiocca F, Dumont JL, et al. Fully covered self-expandable metal stent in the treatment of postsurgical colorectal diseases: outcome in 29 patients. *Therap Adv Gastroenterol*. 2016;9(2):180-188.
61. Testoni PA, Fanti L, Antonucci E, Dabizzi E. Inverted "upside-down" esophageal fully-covered self-expanding metal stent is effective for temporary treatment of colorectal strictures: a pilot case series. *Endosc Int Open*. 2019;7(6):E818-E823.
62. Forshaw MJ, Maphosa G, Sankarajah D, Parker MC, Stewart M. Endoscopic alternatives in managing anastomotic strictures of the colon and rectum. *Tech Coloproctol*. 2006;10(1):21-27.
63. Modarai B, Forshaw M, Parker MC, Stewart M. Self-expanding metallic stents in the treatment of benign colorectal anastomotic strictures: a word of caution. *Tech Coloproctol*. 2008;12(2):127-129.
64. Dederichs F, Knüdel S, Nolte W, Iesalnieks I. Behandlung einer postoperativen Rektumstenose mittels eines selbstexpandierenden resorbierbaren Polydioxanon-Stents [Treatment of a postoperative rectal stenosis with a self-expanding biodegradable polydioxanone stent]. *Z Gastroenterol*. 2013;51(5):437-439.
65. Pérez Roldán F, González Carro P, Villafañez García MC, et al. Usefulness of biodegradable polydioxanone stents in the treatment of postsurgical colorectal strictures and fistulas. *Endoscopy*. 2012;44(3):297-300.
66. Rejchrt S, Kopacova M, Brozik J, Bures J. Biodegradable stents for the treatment of benign stenoses of the small and large intestines. *Endoscopy*. 2011;43(10):911-917.
67. Martínez Alcalá F, Martínez-Alcalá García FR, Sánchez-Yague A, Martínez-Alcalá García A, Ciria Avila JA, Perez Pozo JM. Treatment of a benign, anastomotic refractory rectal stricture with an AXIOS stent. *Endoscopy*. 2015;47 Suppl 1 UCTN:E413-E414.
68. Schlegel RD, Dehni N, Parc R, Caplin S, Tiret E. Results of reoperations in colorectal anastomotic strictures. *Dis Colon Rectum*. 2001;44(10):1464-1468.
69. Valdés-Hernández J, Del Rio FJ, Gómez-Rosado JC, et al. TAMIS repair of a rectal stenosis not treatable by endoscopy. *Tech Coloproctol*. 2018;22(11):891.
70. Baatrup G, Svensen R, Ellensen VS. Benign rectal strictures managed with transanal resection--a novel application for transanal endoscopic microsurgery. *Colorectal Dis*. 2010;12(2):144-146.
71. Pabst M, Giger U, Senn M, Gauer JM, Boldog B, Schweizer W. Transanal treatment of strictured rectal anastomosis with a circular stapler device: simple and safe. *Dig Surg*. 2007;24(1):12-14.
72. Anvari M. Endoscopic transanal rectal stricturoplasty. *Surg Laparosc Endosc*. 1998;8(3):193-196.
73. Kato K, Saito T, Matsuda M, Imai M, Kasai S, Mito M. Successful treatment of a rectal anastomotic stenosis by transanal endoscopic microsurgery (TEM) using the contact Nd:YAG laser. *Surg Endosc*. 1997;11(5):485-487.
74. Gomes da Silva R, Hanan B, Fonseca LM. Treatment of Anastomotic Stricture of a Handsewn Coloanal Anastomosis With Transanal Approach. *Dis Colon Rectum*. 2017;60(7):755.
75. Bong JW, Lim SB. Transanal minimally invasive surgery as a treatment option for a completely occluded anastomosis after low anterior resection: A new approach to severe anastomotic stenosis. *Asian J Endosc Surg*. 2019;12(2):175-177.
76. Kawaguti FS, Martins BC, Nahas CS, et al. Endoscopic radial incision and cutting procedure for a colorectal anastomotic stricture. *Gastrointest Endosc*. 2015;82(2):408-409.
77. Araki Y, Kishimoto Y, Sato Y, et al. Transanal dilation using circular stapling for benign rectal stenosis: report of a case. *Kurume Med J*. 2002;49(3):149-151.
78. Kawak S, Turaihi H, Bjordahl P. Transanal stricturoplasty: a minimally-invasive approach to a challenging problem. *J Surg Case Rep*. 2019;2019(3):rjz087. Published 2019 Mar 29.
79. Yi BQ, Wang ZJ, Zhao B, et al. *Zhonghua Wai Ke Za Zhi*. 2013;51(7):577-581.