SYSTEMATIC REVIEW

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Endoscopic Stricturotomy for the Treatment of Inflammatory Bowel Diseases' Ileocolonic Strictures: A Systematic Review

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ABSTRACT

Background & Aims: Inflammatory and fibrotic strictures are common in inflammatory bowel diseases (IBD) and are challenging conditions to manage. Endoscopic stricturotomy (ESt) is considered as an emerging treatment option. We aimed to summarise evidence on the efficacy of ESt for the treatment of IBD-associated strictures.

Methods: The databases Pubmed and Cochrane Controlled Trial Register were searched to identify all reports related to ESt in IBD, published till January 2025. A systematic review was conducted identifying clinical and endoscopic improvement.

Results: 18 studies involving 317 patients were included in the analysis. ESt improved symptoms in 64.2% of patients after a median follow-up of 7.8 months. Endoscopic improvement was detected in 22% of patients after 9 months. Mean length of treated strictures was 1.6 cm. Major adverse events resulted in 5.6% of patients treated by ESt.

Conclusions: Endoscopic stricturotomy seems to be an effective option for treatment of IBD' strictures. However further data is required to confirm the role of ESt in this setting.

Key words: inflammatory bowel disease – Crohn's disease – ulcerative colitis – strictures – endoscopic stricturotomy – needle-knife stricturotomy.

Abbreviations: CD: Crohn Disease; EBD: endoscopic balloon dilation; ESt: endoscopic stricturotomy; IBD: inflammatory bowel disease; UC: ulcerative colitis.

INTRODUCTION

Inflammatory bowel diseases (IBD) are characterized by strictures occurrence as result of the inflammatory and fibrotic disease evolution or effect of the surgical interventions. This trend is more pronounced in Crohn's disease (CD) and is one of the main reasons of morbidity, hospitalization and surgery [1]. Population-based cohort studies showed that 5-28% of CD have a stricture disease and more than 50% develop strictures or fistulas within 10 years from the diagnosis [2]. Strictures may be single or multiple, affecting any portion of the gastrointestinal tract, and resulting in acute or chronic occlusive symptoms. Distinction between inflammatory and fibrotic stricture can be challenging using current preoperative imaging modalities, but it is crucial to decide the most appropriate therapeutic approach. While in the inflammatory stricture the anti-inflammatory therapy (corticosteroids and biologics) would be indicated [3-4], in the case of predominant fibrotic strictures or when the medical therapy is failing, an endoscopic or surgical approach (or both if necessary) would be recommended [5] to avoid obstruction, perforation or a penetrating disease. The best treatment option would be based also on stricture location, length and angulation, together with the evaluation of concomitant complications (phlegmon, abscess, dysplasia or malignancy), length of symptom-free interval, and patient willingness [6].

Initially, surgery was the only treatment option for strictures unresponsive to medical therapy and/or in the fibrotic forms. Following the new trend of "bowel sparing" surgery, nowadays strictures >5 cm without concomitant complications can be treated by strictureplasty, in order to reduce also the anastomotic leak risk. By making a stricture's longitudinal incision and closing it transversely, stictureplasty brings healthy

tissue proximal and distal to the lesion to create a wider lumen. According to the stricture's length, different strictureplasty techniques can be performed: the Heineke-Mikulicz procedure is preferred for strictures <10 cm, the Finney procedures for strictures between 10-25 cm, Michelassi technique for strictures >25 cm or multiple strictures that are close to each other [7-8] and the D'Hoore technique for terminal ileum strictures >20 cm [9]. No significant differences have been detected among these procedures in terms of complications or relapses [10]. In case of malnourished and septic patients, intestinal segments that cause abscesses and fistulas, intestinal perforations with peritonitis and in the suspicion of neoplastic degeneration, strictureplasty is contraindicated. IBD-associated strictures are also surgically treated by fecal diversion, in order to prevent any obstruction or perianal fistulas; in these cases ileostomies and colostomies have shown similar results [11].

In the last years endoscopy has arisen as an alternative treatment option for IBD stricture, mainly for patients unresponsive to medical therapy, in order to avoid repeated surgeries. The endoscopic procedure cand can be considered more conservative and less invasive than surgery representing a bridging treatment modality between the medical and surgical therapy. Pneumatic dilation, stent placement and, more recently, endoscopic stricturotomy (ESt) are the main endoscopic techniques to treat the IBD strictures.

Through-the-scope radial expanding balloon dilators (with or without a guidewire) are commonly used for strictures located in the colon or ileocolon [12]. While fibrotic stenosis < 4 cm long, mainly post-surgical and without deep ulcers or major deformations of the lumen, are the more common indications for endoscopic balloon dilation (EBD) of CD inflammatory strictures [13], we should pay more attention to the dilation of UC inflammatory strictures, because these lesions could be suspicious for colonic neoplasia, in which the surrounding mucosa is often the site of continuous chronic activity, with a thick wall and narrow lumen up to the end-stage condition of "leadpipe" colon [14]. In these cases EBD can be considered a symptomatic treatment or as a bridge to surgery. Lastly, EBD is considered in strictures <5 cm long, non-angulated and without concomitant complications [15].

Another endoscopic technique used for IBD strictures is represented by the placement of metallic stents, whose complications are related to migration and fistula formation leading to perforations [16].

Although intralesional injection of steroids although has been demonstrated to be effective for peptic, corrosive, anastomotic or post-radiotherapy fibrotic strictures [17], it is not indicated for IBD [18].

Biodegradable stents could be an option in these complications but just a few reports are described in literature [19].

Among the endoscopic procedure the ESt is coming out as an innovative technique to treat the IBD-associated ileocolic fibrotic strictures [20], ileal J-pouch [21], Koch pouch [22], strictures or refractory strictures, also in the presence of fistulas and abscesses [23]. Before cutting the stricture, it could be useful to scan the stricture by a disposable catheter-based doppler ultrasound probe inserted through the endoscopic working channel, in order to identify the fibrotic tissue and proceed with dissection, vertically or tangentially, using a needle knife [24]. The features of this technique preserve intestinal length and reduce complications related to surgery. In our study we aimed to summarize evidence on the efficacy of ESt for treatment of IBD-associated strictures.

METHODS

The databases Pubmed and Cochrane Controlled Trial Register were searched to identify all reports related to endoscopic stricturotomy in IBD. The following search terms were included, "Crohn's disease", "ulcerative colitis", "strictures", "endoscopic stricturotomy", "endoscopic needle knife stricturotomy", "anastomotic strictures", "refractory anal strictures", "ileocolonic resection", "strictureplasty", "ileal-pouch anal anastomosis", "ileal pouch strictures". Key outcomes as reported in individual studies included clinical and endoscopic response. Clinical response was reported if there was any improvement in symptoms after endoscopic stricturotomy and whether this response was maintained over time. Endoscopic response was considered as the absence of strictures and/or the smoothness of the progression of the endoscope.

RESULTS

Included Studies

Ten articles and eight case reports fulfilled the search criteria (Fig. 1, Table I) [25-42]. Collectively, these reports accounted for a total of 317 patients (173 patients with CD and 144 patients with UC) who underwent ESt.

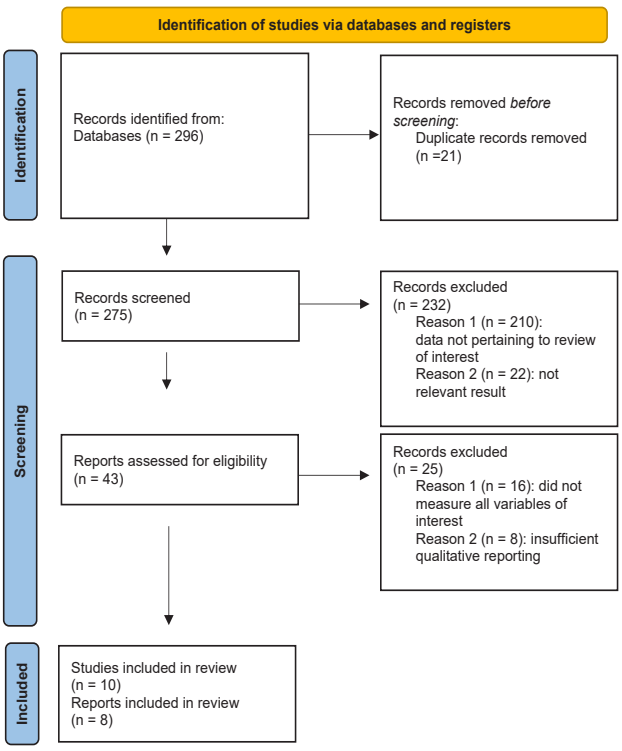

Fig. 1.

Table I.

			Previous Therapies		Stricture				AEs after ESt		Follow up		Reintervention	
Study	Disease	Cases (n)	Medical	Endoscopic	Primary/Secondary	Single/ Multiple	Site	Mean Lenght (cm)	Perforation	Bleeding	Clinical S.	Endoscopic S.	Endoscopy	Surgery
Min Chen et al (32)	UC	1	NS	EBD	Se: Nipple valve stenosis	S	terminal neo-ileum	NS	NS	NS	yes (7m)	yes (7 m)	no	no
Nyabanga CT et al. (33)	CD	1	ADA, CER, ETA	EBD	Se: sealed outlet of diverted large bowel	S	rectum	NS	NS	NS	NS	NS	no	no
Chidi V et al (34)	CD	1	NS	Roth net	Se: two not specified SB resection	S	terminal neo-ileum	NS	NS	NS	NS	NS	no	no
Lan N et al (25)	CD/UC	50/35	anti-TNF, anti-Integrin	EBD (54.3%)	P/Se: 127 strictures (each patient received a median of 2 treatments)	S/M	variable	1.5	0.37%	3.3%	yes (9m 54.7%)	NS	ESt/EBD 77/85 (60.6%): ESt 44.9%, 11% ESt+EBD, 22.8% EBD	15.3%
Lukas M et al (35)	UC	1	NS	NS	P: proximal to IPAA	S	5 cm above ileal inlet	NS	NS	NS	NS	NS	no	no
Khan F et al (36)	UC	1	NS	NS	Se: IPAA	S	diverted pouch outlet stricture	NS	NS	NS	yes (1m)	NS	no	no
Lan N et al (26)	CD	35	IMM, BIO	EBD (22.8%)	Se: NS	S/M	NS	2	2.04%	8.1%	yes (8m 58.3%)	yes (8m 58.3%)	no	11.3%
Zhang LG et al (27)	CD/UC	25/24	IMM, BIO	EBD (51%)	Se: 24 IPAA, 22 ileocolonic anastomosis, 2 ileorectal anastomosis, 1 colo-colonic anastomosis	S/M	variable	0.8 +-1.8	0	4.7%	yes (11m 67.6%)	yes (11 m 20.4%)	no	12.2%
Lan N et al (28)	CD	13	IMM, BIO	no	P	S	distal ileum	0.9+-2.4	0.07	0	yes (1.8m 50%)	0	no	15.4%
Lan N et al (29)	UC	40	BIO	no	Se: IPAA	S	pouch inlet or afferent limb	2	0	4.6%	yes (6m 42.3%)	NS	no	12.5%
Nobel YR et al (37)	CD	1	IMM, BIO	EBD	Se: Heineke-Mikulicz strictureplasty	S	inlet stricture	NS	0	0	yes (1m)	yes (1m)	ESt+EBD	no
Navaneethan U (38)	CD	2	IMM, BIO	EBD	Se:IPAA / ileo-colonic resection	M	terminal neo-ileum and anal	NS	0	0	yes (1y)	NS	no	no
Shen Bo et al (30)	UC	10	NS	EBD	Se: Ileal pouch anal anastomosis strictures	NS	ileal pouch anal	NS	NS	NS	yes (60%)	NS	no	no
Lan N et al (31)	CD	21	BIO	EBD (57.1%)	Se: ileo-colonic/rectal anast. - colo-colonic anast.	S/M (8.5%)	variable	1.5	0	3.6%	yes (8m 72.7%)	NS	ESt/EBD 12/21 (57.1%): ESt 28.5%, EBD 19.05%, ESt+EBD 9.5%	9.5%
Partha P et al (40)	CD	6	ADA, IMM, BIO	EBD	P: ileo-cecal (1), rectal (3) / Se: ileo-transverse anstomotic stricture (1), rectosigmoid stricture (1)	S	variable	NS	0	16.6%	yes (>12m 80%)	NS	EBD (1/6) 16.6%; ESt (1/6) 16.6%	no
Schulberg JD et al (41)	CD	16	IMM, BIO	EBD	P 6; Se 10	S	colon, terminal ileum, ileal and ileocolic anastomosis	2	0	6.25%	yes (6m 93.3%)	NS	no	no
Jabi O et al (39)	UC	13	IMM, BIO	NS	Se	M	stoma closure site stricture	1.7+1	0	15.3%	yes (11 m 66.7%)	NS	ESt/stricturotomy 46.7%	no
Koby H et al (42)	CD/UC	22	IMM, BIO	NS	Se	NS	anorectal, anopouch	2.4+1.2	0	0	yes (4m 22%)	NS	endoscopic insulated tip/ESt 67%	0.11

AEs: adverse events; ESt: endoscopic stricturotomy; NS: not specified; SB: small bowels; TNF: tumor necrosis factors; P: primary; Se: secondary; S: single; M: multiple; UC: ulcerative colitis.

Most of the patients were previously prescribed immunomodulatory therapies: 89% of patients biologic therapies (among them anti-TNF alpha, anti-integrin, anti-IL12/23) [25-29, 31, 33, 39-42], 87.3% immunosuppressants [26-28, 39-42], 3 patients ustekinumab and methotrexate [37-38] and 5 patients are not provided with any information on this, as it was not reported in the studies [30, 32, 34-36]. Many of the patients enrolled for the endoscopic procedure had carried out previous treatments, in detail: 85.6% underwent EBD [21, 25-27, 31-33, 37, 38, 40, 41], one patient through Roth net [34], 53 subjects did not undergo any preliminary therapy [28-29], in four patients we have no data about previous treatments [35-36-39-42]. The number of interventions was higher than the number of patients enrolled, because some of the enrolled subjects had received multiple endoscopic treatments [25, 27, 28, 31]. The strictures considered, being the two phenotypically different inflammatory diseases, were primary (85/274; 31.02%) [25, 28, 35, 40, 41], but most of them were secondary to surgical operations (243/308; 78.9%) [26, 27, 29-33, 34-39, 41, 42]. ESt was therefore performed on different strictures: while CD strictures (at the level of the pouch, ileum, ileociecal valve, perianal site) or UC strictures (colic, rectal, pouchitis type) were included among the primary forms, the anastomoctic strictures (nipple valve, pouch, distal rectal, ileal inlet into the pouch, diverted pouch outlet, ileocolonic, ileorectal, colo-colonic, mid-jejunum, refractory anal strictures) were included among the secondary. A case report regarding a fecalith occluding the neo-terminal ileum was also included in our study [34].

Mean Length and Adverse Events

Mean length of the treated strictures was 1.6 cm [25-29, 31, 39, 41, 42]; there is no data to specify the type of used setting (cutting and coagulation power). ESt adverse events was 5.6% [25-29, 31, 37-42]: in detail 5.2% resulting from bleeding [25-29, 31, 37-42] and 0.7% resulting from post-procedural perforation [25-29, 31, 37-42]. In case of intestinal perforation three patients required hospitalization: one patient was treated by an urgent exploratory laparotomy with extensive lysis of adhesions and loop ileostomy [25], one patient received laparotomy and ileocolonic anastomosis resection and creation of neoanastomosis [26] and one patient underwent an emergency exploratory laparotomy with ileo-colonic resection and creation of neoanastomosis [28]. In case of bleeding 12 patients received blood transfusions [25-27, 31], 2 patients were treated with endoscopic clipping [26], one with an adrenaline injection [41] and in the remaining patients the bleeding complication resolved spontaneously [25, 27, 39, 40].

Symptomatic and Endoscopic Improvement

Symptomatic improvement from the procedure was detected in 64.2% of patients after a median follow-up of 7.8 months [25-29, 32, 36-42]. Endoscopic improvement was documented in 22% [25-42] of patients after 9 months. In one study 60% of patients maintained a functional pouch [30], although data on the length of the period of this condition are missing. In one case series of patients undergoing ESt and EBD at the same session, 50% (1/2) of them showed symptomatic improvement after four months [31]. Concerning the re-treatments, 36.7% of patients underwent further treatment [25-42]; more precisely 17.7% of the patients were treated by new sessions of ESt, 18.1% of the patients through EBD and 13.3% received both treatments [25-38, 41]. In two studies, the number of patients who underwent ESt/stricturotomy or endoscopic insulated tip/ESt was not specified [39, 42]. The mean interval between the initial ESt and the first subsequent therapeutic endoscopic intervention was a period between 4 and 8 months [25-38].

Post-endoscopic Surgical Treatment

A subsequent surgical intervention was observed in 4.1% [25-42] of patients. In detail, in a study 13 patients (38.5%) underwent a diverting loop ileostomy: three of them had the ileostomy closure and three remained with the diversion, two (15.4%) had a pouch redo, five (38.5%) had a partial colectomy [25]. In another study three re-anastomosis and diverting loop ileostomy and one ileostomy were performed [26]. In a further study 12.5% (5/40) or the patients were surgically treated by bowel resection or strictureplasty. In a study one patient required a proctectomy and end ileostomycreation for a rectovaginal fistula with associated abscesses [42].

The factors determinating the choice for endoscopic or surgical approach are listed in Tables II and III.

Table II.

Factors determining the choice of endoscopic treatment [5-6-13-15-23]
Choice of patient
Symptomatic narrowing predominantly fibrotic in the absence of significant deformation of the lumen
Straight single shorthand
Short stricture (<5 cm)
First expansion
Anastomosis and stricture de novo
Non-angulated strictures, no accompanying features
Presence of fistulas and abscesses (only for ESt)
Preserving intestinal length
Less invasiveness

Table III.

Factors determining the choice of surgical treatment[6]
Choice of patient
Predominantly inflammatory strictures
Multiple narrowings of the small intestine
Long strictures (>5 cm)
Duodenal strictures
Presence of phlegmon, abscess, dysplasia or malignancy
Significant stricture angulation

DISCUSSION

The treatment of primary and secondary strictures in IBD patients represents an important challenge for clinicians.

Surgical and/or endoscopic approach is recommended for inflammatory strictures not responsive to medical therapy and for the fibrotic ones. Endoscopic ballon dilatation is one of the most widely used techniques for IBD-associated strictures, being an attractive alternative to surgery mainly because of its less invasiveness [43]. However, the long-term efficacy and outcomes remain unclear. A systematic review with meta-analysis involving 1089 patients (for a total of 2664 EBD) across 25 studies reported a symptomatic response rate of 70.4%. The proportion of patients requiring a new EBD after one and two years was 31.6% (160/506) and 25.9% (117/451), respectively. Most patients within 5 years required recurrent EBD (80%) and/or surgical interventions (75%) [44]. The main factors predicting a successful EBD are represented by symptomatic predominantly fibrotic strictures, short straight strictures in-line with the bowel lumen distal to the duodenum (non-ulcerated in a location without any adjacent abscess and at least 5 cm from a fistula orifice), single straight stricture, anastomotic stricture, first dilation and lack of an overlap process contributing to symptoms (SIBO or IBS) [45]. Endoscopic ballon dilatation is a minimally invasive procedures with a low rate of complications: a large systematic review evaluating 24 non-randomized studies including 1163 patients detected a 3% of iatrogenic perforation and 4% of infection and hemorrhage [45].

In our systematic review we focused on the ESt technique in patients with CD and UC presenting mainly fibrotic strictures, primary or secondary to a surgical operation. We detected a 59.2% (92/155) symptomatic improvement after a mean follow-up of 6.3 months in line with the results related to EBD [25-29, 32, 37, 38]. Fewer studies reported data regarding the endoscopic improvement (considered as the absence of strictures and/or an easy endoscope progression) that was detected in 22% (11/50) of patients after a mean follow-up of 9 months [27, 38]. Few data are present in literature about the ESt in the treatment of the pouch and about the combined treatment of strictures by ESt and EBD: a study conducted by Shen et al. [30], showed that 60% (6/10) of patients maintained a functional pouch, although no data were reported around the durability of this condition. In a small study of Nan et al. [31] 50% (1/2) of patients who underwent ESt and EBD at the same session had a symptomatic improvement after a four-month follow-up. As well as for EBD, ESt seems to be characterized by a low rate of complications, lower than in surgical treatment: we detected a 5.28% (29/549) complication rate [25-29, 31], of which 4.95% related to bleeding and 0.77% resulting from post-procedural perforations. Most of the complications have been managed conservatively. Through our review we detected that 36.7% of patients underwent further endoscopic therapies following the ESt treatment [25-42]: 17.7% were treated by further ESt sessions, 18.1% through EBD and 13.3% received both treatments [25-38, 41]. This suggests that ESt could be repeatable and its use does not prevent other treatment modalities; indeed, in some cases, two combined endoscopic approaches could be used to optimize the outcomes. When the treatment by multiple sessions of ESt or a combined therapy by ESt and EBD failed, a surgical operation was needed: in our review we detected 4.1% [25-42] of patients who needed surgery. In these cases the surgical approach was considered as a last line of treatment, mainly in CD patients where sparing mucosa was considered safer: in fact both endoscopic techniques preserve the intestinal length, while any intestinal resection alters the absorption mechanisms mainly if practiced at the fasting or terminal ileum level. However, it should be noted that although ESt is more invasive than EBD, it is more effective in the short term and has a lower rate of long-term recurrence.

There are a few limitations in this review. First, the number of strictures is higher than the number of patients enrolled: some patients received multiple ESt sessions making the results heterogeneous. Second, most of the studies considered mainly the post-surgical strictures which are more suitable to be treated by an endoscopic approach, compared to de novo strictures in which both symptomatic and endoscopic improvement are hard to be reached. Third, just a few studies reported the characteristics of strictures (length, single or multiple, straight or angled) which are a key point to select the best option of treatment. However when reported, the mean length of endoscopically treated strictures was 1.6 cm [25-29, 31, 39, 41, 42]; indicating that ESt, like EBD, could be suitable for short strictures. Lastly, the adverse events have not been reported in all of the studies (which is important for choosing the endoscopic technique to be performed and in the evaluation of a possible surgical approach).

CONCLUSIONS

Endoscopic stricturotomy can be considered as a new treatment option for IBD-associated strictures achieving a good efficacy and an acceptable safety profile that plays an important role in preventing surgery and wasting mucosa, mostly in the short post-surgical strictures. However, the space of this endoscopic technique in the treatment algorithm of IBD strictures has yet to be clearly defined; further studies with a long-term follow-up are required to empower the role of this new promising procedure.

Conflicts of interest: None to declare.

Authors' contribution: C.R. designed the review, collected and interpreted the data, reviewed and edited the manuscript. M.M., J.P., S.V., M.B. collected and interpreted the data. M.B. reviewed and edited the manuscript. C.R., M.M., J.P., S.V. were major contributors in writing the manuscript and all authors read and approved the final manuscript.

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