

# Endoscopic Balloon Dilatation of Ileal Pouch Strictures

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**BACKGROUND:** Restorative proctocolectomy with ileal pouch-anal anastomosis is the surgical treatment of choice in patients with ulcerative colitis. Strictures can occur at the inlet and outlet of the pouch. Endoscopic balloon dilatation has been successfully used in patients with Crohn's strictures at the small intestine and colon. There are no published trials on endoscopic balloon therapy of ileal pouch strictures.

**AIM:** To evaluate outpatient endoscopic balloon dilatation of strictures in ileal pouches.

**METHODS:** Patients underwent nonfluoroscopy-guided, nonsedated, outpatient endoscopic dilations with an 8.6-mm upper endoscope and through-the-scope balloons (size: 11–18 mm). Pre- and posttreatment Pouchitis Disease Activity Index symptom scores (range: 0–6), endoscopic stricture scores based on resistance in passing the endoscope (range: 0–4), and Cleveland Global Quality of Life were compared.

**RESULTS:** Nineteen patients with pouch strictures who had concurrent Crohn's disease of the pouch ( $n = 11$ ), cuffitis ( $n = 5$ ), and pouchitis ( $n = 3$ ), including 14 inlet and 14 outlet strictures, were enrolled. The mean number of strictures for each patient was  $1.61 \pm 0.78$ . All strictures were successfully dilated with the through-the-scope balloon, with a mean of  $1.74 \pm 1.19$  (range: 1–5) sessions for each patient. Nine patients had a second endoscopy at 8 wk and five patients had a third pouch endoscopy at 16 wk after the initial endoscopic dilatation. Endoscopic stricture scores immediately ( $0.30 \pm 0.47$ ), 8 wk ( $0.40 \pm 0.51$ ), and 16 wk ( $0.44 \pm 0.76$ ) after the dilatation were significantly improved compared to the predilatation stricture scores ( $2.67 \pm 0.78$ ). The symptom scores and quality-of-life (QOL) scores improved at week 8 and 16 following dilatation, with a mean follow-up of  $6.10 \pm 5.83$  months (2–25 months). No complications were experienced with the procedure. One patient with CD who failed endoscopic and medical therapy underwent pouch resection.

**CONCLUSION:** In conjunction with medical therapy, outpatient endoscopic balloon dilatation appears safe and effective in treating pouch inlet and outlet strictures, by relieving symptoms, restoring pouch patency, and improving QOL in the majority of patients.

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## INTRODUCTION

Restorative proctocolectomy with ileal pouch-anal anastomosis (IPAA) is the surgical treatment of choice for patients with medically refractory ulcerative colitis (UC), UC with dysplasia, or familial adenomatous polyposis (1, 2). Restorative proctocolectomy with IPAA has improved health-related quality-of-life (QOL) scores in UC patients who required surgery (3–7). However, problems such as pouchitis, cuffitis (inflammation of the rectal cuff or anal transitional zone), or Crohn's disease (CD) of the pouch, can develop after the surgery. The IPAA complications can be classified as mechanical (such as strictures, fistula, leak, or afferent limb syndrome), inflammatory (such as pouchitis and cuffitis), and functional (such as irritable pouch syndrome).

Two common locations are prone to develop strictures, the pouch-anal anastomosis (pouch outlet) (8) and the pouch inlet at the junction of neo-terminal ileum and pouch. Other locations of strictures are at the mid-pouch, pouch-rectal anastomosis, and distal small intestine. Causes of strictures include CD, cuffitis, ischemia, abscess, and NSAID use. Management of the pouch strictures, especially inlet stricture, can be challenging. There is limited data in the management of pouch strictures. Endoscopic balloon dilations have been used for patients with Crohn's strictures at the ileocolonic or colocolonic anastomosis, colon, and small intestines (9–12). The procedure appears safe and effective in avoiding or postponing surgery (9–12). Topical injection of a long-acting corticosteroid after endoscopic dilatation of anastomotic strictures may help to maintain luminal patency (10, 11). However, endoscopic balloon dilatation has not been evaluated in pouch strictures. The aim of this study was to assess feasibility,

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safety, and efficacy of outpatient endoscopic balloon dilatation of strictures in IPAA.

## METHODS

### Patients

The Cleveland Clinic Institutional Review Board approved the study (IRB#6844). We enrolled 19 consecutive IPAA patients with inlet and/or outlet (pouch-anal anastomosis) strictures from our outpatient clinic at the Center for Inflammatory Bowel Disease. All the 19 patients had a preoperative diagnosis of UC with medically refractory disease or dysplasia. To avoid selection bias, 19 consecutive patients with pouch strictures referred to the primary investigator (B.S.) from May 2002 to March 2004 were all included in the study. All pouch strictures detected during the routine pouch endoscopy were balloon-dilated by the single investigator. Patients with mechanical complications from the surgery such as pouch leak, afferent limb syndrome, and abscess or sepsis were excluded. Patients with pouch-anal anastomotic strictures without concurrent inflammatory complications of IPAA were also excluded.

### Clinical Evaluation and Follow-up

Patients' demographic, clinical, endoscopic, and histologic data were collected. The Pouchitis Disease Activity Index (PDAI) instrument (13) also was used to quantify symptoms, endoscopic, and histologic inflammation. In addition to the PDAI symptom scores (ranging from 0 to 6 points) bleeding, fever, obstruction (persistent nausea, vomiting, bloating), stool consistency, food or stress-associated symptom exacerbation, and bloating were evaluated. Use of concurrent medication was documented.

### Endoscopic Evaluation and Dilatation

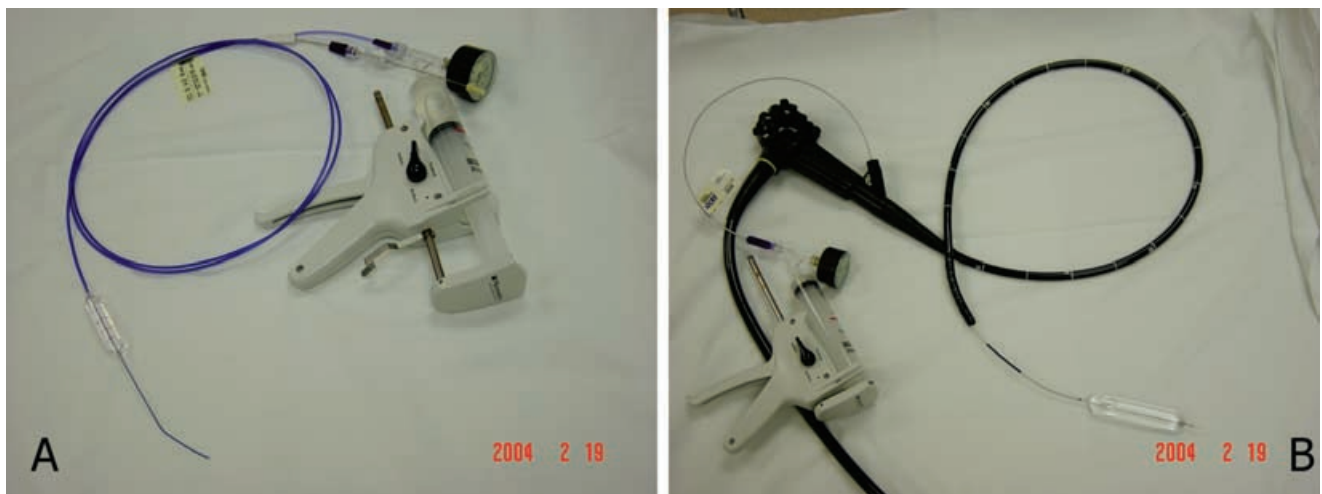
Outpatient nonfluoroscopy-guided, nonsedated, outpatient endoscopic dilations with an 8.6-mm flexible, single-channel,

video upper endoscope (GIF-160, Olympus Optical Co., Ltd, Tokyo, Japan) and through-the-scope balloons (CRE balloons, Boston Scientific Microvasive, Natick, MA) were performed. The balloon size ranged from 11 to 18 mm (Fig. 1). A pouch-anal anastomosis stricture was suspected when the anal canal could not admit endoscopist's little finger during digital examination and no digital dilation was attempted. Segmental evaluation of the prepouch neo-terminal ileum, pouch, and cuff was conducted with minimal air insufflation. There was an open space between the distal tip of endoscope and the proximal end of balloon, which allowed anal canal and anal sphincter to be undisturbed during dilation, which minimized patients' discomfort (Fig. 2).

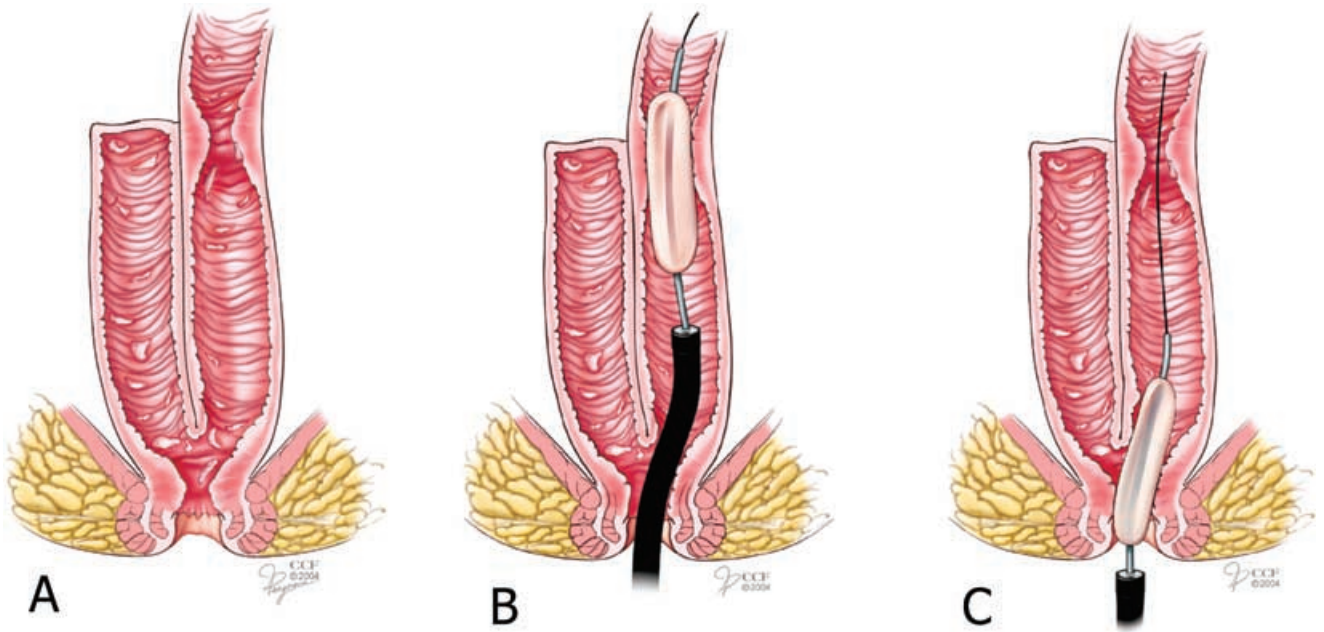
The degree of stricture was quantified by the endoscopist based on the degree of resistance to the passage of the endoscope (0 = no resistance; 1 = mild resistance; 2 = moderated resistance; 3 = severe resistance; and 4 = pinhole and not traversable). The sizes of the balloons were chosen based on the degree of strictures. For high-grade inlet and outlet strictures not traversable by the endoscope, CRE balloon with a guidewire was used after retrograde pouchography was performed, excluding the strictures or fistulas at the proximal neo-terminal ileum. Sequential dilations with the same balloon up to three sizes were performed. Passage through the stricture was attempted immediately after the dilation and the passage without resistance was interpreted as a sign of technical success. At the site of strictures, 4-quadrant endoscopic injection of triamcinolone (5 ml of 40 mg/ml diluted to 5 ml with normal saline, 1 ml aliquots in each quadrant) was performed using an endoscopic injection needle immediately following the balloon dilatation (Fig. 3). Patients were closely monitored for signs of excessive bleeding and abdominal pain during and after the procedure.

### Histologic Evaluations

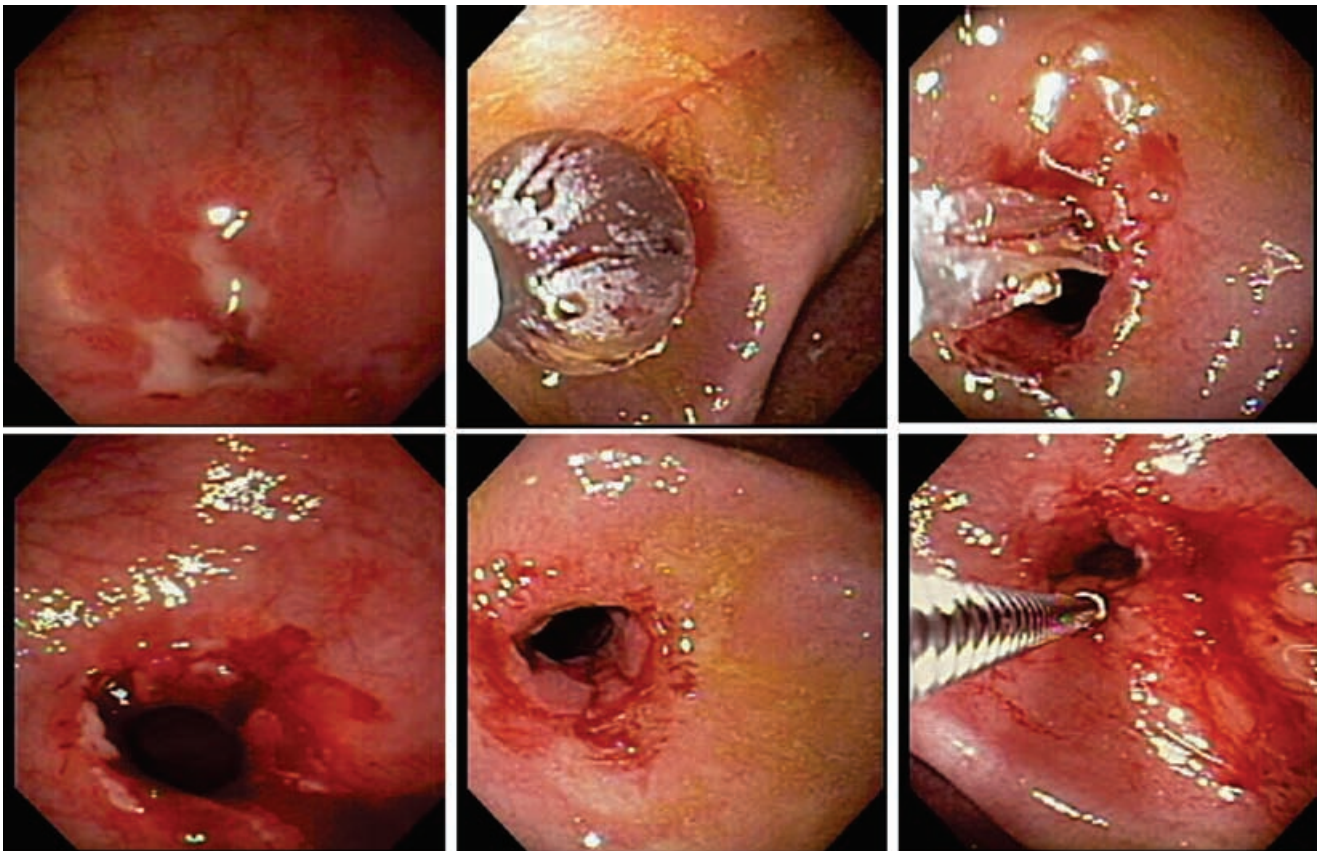
Segmental biopsies from the prepouch neo-terminal ileum, pouch, and cuff were taken and labeled separately. Mucosal



**Figure 1.** Through-the-scope balloon with a guidewire and pressure gauge (A). The balloon is passed through the operating channel of an upper endoscope (B).



**Figure 2.** Inlet and outlet strictures (A) and balloon dilation treatment (B and C). Notice an open space between the distal end of endoscope and the proximal end of balloon during the dilation of outlet stricture (C), which allows avoidance of irritation of anal sphincters.



**Figure 3.** Endoscopic balloon dilation with topical corticosteroid injection of a high-grade (stricture score = 4) pouch inlet stricture in a patient with Crohn's disease.

biopsies were taken from the areas with maximal inflammation in the neo-terminal ileum, pouch, and cuff, or from the posterior wall of the pouch if the pouch had a normal endoscopic appearance. Based on the PDAI histology scores (ranging from 0 to 6 points), the gastrointestinal pathologist, who was blinded to demographic, clinical, endoscopic, and histologic data, assessed and graded inflammation of the biopsy specimens from the neo-terminal ileum, pouch, and cuff. Additional features of mucosal histopathology were documented, including dysplasia, granuloma, pyloric gland metaplasia, and cytomegalovirus infection. During the follow-up endoscopy, mucosal biopsies were not taken.

Concurrent inflammatory conditions (CD of the pouch, pouchitis, or cuffitis) were diagnosed based on combined assessment of clinical, endoscopic, and histologic data. CD of the pouch was diagnosed based on presence of nonsurgery-related perianal fistula or inflammation or ulcerations at the prepouch neo-terminal ileum or small bowel in the absence of NSAID use, or granulomas on histology. The 18-point PDAI was used for the diagnosis of pouchitis. Pouchitis was PDAI  $\geq 7$ . Cuffitis was defined as inflammation of the rectal cuff or anal transitional zone on endoscopy and histology without or with minimal inflammation of the pouch.

### Outcome Measurement

Outcome was measured by assessing scores of symptoms, QOL, and stricture before and after dilatation and by assessing need for surgery. Patients were scheduled for follow-up clinical and endoscopic evaluation at week 8 and 16 after the initial treatment to assess patency of dilated strictures as well as mucosal inflammation. If strictures persisted or recurred, additional endoscopic balloon dilations were performed. We compared the pre- and posttreatment PDAI symptom scores (range: 0–6), endoscopic stricture scores, and the Cleveland Global Quality of Life (CGQL, range: 0–1, with 1 being the best QOL). The 3-item CGQL was specifically designed for the IPAA patients (3). All questionnaires were filled by the patients at outpatient visit before initial and follow-up clinical and endoscopic evaluations. For patients who failed to come for a follow-up visit, telephone contact was conducted for the documentation of questionnaires of the PDAI symptom scores and CGQL at week 16.

Concurrent use of medicines was allowed during the study. In patients with prior diagnoses of CD of the pouch, pouchitis, or cuffitis who had been on immunomodulators, infliximab, corticosteroids, mesalamines, or antibiotics, their medical regimens were continued without alteration throughout the 16-wk follow-up. In patients with the newly detected pouch strictures who had concurrent CD of the pouch, pouchitis, or cuffitis at entry, the following medical regimens were given: (1) budesonide 9 mg/day  $\times$  8 wk and long-term 6-mercaptopurine 1.5 mg/kg/day for CD of the pouch, (2) ciprofloxacin 500 mg b.i.d. PO  $\times$  8 wk for pouchitis, and (3) topical mesalamine (Canasa<sup>®</sup>) 500 mg b.i.d.  $\times$  16 wk for cuffitis.

### Statistical Analysis

Student's *t* and  $\chi^2$  tests were used to compare the pre- and posttreatment variables. The *p* values  $<0.05$  were considered as statistically significant.

## RESULTS

The 19 patients consisted of a group of mixed patients with CD of the pouch, pouchitis, and cuffitis. Eleven CD of the pouch comprised the majority who were initially operated for a preoperative diagnosis of UC (Tables 1–3). Fistulas were seen only in patients with CD of the pouch (Table 2). One patient had granulomas and two patients had pyloric gland metaplasia on pouch biopsy specimens.

In addition to the symptoms listed in the PDAI instrument, other symptoms were also common, including obstructive symptoms, extraintestinal manifestations, bleeding, and weight loss (Table 2).

The length of strictures was measured with endoscopy. None of the strictures was longer than 1.0 cm. All strictures had superficial ulceration on the overlying mucosa. The inlet strictures occurred only in patients with CD. Two patients with CD had a stricture only at the outlet. Strictures that occurred in patients with pouchitis and cuffitis all were located in the pouch outlet (pouch-anal anastomosis) (Table 3). The technical success rate for balloon dilatation was high (100%). All inlet and outlet stricture become traversable to the GIF

**Table 1.** Demographic Data of the 19 Patients with Pouch Strictures

	Demographic Data
Age, yr, $\pm$ SD	35.6 $\pm$ 11.6
Male gender, n (%)	8 (42.1%)
Duration of UC, yr, $\pm$ SD	14.4 $\pm$ 6.1
Duration of IPAA, yr, $\pm$ SD	7.4 $\pm$ 5.4
Fulminant colitis, n (%)	1 (5.3%)
Indications for colectomy, n (%)	
Refractory/steroid-dependency UC	17 (89.5%)
UC with dysplasia or cancer	2 (10.5%)
Type of pouch, n (%)	
J	16 (84.2%)
S	2 (10.5%)
Ileal pouch-rectal anastomosis	1 (5.3%)
Pancolitis, n (%)	18 (94.7%)
Stages of IPAA, n (%)	
1	1 (5.3%)
2	14 (73.7%)
3	3 (15.8%)
Redo pouch	1 (5.3%)
NSAIDs more often than monthly, n (%)	7 (36.8%)
Current smoking, n (%)	0
Family history of IBD in first-degree relatives, n (%)	3 (15.8%)
Mean number of strictures, $\pm$ SD	1.74 $\pm$ 1.19
Concurrent diseases	
Crohn's disease	11 (57.9%)
Pouchitis	3 (15.81%)
Cuffitis	5 (26.3%)

**Table 2.** Clinical Presentations in the 19 Patients with Pouch Stricture

	n (%)
Diarrhea	18 (94.7%)
Abdominal pain	19 (100%)
Perianal pain	15 (78.9%)
Bloating	9 (47.4%)
Nausea or vomiting	3 (15.8%)
Bleeding	4 (21.1%)
Fever	0
Daily use of antidiarrheal agents	8 (42.1%)
Fistulas	6 (31.6%)
Extraintestinal manifestations	
Arthralgias	8 (42.1%)
Primary sclerosing cholangitis	1 (5.3%)
Iritis or uveitis	1 (5.3%)
Weight loss	5 (26.3%)

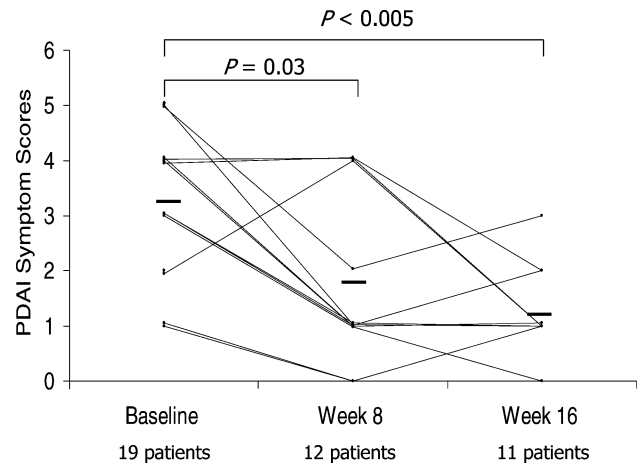
scope with no or minimal resistance after balloon dilation, suggesting that endoscopic balloon dilations were technically feasible (Fig. 3).

The mean number of dilation sessions was  $1.74 \pm 1.19$  (range: 1–5). Balloon sizes ranged from 11 to 18 mm. The ultimate goal was to keep luminal patency  $\geq 15$  mm. For inlet strictures, topical triamcinolone was injected immediately following the dilation. The mean duration of follow-up after dilation was  $6.10 \pm 5.83$  months (range: 2–25 months). Endoscopic dilation together with concurrent medical therapy lead to the improved PDAI symptom scores, stricture scores, and the CGQL scores (Figs. 4–6). Nine patients and five patients had a follow-up pouch endoscopy at week 8 and 16, respectively, and the stricture scores were available for calculation. The PDAI symptom scores and CGQL scores in 12 patients at week 8 and in 11 patients at week 16 were available for calculation. The rest of the patients either were lost to follow-up despite multiple attempts at telephone contact or had initial stricture dilation  $< 8$  wk (Table 4).

The mean PDAI symptom scores at week 8 and 16 were  $1.89 \pm 1.69$  and  $1.27 \pm 0.79$ , respectively, which were significantly lower than the predilation baseline of  $3.32 \pm 1.25$  ( $p < 0.03$ ) (Fig. 4). The mean stricture scores immediately after dilation, at week 8 and week 16 were  $0.30 \pm 0.47$ ,  $0.40 \pm 0.51$ , and  $0.44 \pm 0.78$ , respectively, which were significantly improved from the predilation baseline of  $2.67 \pm 0.78$  ( $p < 0.001$ ) (Fig. 5). The dilation with concurrent medicines lead to the improvement of QOL, as evidenced by the increase in

**Table 3.** Types of Strictures in Inflammatory Complications of IPAA

	Number of Cases	Inlet Strictures	Outlet Strictures
Crohn's disease of the pouch	11	14	6
Cuffitis	5	0	5
Pouchitis	3	0	3
Total	19	14	14

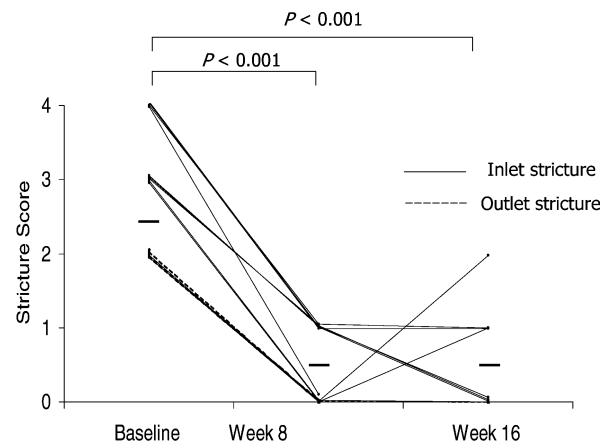


**Figure 4.** Pouchitis Disease Activity Index symptom scores before and 8 and 16 wk after endoscopic balloon dilation. The horizontal bars indicate statistical means.

CGQL scores from the baseline of  $0.52 \pm 0.19$  to  $0.69 \pm 0.08$  at week 8 and  $0.71 \pm 0.11$  at week 16 ( $p < 0.007$ ) (Fig. 6).

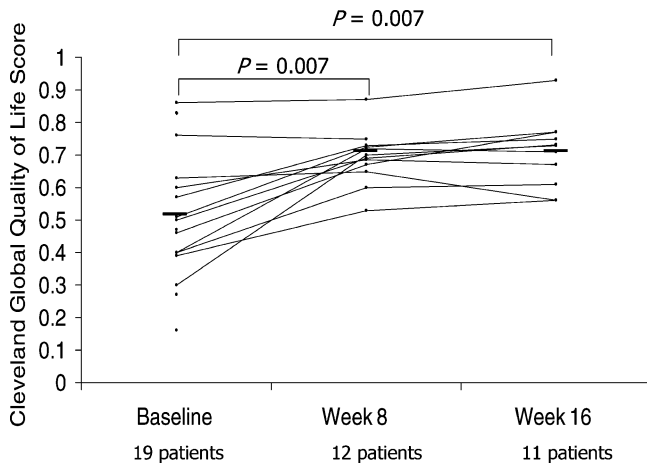
All patients tolerated the procedures. No excessive abdominal pain, bleeding, or perforation were experienced by any patients. One CD patient with both inlet (stricture score = 3) and outlet (stricture score = 2) strictures and inflammation of the pouch and neo-terminal ileum was scheduled for pouch resection and ileostomy. The inlet and outlet strictures initially responded to the balloon dilations, with improvement of symptoms and QOL scores. However, the inlet stricture (stricture score = 2) and obstructive symptoms recurred, despite repeat dilations and concurrent use of methotrexate and infliximab.

Medical therapy was instituted for patients with CD of the pouch, pouchitis, and cuffitis, respectively. In the 11 patients



	Baseline	Week 8	Week 16
# inlet strictures	14	10	6
# outlet strictures	14	5	3

**Figure 5.** Stricture scores before and after endoscopic balloon dilation. The horizontal bars indicate statistical means. The mean number of dilation sessions was  $1.74 \pm 1.19$  (range: 1–5).



**Figure 6.** The Cleveland Global Quality of Life scores before and after endoscopic balloon dilatation. The horizontal bar indicates statistical mean.

with CD of the pouch, the following medicines were given: scheduled infliximab infusion (2 patients), oral budesonide (3 patients), oral mesalamine (3 patients), 6-mercaptopurine (3 patients), methotrexate (1 patient), ciprofloxacin (3 patients), and metronidazole (1 patient). Some of patients with CD of the pouch received a combination of medical therapy. All five patients with cuffitis were treated with topical mesalamine suppositories (Canasa<sup>®</sup> 500 mg b.i.d.) and three patients with pouchitis were treated with ciprofloxacin, 500 mg b.i.d. PO. During the follow-up period, all patients continued their initial regimen with no alterations in the medicines.

## DISCUSSION

This series demonstrates that pouch inlet and outlet strictures in patients with IPAA can be treated with endoscopic balloon dilatation along with medical therapy. To our knowledge, this is the first study of its kind involving nonsurgical, endoscopic balloon treatment of the pouch inlet and outlet strictures. All 19 patients were symptomatic and had concurrent CD of the pouch, cuffitis, or pouchitis. Pouch inlet strictures were exclusively seen in patients with CD of the pouch. Outpatient endoscopic balloon dilatation appears well tolerated, safe, and feasible. In conjunction with medical therapy, endoscopic dilatation appears to be effective in maintaining the pouch inlet

and outlet patency, relieving symptoms, and improving patients' QOL scores in the majority of patients.

It was not clear why pouch inlet strictures almost always involved the junction between the pouch body and neo-terminal ileum. This is not a common location for ischemic or anastomotic strictures. Patients with pouch inlet strictures often had concurrent inflammation of the neo-terminal ileum and pouch. In this cohort, patients with inlet strictures all had CD, of whom some had additional strictures at the distal neo-terminal ileum above the junction. The inlet strictures all were short (<1.0 cm), which make endoscopic dilatation feasible and safe.

Pouch-anal anastomotic strictures (outlet strictures) are common (8, 14–18), and are often associated with poor functional outcome (15, 19). In one study of 102 patients with IPAA, the prevalence of outlet strictures was as high as 38% (8). The risk factors that may be associated with pouch-anal anastomotic strictures include handsewn technique (18), small diameter staple gun, use of a quadruplicated reservoir, use of a defunctioning ileostomy, anastomotic dehiscence, pelvic sepsis, “W”-shaped pouch (8), excessive operative blood loss, and overweight male gender (17). Cuffitis may be an additional contributing factor for the development of outlet strictures. Under this circumstance, concurrent use of topical antiinflammatory agents, such as mesalamine or corticosteroids, in addition to endoscopic balloon dilations, is desirable.

Dilatation of outlet strictures using bougies under the general anesthesia (8, 14) or self-dilatation at home (18) is part of a salvage strategy to manage the IPAA complications before pouch resection. Prudhomme *et al.* (18) further classified the outlet strictures into fibrotic and nonfibrotic based on the presence of palpable fibrosis on digital examination. It appears that nonfibrotic strictures were more responsive to dilatation therapy than the fibrotic strictures (18). Dilatation of outlet stricture or pouch-anal anastomotic stricture can be uncomfortable. However, in the authors' experience, this is much more often experienced by patients with long ( $\geq 1.0$  cm) or high-grade outlet stricture who underwent bougie dilatation. We believe that patients' discomfort largely results from pressure or irritation of the anal canal or anal sphincter. In these conditions, dilatation with intravenous sedation or under general anesthesia would be recommended. In this series, all inlet or outlet strictures were <1 cm in length. We achieved the goal for both diagnostic evaluation and balloon dilatation during the same session of endoscopy. Advantages of endoscopic balloon dilatation over bougie dilatation are (1) dilatation is performed under a direct endoscopic view; and (2) there is an open space between the distal tip of endoscope and the proximal end of balloon, which allows anal canal and anal sphincter to be undisturbed during dilatation, minimizing patients' discomfort.

Do all pouch strictures require treatment? Analogous to this question is that ileocolonic strictures in some patients with CD after ileocelectomy may not progress for years (20). It is still controversial regarding whether to treat

**Table 4.** Immediate Effect of Endoscopic Balloon Dilatation of Inlet and Outlet Strictures of IPAA

	Number of Strictures	Predilatation Stricture Scores ( $\pm$ SD)	Postdilatation Stricture Scores ( $\pm$ SD)	<i>p</i> Value
Inlet strictures	14	3.14 $\pm$ 0.77	0.57 $\pm$ 0.51	<0.001
Outlet strictures	15	2.21 $\pm$ 0.42	0	<0.001

asymptomatic patients with ileocolonic stricture and a similar question would be raised in the inlet and outlet stricture of IPAA. All patients in this study had symptoms. We believe that the symptomatic patients with pouch strictures should be treated, if a treatment modality is easy, safe, and effective, and the delay or avoidance of such treatment may result in adverse consequences. The alternatives for the balloon dilation would be medical therapy alone, pouch resection or reconstruction, or proximal diverting stoma (8, 18, 21), or surgical stricturoplasty (22).

All 19 patients in this series had concurrent inflammatory complications of IPAA, *i.e.*, CD of the pouch, pouchitis, and cuffitis. Although we do not know to what degree these inflammatory conditions contributed to the development of pouch strictures, we believe that it is necessary to medically treat the inflammation. The improvement in patients' symptoms, stricture scores, and QOL after endoscopic dilation might also attribute to the concomitant use of antiinflammatory agents or immunomodulators. For the patients with CD of the pouch in this study, a spectrum of medicines were given, including 5-aminosalicylate, immunomodulators, corticosteroids, and infliximab. Antibiotics were used for pouchitis. Topical mesalamine suppositories were used in patients in cuffitis. Our recent study showed that the use of topical mesalamine suppositories improved the symptom, endoscopic, and histologic scores in patients with cuffitis (23). This case series consisted of a mixed group of patients with different underlying diseases, *i.e.*, CD of the pouch, cuffitis, and pouchitis. This leads to the concomitant use of a variety of medicines, which could be the confounding factors for the assessment of sole effect of endoscopic dilation on pouch strictures. Nonetheless, combined endoscopic and medical therapy would be ideal for patients with both mechanical (*i.e.*, stricture) and inflammatory (*i.e.*, CD, pouchitis, or cuffitis). The major limitation of the study is the absence of a control group. However, because of ethical issues, a sham-controlled, randomized trial is not feasible. The patients with pouch-anal anastomotic strictures without the concurrent inflammatory conditions (*i.e.*, CD of the pouch, cuffitis, and pouchitis) were not included in the study. This type of stricture is often treated with bougie dilation without endoscopy in an outpatient setting.

The endoscopic balloon dilation has been investigated in patients with Crohn's strictures of the small bowel, colon, or anastomosis. The majority of the studies were retrospective and colonoscope was used. Measurement of outcome included symptom relief (9–11, 24, 25) and avoidance of surgery (9, 24). There is little literature on pouch stricture and treatment. This is the first study of its kind using an upper endoscope and a through-the-scope balloon to dilate pouch stricture. An upper endoscope has advantage over adult or pediatric colonoscope or flexible sigmoidoscope, for being small-caliber and more flexible. We expanded the variables of outcome measurement used in the literature by assessing patients' symptom scores, QOL scores, stricture scores, and need for surgery. This might help us to assess results from the

endoscopic dilation therapy with a confounding factor of concurrent medical therapy. We assumed that subjective symptom score and QOL score were more likely affected by concurrent medical therapy than stricture score measured during endoscopy. We believed that stricture scores before and after endoscopic treatment more likely reflected the effect from the balloon dilation than that from the concurrent medical therapy. To our knowledge, there are no validated stricture scores in IBD available. The stricture scores designed and used in this study need to be validated in future multicenter, randomized trials. No doubt there was intraobserver and interobserver variation in measuring the degree of strictures. We would speculate that interobserver variability would be greater than intraobserver variability. To maximize consistency in assessing degree of strictures, a single endoscopist performed all pouch endoscopy and dilations.

We realized that there was a issue of noncompliance with a high rate of dropout, which could be due to (1) the majority of patients from out of state at a great geographic distance from authors' institution; (2) some patients might feel better after initial endoscopic dilation together with medical therapy; and (3) two patients lived out of state lost their insurance coverage. To make sure that noncompliance in some patients was not due to the deterioration of symptoms or disease conditions, follow-up telephone contact was attempted. Because of its small sample size, the data were only analyzed per protocol.

In summary, endoscopic balloon dilation of pouch inlet and outlet strictures appears feasible and safe. Endoscopic dilation, in combination with medical therapy, may prolong or avoid surgical interventions in the majority of patients. The long-term follow-up is warranted.

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