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Outcomes of Serial Dilation for High Grade Radiation-Related Esophageal Strictures in Head and Neck Cancer Patients

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Abstract

Objective—Dysphagia and esophageal stricture are frequent consequences of treatment for head and neck cancer. This study examines the effectiveness of the antero-grad-retro-grad rendezvous procedure and serial dilations in re-establishing esophageal patency to allow return to oral diet and gastrostomy tube removal in a cohort of patients with complete or near-complete esophageal stricture following non-surgical cancer treatment.

Study Design—Retrospective review of patients treated with radiation therapy with or without concurrent chemotherapy presented with complete or near-complete esophageal stricture. Patients underwent serial dilations using combined antero-grad-retro-grad dilation (rendezvous) techniques.

Methods—Medical records of patients having undergone treatment between 2006 and 2012 were reviewed and semi-structured interviews were also conducted to determine current swallowing function and actual patient experience. The primary outcome was swallowing improvement that allowed for return to oral diet and/or gastrostomy tube removal. Outcomes were compared between patients with complete and near complete (<5 mm diameter) strictures and univariate analysis performed to identify associations between patient, cancer, and treatment characteristics on odds of gastrostomy tube removal.

Results—Twenty-four patients (Median age, 59.5 yrs; 63% male; 91% Caucasian) underwent treatment. 50% of patients had complete occlusion of the esophageal lumen. The majority (92%) patients underwent either antero-grad (54%) or combined antero-retro-grad (38%) approach. Following a median (IQR) 9 (6-20) dilation sessions, 42% of patients were able to return to an oral

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diet and/or had their gastrostomy tube removed. This outcome was independent of whether the stricture was complete or near complete ($p=0.67$). Of patients who had their gastrostomy tubes removed, only 33.3% had ever smoked, compared to 92.3% of those whose tubes were not discharged ($p=0.007$).

Conclusions—Recannulation is possible even in cases of complete or near-complete stricture. Several factors appear to impact the likelihood of successful outcome, but in this study, only patients with a history of smoking had a significantly lower likelihood of return to full oral diet.

Keywords

combined antegrade and retrograde dilation; rendezvous procedure; esophageal stricture; radiation complications; head and neck cancer; dysphagia; gastrostomy tube dependence

Introduction

Pharyngoesophageal toxicities have been increasingly encountered¹ since the first radiation-induced esophageal stricture was reported in 1968². It is now estimated that greater than 40% of head and neck cancer patients who receive radiation develop clinically significant treatment-attributable dysphagia¹ and between 3.3% and 23% develop esophageal strictures^{1,3,4}. Strictures originate from sufficient mucosal injury or mucositis during treatment to later result in coalescence of approximating pharyngeal or esophageal mucosa and formation of partial or complete obstruction⁵. Pathophysiologically, coalescence and obstruction is mediated by fibrosis caused by obliterative endarteritis, which leads to esophageal wall ischemia. In addition to fibrosis, muscular activity controlling peristalsis becomes disordered.

Several factors have been associated with stricture development including higher radiation dose to esophagus^{3,6} larynx⁷, and pharyngeal constrictors⁸, certain fractionation schedules⁹, pre-treatment presence of nasogastric or gastrostomy tube^{3,10}, combined therapy (i.e. radiation + chemotherapy)^{1,4,9,11}, laryngeal or hypopharyngeal primary cancers^{1,9}, female gender⁹, high-grade mucositis¹², and taxane-based chemotherapy^{4,13}. However, there is still considerable variability in reported risk factors and their relative contribution to stricture formation are not fully elucidated.

Regardless of etiology, quality of life consequences of esophageal strictures are significant¹⁴; particularly, for patients with high-grade strictures who are routinely gastrostomy tube dependent and require repeated dilations in attempts to re-establish a patent alimentary tract. Treatment of high-grade strictures is challenging and thus several different approaches have been attempted¹⁵⁻¹⁸. The ultimate goal of therapy is to return patients to an oral diet that permits gastrostomy tube removal. Additionally, improving swallowing sufficiently to allow passage of saliva also represents a substantial improvement in patient quality of life. To date, few studies have reported on long-term effectiveness of serial dilation at achieving this goal in patients with high-grade esophageal strictures. One recent case series described post-treatment swallowing outcomes for patients dilated for radiation-induced esophageal strictures, but did not report data specifically for those with high-grade strictures¹⁹. Another focusing only on high-grade strictures achieved a 60%

gastrostomy tube removal rate with combined antegrade and retrograde dilation approach²⁰. The aim of this study was to measure the effectiveness of serial dilations in re-establishing sufficient esophageal patency to allow oral intake for sustenance and/or enable gastrostomy tube removal in a cohort of patients with complete or near complete esophageal strictures following non-surgical treatment for head and neck cancer.

Materials and Methods

This study was performed in accordance with the Declaration of Helsinki, Good Clinical Practice, and was approved by the Vanderbilt Institutional Review Board (IRB#120094).

Patient Population

Included were head and neck cancer patients with pathologically confirmed squamous cell carcinoma treated with radiation therapy with or without concurrent chemotherapy that presenting to the Digestive Disease Center between 2006 and 2012 with complete or “near-complete” esophageal stricture. Complete esophageal stricture was defined as no identifiable lumen on endoscopic evaluation while “near-complete” refers to a stricture patency less than or equal to the 4 mm pediatric endoscope diameter. Additionally, those with recurrent disease or having had extirpative surgery for their head and neck cancer were excluded. Patients with lower grade strictures presenting for dilation were also excluded from this analysis.

Technique

Patients underwent esophageal evaluation and dilation under general anesthesia. The dilation algorithm described is shown in Figure 1. Degree of luminal occlusion was confirmed by traditional endoscopy employing a 9mm endoscope followed by a 4mm endoscope via the antegrade approach. If occlusion was not complete, an endoscope balloon (CRE non-wire guided; Boston Scientific, Marlborough, MA) was advanced through the opening and if any resistance is encountered, then combined antegrade and retrograde approach was used as described below. If no resistance to the CRE balloon, the stricture was routinely dilated to 12mm and subsequently inspected by antegrade esophagoscopy initially using the 4mm- and then the 9mm-endoscope.

When complete occlusion was encountered, the percutaneous endoscopic gastrostomy (PEG) tube was removed and a 4mm TNE scope advanced into the stomach. Gastroesophageal (GE) junction was identified and intubated and retrograde esophagoscopy used to confirm complete luminal occlusion (Figure 2a). Employing combined antegrade rigid cervical esophagoscopy by otolaryngology and retrograde esophagoscopy allowed for transillumination to localize the most optimal site for puncture. A Savary guidewire (Cook Endoscopy, Winston-Salem, NC) was used to puncture the occluded lumen either via 1) retrograde or antegrade approach. The wire was then carefully pulled through the mouth and the esophagus to the stomach and out of the gastrostomy. In both approaches, dilations occurred from above using Savary dilators up to 36F. Upon completion of dilations, the PEG tube was replaced and patency of the cervical esophagus confirmed by an antegrade esophagoscopy using a 9mm endoscope (Figure 2b). In all cases, serial Savary dilation

(Cook Endoscopy) was performed initially one week post-procedure and then every two weeks followed by monthly dilation to ensure continued luminal patency. There was fair consistency in recannulation techniques used; however, variability, adaptability, and creativity were often necessary based on degree and morphology of each strictured esophageal segment.

Data Collection

Data were collected retrospectively from the patient's medical record. Patient's cancer diagnosis and treatment often occurred at outside centers and associated records were requested and examined, when available, from all available sources. Data obtained included patient characteristics [age, gender, race], cancer characteristics [site, stage], cancer treatment information [radiation (y/n), type (e.g. intensity modulated radiation therapy), dose, concurrent chemotherapy (y/n) and type], swallowing function [baseline swallowing function prior to initiating cancer treatment, gastrostomy tube placement (y/n), timing and date of its placement (before, during, after treatment)], endoscopic procedure data [site of stricture, severity, number of dilations, successful re-cannulation (y/n), approach (anterograde, retrograde, combined anterograde-retrograde dilation (CARD), otolaryngology assist), and complications], duration of follow-up, and vital status. CARD is often referred to and is herein used synonymously with the "rendezvous procedure". The primary outcome was return to oral diet (no restrictions or sustenance with soft food) and/or gastrostomy tube removal due to improved swallow.

Interviews

Prospective semi-structured interviews were performed to determine current swallowing function and actual patient experience with esophageal stricture. Interviews were semi-structured in that specific questions were asked of all patients, with additional opportunities for patients to voluntarily and independently share their own perspectives. These were performed either in person or via phone depending on patient preference. Patients completed interviews voluntarily and were able to stop at any point. Patients were asked about the onset of dysphagia in relation to cancer treatment, when stricture was diagnosed, dilation effectiveness, current diet, whether they were still gastrostomy tube dependent, and if it had been removed. Duration of follow-up was defined as either time from first dilation to phone interview or, if phone interview unobtainable, time from first to last follow-up visit.

Analysis

All data were recorded in the secure web-based Digestive Disease Center REDCap (Research Electronic Data Capture) (1 UL1 RR024975 NCRR/NIH). REDCap is an application designed to support data capture for research studies providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources²¹. There was strict control and supervision of the data entry and access for this study.

All statistical analyses were performed using STATA® MP Version 12 software (STATACorp, College Station, TX). Univariate analysis for continuous variables used

median and interquartile ranges (IQR) and percentages for binary variables. Fisher's exact and rank-sum tests were used, where appropriate, to compare dilation effectiveness between patients with complete and near-complete strictures. Within these groups, parameters associated with successful return to oral diet (i.e. no limitations or soft diet) and/or gastrostomy tube removal were assessed. Secondary outcomes included patient-reported satisfaction with swallow (scale: 1 - 2 = unsatisfied; 3 = moderately satisfied; 4 - 5 = very satisfied) and whether they have experienced improvement from baseline dysphagia.

Results

Of 55 identified patients with esophageal strictures, 24 met criteria for inclusion [median (IQR) age 59.5 years (IQR 48.5 – 64), 62.5% male (15/24), 91.3% Caucasian (21/24), 67% current or prior smokers (16/24), 8.3% history of alcohol abuse (2/24); Table 1]. The remainder (n=31) had lower grade strictures and thus did not meet inclusion criteria. The larynx was the most common cancer site (12/24) followed by oropharynx (11/24) and oral cavity (1/24). Of those with available staging information (15/24), most (13/15) were treated for advanced cancer (III/IV). No patients had stage IVC cancer. In all, 91.7% (22/24) of patients had gastrostomy tubes at presentation for dilation, which were placed during (11/24), before (7/24), or after (4/24) their cancer treatments. A quarter of ever smokers continued to smoke through treatment for their stricture (4/16). Patients presented for first dilation a median of 8.0 months (IQR 6.4 – 20.7) after gastrostomy tube placement and, of those with known treatment end dates (N=18), a median of 9.5 months (IQR 5 – 21) after completing cancer treatment.

Cancer Treatment

All patients were treated with definitive radiation therapy (24/24) and most (87.5%; 21/24) received concurrent chemotherapy (21/24; Table 1). Specific chemotherapy data was available for 12/21 patients, of which 9/12 had combined taxane and platinum-based therapy. Intensity modulated radiation therapy (IMRT) was used in 12/19 (63.2%) patients who had available radiation data with the remainder undergoing conventional 3D conformal external beam radiation (7/19). For the remaining five patients, medical records and/or patients confirmed receiving definitive radiation therapy, though detailed records were not available for review. Overall, the median maximum IMRT dose to the cricopharyngeus/upper esophageal sphincter (UES) was 7080 cGy (IQR 6300 – 7336; N=10). Similarly, for patients who received conventional radiation therapy, this entire area was well within the region prescribed 7000 cGy and thus received at least this dose, and likely higher.

Stricture Management

In order, the initial endoscopic approach to stricture was anterograde (62.5%) followed by combined approach (37.2%). Strictures were universally present at or within 2 cm of the upper esophageal sphincter (UES) and were complete (no identifiable lumen) in 50% of patients (12/24). Otolaryngology assist was required for CARD in 10/12 complete strictures. All patients were successfully dilated at initial endoscopy. Overall, this population required a median of 9 dilations (IQR 6 – 20; range 2 - 37) over a median follow-up of 21.0 months (IQR 11.9 – 30.4) (Table 1).

Safety

Of 276 dilations performed in this population, there was a 1.8% complication rate that consisted of microperforations [N=2 pneumomediastinum (dilations #1, #2); N=2 subcutaneous air (dilation #3, #5)], which were managed conservatively with overnight observation and 1 major complication of delayed bilateral vocal fold paralysis that occurred after cervical esophageal stent placement (dilation #8) requiring tracheostomy. In all, 21.7% of patients experienced a complication with risk being independent to degree of their obstruction (near-complete 16.7% vs. complete 25%; $p=1.00$). All perforations occurred within the first 5 dilations.

Primary Outcomes

All patients with complete stricture (12/12) and 75% of those with near complete stricture (10/12) presented with gastrostomy tubes at the time of initial dilation ($p=0.48$) (Table 2). Patients with complete strictures presented for first dilation a median 11 months earlier after cancer treatment than those with near complete: median 6 months (IQR 5 – 10) compared to 17 months (IQR 11 – 48.5; $p=0.07$). After dilations, 42% of patients (10/24) were able to return to a full oral diet without limitations. Achievement of this outcome was independent of whether the stricture was complete ($p=0.67$). Among those with complete stricture, 33.3% (4/12) had their gastrostomy tube removed after dilations reestablished the ability to maintain oral nutrition, while 50% with near-complete stricture (5/10) had them removed as a result of dilations. Patients who eventually had their gastrostomy tube removed presented for dilation earlier, but not significantly more so, than those who remained dependent at the time of last follow-up [removed: 6 months (IQR 5 – 16) vs. remained: 10 months (IQR 5 – 33); $p=0.34$]. Of patients who had their gastrostomy tubes removed, only 33.3% (3/9) had ever smoked, while 92.3% (12/13) of those who remained dependent had ever smoked ($p=0.007$). The number of dilations was higher, albeit not significantly, among those with complete stricture [near-complete: median 7 (5.5 – 11) vs. complete 13 (IQR 8.5 – 23.5); $p=0.19$].

Secondary Outcomes

Of the 24 patients in the cohort, 18 were alive at the time of the study and 17 participated [1 declined interview] in semi-structured interviews. Nearly all patients (94.1%; 16/17) reported improved swallow due to dilations and 68% were “moderately” to “very satisfied” with their swallowing result. All interviewed patients were able to swallow their own saliva. Not surprisingly, those who were less satisfied were only able to take soft foods ($n=2$) or swallow their own saliva ($n=3$).

Discussion

Pharyngoesophageal toxicities from radiation with or without concurrent chemotherapeutic treatment (CRT) of head and neck cancer are frequent, appear to be increasing¹, and can be devastating. Here, we explore the effectiveness of serial dilation of CRT-related complete and near-complete esophageal strictures. In total, 55 symptomatic esophageal strictures were treated at our center between 2006 and 2012, of which 24 were high-grade (i.e. complete or near complete) and sufficient follow-up was available to assess treatment effectiveness. The

success rate of recannulation was 100% with otolaryngology assisting with rigid esophagoscopy in 83% of complete strictures. Nonetheless, despite successful recannulation, reestablishment of oral diet and removal of gastrostomy tube was achieved in 42% overall, and 33% and 50%, respectively, among patients with complete and near-complete esophageal stricture. Of those interviewed, 68% were “very satisfied” or “moderately satisfied” with swallowing after and during treatment. Overall, 94.1% admitted to significantly better swallowing than they had before initiating dilations.

Treating this patient population is complicated, evidenced by the multitude of approaches described in the literature¹⁵⁻¹⁸. Despite attention to radiation-induced stricture and its treatment, little is known about the long-term effectiveness of dilation techniques on swallowing and patient satisfaction in high-grade strictures. Presumably, the low incidence of high-grade stricture has resulted in most treatment outcomes studies being relatively small (N = 15)²²⁻²⁵ or case reports²⁶⁻²⁹.

However, two larger single institutional case series performed over a similar period as ours (2000 – 2008) do provide some insight. In one study of 45 patients who underwent CARD, resumption of oral intake occurred in 36/46 (80%) with gastrostomy tube removal possible in 27/45 (60%) in a median 116 weeks²⁰. Failure (gastrostomy tube dependency and NPO) was recorded in 9/45 (20%). Another more recent large case-series of 111 patients with stricture included a subset of patients similar to ours: 20 with esophageal patency <5 mm (“near complete”) and 23 with complete esophageal stricture¹⁹. While results were not specifically reported for this severe subset, the study's overall results are enlightening. Among their entire cohort (i.e. all stricture severities), an average 2.4 dilations were used per patient (range 1 – 8) resulting in 78% and 88% having their gastrostomy tube removed at 1- and 2-year follow-up, respectively. Interestingly, 4/23 (17%) with complete stricture remained gastrostomy dependent despite repeated dilations with two of four becoming diet independent at 18- and 24-months after starting treatments. In contrast, our high-grade stricture patients required a median of 9 dilations over a 21-month median period resulting in a 42% PEG removal rate.

Discrepancy between the current study's results and those of Chapuy *et al.* is interesting especially since similar endoscopic dilation techniques were applied¹⁹. First, only 47% of strictures treated classified as high-grade by our criteria. Thus, the majority of the strictures reported on were less severe, more easily dilated, and, therefore, more amenable to durable dilation results. However, perhaps the most important differentiating factor between both Chapuy *et al.*¹⁹ and Goguen *et al.*²⁰ outcomes were that their stricture patients presented a median 3.6 and 4.2 months earlier after cancer treatment: 5.9 months and 5.1 months versus 9.5 months in our series. These series reported higher gastrostomy tube removal rates, but was not specific to high-grade strictures in one, while the other reported a 60% rate²⁰ with substantially fewer required dilations (median 3 versus 9). Earlier recognition may prevent more severe strictures from developing and also translate into dilations of less fibrotic and more easily distensible segments.

Supporting this assertion is the finding that when initial dilation occur >6 months after CRT there was a 2.4-fold increased odds of dilations failing to restore sufficient oral nutrition to

allow gastrostomy tube removal¹⁹. This corresponds with data herein indicating that patients who were able to achieve gastrostomy removed presented a median 4-months earlier than those that remained dependent. While not a statistically significant difference ($p=0.33$) likely due to inadequate statistical power, this finding raises the question whether early detection of strictures results in better patient outcomes.

Another distinction between our study and Chapuy *et al.* was the distribution of primary site; laryngeal cancers represented 50% in our series compared to 13.5% in theirs¹⁹. Moreover, their population included 35% advanced T-stage (T3/4) compared to 13/15 of our population. In this study, 63% of patients with high-grade esophageal strictures were treated with IMRT. While IMRT is a useful technique to help reduce normal tissue toxicity and still deliver comparable dose to the tumor³⁰, dose inhomogeneity can result in “hot spots” within the treatment volume or closely associated surrounding normal structures. In our cohort, with a larger percentage of patients having laryngeal primaries, the proximal inferior constrictors and esophagus are at increased risk of high-dose exposure compared to conventional radiation techniques. Dose greater than 50 - 60 Gy to the larynx and inferior constrictors has been associated with significantly increased risk of stricture^{4,7,31}. Studies comparing conventional radiation therapy to IMRT are mixed; with some reporting better swallowing with IMRT^{32,33} while others found no added benefit^{34,35}. One recent study found that IMRT increased the risk of cervical esophageal stricture, though the significance may be overstated as there was no incidence of stricture and somewhat decreased use of concurrent chemotherapy in the patients who underwent conventional treatment³⁶. Attempts to limit the constrictor and esophagus dose (when not involved) below 50 Gy becomes an important consideration in IMRT planning, though this may often be challenging when treating laryngeal tumors regardless of radiation technique. In all, these findings highlight the important role that radiation dose and target volume play in the pathogenesis of pharyngoesophageal sequelae⁵.

Some evidence suggests that tobacco use is a risk factor for esophageal stricture formation. Specifically, patients treated with endoscopic mucosal resection of neoplastic Barrett's esophagus had nonsignificantly increased odds of developing esophageal stricture if patients had greater than or equal to 25 pack-years of smoking (Adjusted OR 3.33, 95% CI 0.929 – 12.1)³⁷. Another study of head and neck cancer patients treated with both total laryngectomy and radiation therapy, found an incidence of esophageal stricture of 33% and alcohol and tobacco use were contributing factors to formation³⁸. Another study failed to demonstrate an increased risk of stricture formation based on smoking status¹².

Perforations were the most common complication, which occurred in 1.8% of the 276 procedures performed and impacted 21% of patients within the first 5 dilations. This compares favorably with the 4% rate reported by Chapuy *et al.*¹⁹ and 29% rate in another series of 63 CARD procedures²⁰. Small perforations were most common and were treated conservatively with overnight observation and monitoring. Perforation rates in near-complete and complete esophageal stricture recannulation are expectedly higher than the 0.033% reported for routine esophagogastroduodenoscopy (EGD)³⁹ and 0.4% for EGD with dilation⁴⁰. They occur when the guide wire is passed through the blind pouch separating the proximal and distal segments. Often the strictured segment is quite narrow, thus the wire

may be passed extraluminally before passing into the opposing pouch. These perforations can predispose toward mediastinitis and therefore, overnight observation with chest imaging and appropriate surgical consultation is recommended if significant neck or chest crepitus are encountered. The only major complication, not previously described in the literature was delayed bilateral vocal fold paralysis occurring after polyflex stent placement in the cervical esophagus. This required urgent tracheotomy and hospitalization. At last examination, approximately 1 year later, vocal fold paralysis persisted.

This retrospective cohort study demonstrates the difficulty in managing high-grade radiation-induced esophageal strictures and found that independence from gastrostomy tubes was possible in 42% of patients. Despite several important findings, this study does have limitations that deserve mention. First, the Digestive Disease Center is a tertiary care center and therefore patients presented from a large catchment area. Thus, most patients were treated at outside institutions and not all clinical data were accessible or retrievable for review and analysis. This included information on staging, chemotherapy regimen, and radiation schedules. Second, due to incomplete records and low incidence of high-grade strictures, the cohort was relatively small potentially providing inadequate statistical power to identify important associations and to perform multivariate analysis.

Conclusion

Radiation-induced esophageal strictures cause significant dysphagia and, in severe cases, gastrostomy tube dependence among head and neck cancer patients. This study demonstrates that, even in cases of complete or near complete stricture, recannulation is possible, and that through serial dilations over 40% of patients can have their gastrostomy tube removed and over 90% have improved quality of life with the ability to swallow their own saliva. Several factors appear to impact likelihood of return to oral diet and gastrostomy tube removal, but in this study, only patients with a history of smoking had a significantly lower likelihood of return to complete oral sustenance. Validity of this and other associations is uncertain and future work is required to better understand why these strictures develop and how these high-grade strictures can best be treated.

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Figure 1. Esophageal Stricture dilation algorithm

Figure 2. Pre- and post-recannulation of complete radiation-induced esophageal stricture; 2a: Image from retrograde esophagoscopy of stricture at level of upper esophageal sphincter, 2b: Image from anterograde esophagoscopy after recannulation

Table 1
Patient Characteristics and Treatment

Age, median years (IQR)		59.5 (48.5 – 64)
Gender	Male	62.5%
	Female	37.5%
Race (N=23)	Caucasian	91.3%
	African American	8.70%
Smoking	Ever smokers	66.7%
	Smoker during dilations	16.7%
Alcohol	History of abuse	8.33%
Cancer site	Larynx	50.0%
	Oropharynx	45.8%
	Oral cavity	4.17%
AJCC Stage (N=15)	I/II	13.3%
	III/IV*	86.7%
Treatment modality	Radiation alone	12.5%
	Chemoradiation	87.5%
Radiation Type (N=19)	Conventional	36.8%
	IMRT	63.2%
Gastrostomy at presentation for dilation		91.7%
When was it placed?	Before treatment	31.8%
	During treatment	50.0%
	After treatment	18.2%
Placement to First Dilation, median days (IQR)		245 (196 – 631)
Stricture Type	Near complete	50%
	Complete	50%
Initial Dilation Approach	Anterograde	62.5%
	Combined approach	37.5%
Total Dilations Performed, median (IQR)		9 (6 – 20)
Dilation Period, median days (IQR)		639.5 (362 – 928)
Gastrostomy removed/return to normal diet		42%

* None with stage IVC disease

Table 2
Outcomes of Recannulation after anterograde-retrograde rendezvous procedure

	Near Complete Stricture (N=12)	Complete Stricture (N=12)	P
G-Tube at Presentation	83.3%	100%	0.48
Number of dilations, median (IQR)	7 (5.5 – 11)	13 (8.5 – 23.5)	0.19
G-tube removed/return to normal diet	50%	33.3%	0.67

*
 G-tube = gastrostomy tube