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ENDOSCOPIC BLIND LIMB REDUCTION WITH SEPTOTOMY FOR THE TREATMENMT OF CANDY CANE SYNDROME AFTER ROUX-EN-Y GASTRIC BYPASS. A PILOT FESIBILITY STUDY

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Dennis Yand MD is a consultant for Microtech, Medtronic, Olympus, FujiFlim, Apollo Endosurgery
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Bello Vincentelli, Gustavo MD is a consultant for Teleflex Medical Device Company
The remaining authors have no conflict of interest to declare

Abstract:
Background:
Candy cane syndrome (CCS) refers to patients with a long and symptomatic blind afferent roux limb (BARL) after Roux-en-Y gastric bypass (RYGB). Revisional surgery is efficacious but can be cost prohibitive.
Methods:
We describe endoscopic blind limb reduction (EBLR), that converts the BARL into a “common channel” and eliminates food pooling, thereby improving symptoms. Patients that did not have a complete symptomatic response underwent a repeat EBLR or EBLR with septotomy (EBLR-S) based on residual BARL length.
Results:
A total of five patients with CCS underwent the EBLR procedure. Mean age 60.4 years, average BARL length 5.8 cm, median Charlson comorbidity index of 3. Technical success was achieved in all 5 patients (100%). Symptom resolution was achieved in all 5 patients (100%). Two patients required a second procedure.
Conclusion:
EBLR may be a potentially safe, efficacious and cost-effective alternative to surgery in patients with CCS. Further prospective studies are needed.

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Patient No.	Age	Gender	Time since RYGB	Charlson Comorbidity index	BARL length prior to intervention	EBLR	Symptomatic response	BARL length on repeat EGD	Repeat intervention	Time between first and second procedure	Follow up period	Symptomatic response during follow up
1	51	F	11 months	3	6 cm	Yes	Incomplete	4 cm	Yes *	6 weeks	1 year	Complete
2	72	F	12 months	3	5 cm	Yes	Complete	2 cm	No	NA	8 months	Complete
3	56	F	9 months	2	6 cm	Yes	Complete	2 cm	No	NA	3 months	Complete
4	52	F	6 years	2	7 cm	Yes	Complete	3 cm	No	NA	3 months	Complete
5	71	M	18 months	4	5 cm	Yes	Incomplete	2 cm	Yes **	8 weeks	6 months	Complete

Table 1

ENDOSCOPIC BLIND LIMB REDUCTION WITH OR WITHOUT SEPTOTOMY FOR THE TREATMENMT OF CANDY CANE SYNDROME AFTER ROUX-EN-Y GASTRIC BYPASS. A PILOT FESIBILITY STUDY.

INTRODUCTION:

Candy Cane Syndrome (CCS) was first described in 2007 and refers to a constellation of post-prandial abdominal pain, nausea and vomiting that is caused by the preferential flow of enteral contents into an excessively long bling afferent roux limb (BARL) after Roux-en-Y gastric bypass (RYGB). [1] Symptoms are frequently debilitating and in extreme cases may lead to food aversion, cachexia and rupture of the BARL. [2] The diagnosis of CCS is frequently challenging due to symptom overlap with other disorders such as dumping syndrome, ulcer disease etc. and requires a high index of suspicion. The radiographic or endoscopic appearance of a long or dilated BARL that preferentially fills with radio-contrast, should prompt a diagnostic workup. The true prevalence of CCS may be higher than is currently estimated and expected to rise with the increasing number of RYGB's being performed worldwide.

Surgical resection of the BARL has been considered standard of care. While highly efficacious, surgery can be cost prohibitive and is frequently associated with a high risk (up to 25%) of adverse events. Patients with complex medical problems, extensive surgical histories, and patients that are not nutritionally optimized are not considered surgical candidates. [3] Such patients may go untreated, sometimes for several years following the RYGB. Given the increasing prevalence of CCS and the high cost and morbidity associated with surgery, there is a need to develop a minimally invasive, efficacious and cost-effective treatment for patients with CCS.

METHODS

Study design:

This was a prospective series of five patients who underwent Endoscopic Blind Limb Reduction (EBLR) for the management of CCS. The study was conducted at a large tertiary referral center under a prospective registry was approved by our IRB. All patients were followed in clinic 1 month after the EBLR procedure and underwent a follow up upper endoscopy to ensure healing. Patients with residual symptoms or inability to progress to solid food underwent a repeat endoscopic procedure. Patients with a residual BARL length of < 2 cm underwent EBLR and patients with a BARL length of > 2 cm, underwent EBLR-S. Patients were monitored for immediate adverse events after procedure and followed for delayed adverse events after procedure via phone or clinic visits.

Outcome definitions:

The main aim of our study was clinical success that was defined as resolution of post-prandial symptoms and the ability to restart a solid diet. Technical success was defined as the ability to complete all intended procedure steps.

Patient Characteristics:

A total of five patients with a diagnosis of CCS were enrolled after a detailed evaluation that included history, diagnostic testing and/or prior endoscopic evaluation. All 5 patients were referred by our bariatric surgical service and were deemed high risk for surgical intervention. Prior to the procedure, all patients were seen in a clinic to discuss the risks and benefits of this novel technique and verified informed consent was obtained. All procedures were performed under general anesthesia in the left lateral position by an endoscopist with experience in endoscopic suturing and bariatric endoscopy (KK). (Table 1)

Procedure Description:

Endoscopic blind limb reduction (EBLR):

Using a gastroscope and an endoscopic suturing device (Appolo OverStitch, Boston Scientific, Marlborough, MA) a single suture was applied at each end of the inter-jejunal septum (IJS). (Fig 1a) With each suture, multiple passes or bites were taken while applying constant outward suture traction and after the desired BARL length was achieved, a cinch was applied. (Fig 1b). Use of the described technique results in shortening of both the BARL and IJS and creation of a common channel or pouch that extends from the gastro-jejunal anastomosis above to the afferent limb below (Fig 1c). All patients were started on a liquid diet the same day and advanced to a solid diet as tolerated.

Endoscopic blind limb reduction with septotomy (EBLR-S):

Using a linear echoendoscope, the IJS was thoroughly evaluated to exclude major blood vessels and adjacent organs. Following this a repeat EBLR was performed, and two sutures were applied at either end of the IJS, using the technique described above. A scissor type electrosurgical knife (Clutch Cutter, Fujifilm Medical, Tokyo, Japan) was then used to dissect the IJS along a horizontal plane that is equidistant from the sutures (Fig 1d). A hemostatic clip was applied at the apex of the septal dissection. Water soluble radiocontrast was subsequently injected into the gastric pouch to exclude leaks or perforations. Both procedure techniques have been previously described in video format. (4)

RESULTS

Patient and procedure characteristics:

Five patients (4 females and 1 male) were included, mean age 60.4 years, average BARL length 5.8 cm (range 5-7 cm), median Charlson comorbidity index of 3. All patients were deemed unsuitable for surgical management. 3 patients had RYGB within the last year. One

patient had RYGB 1.5 years ago and one patient had it 6 years ago. Follow-up ranged from 3 months to a year. (Table 1)

Study outcomes and adverse events:

Technical success was achieved in all 5 patients (100%). Clinical success was achieved in 3 of 5 patients after the first procedure. Two patients with incomplete symptom resolution underwent a repeat intervention. Following this, both patients experienced complete resolution of symptoms (100%). Amongst the two patients with an incomplete clinical response, the first patient underwent a repeat EBLR procedure (Fig 2), and the second patient underwent a repeat EBLR procedure with septotomy (Fig 3). Following the second procedure, both patients had resolution of their symptoms and were able to restart a solid diet.

There were no major early or delayed adverse events in any of the procedures. Mild self-limited bleeding was encountered in one patient and stopped spontaneously after cinching. The most common minor adverse event was mild nausea and abdominal pain that responded well to medical management and lasted for 2-3 hours post procedure.

DISCUSSION

Abdominal pain and nausea in post-RYGB patients present clinicians with a diagnostic challenge due to the wide range of potential causes. The diagnosis of CCS requires a high index of suspicion and is likely under-reported. If left untreated, patients can experience severe morbidity, a persistent aversion of solid food and a poor quality of life. Surgical revision remains the gold standard for management of such patients. While highly efficacious in carefully selected patients, revisional surgery can be associated with a high complication rate, particularly in patients that have poor nutritional status, multiple comorbidities or prior history of open surgery. With an increase in the obesity epidemic and number of patients undergoing RYGB, there is an urgent need to develop a more cost effective, safe, and efficacious treatment for patients with CCS.

In recent years, several endoscopic techniques have been developed. Examples of such techniques include endoscopic closure of the blind pouch, endoscopic revision of the gastrojejunostomy to redirect food to the Roux limb, the use of a lumen-apposing metal stent (LAMS) to connect the blind end to the efferent limb and a magnetic compression wire cutting septotome [4-9]. While initially encouraging and minimally invasive, the described techniques are mostly single patient case descriptions without long term follow-up. In addition, there are concerns around adverse events, LAMS migration, LAMS indwelling time, septotome migration etc. Most currently described techniques are viewed as a bridge to more definitive surgical re-intervention after patient nutritional status is optimized. [10]

Pros of the described EBLR and EBLR-S techniques include, 1) it is minimally invasive and most patients can be discharged the same day, 2) it is more cost effective than surgery and most of the currently described endoscopic techniques, 3) in patients with long BARL

lengths, EBLR with or without septotomy may be repeated as many times as needed, to achieve the desired BARL length or until symptom resolution, 4) there are no in-dwelling devices such as a LAMS, 5) there are no potential complications from migration or retention of devices such as magnet and wire devices, 6) the re-modeling of the BARL and IJS into a common chamber, is permanent and the procedure may be considered destination therapy and an alternative to surgical re-intervention as opposed to a temporary bridge to more definitive surgery.

Drawbacks of our study are 1) low number of patients and limited assessment of efficacy and safety, 2) patients with long BARL's, may require repeat intervention due to the limited length of BARL and IJS that can be captured within the jaws of the suturing device during each session. This can be adjusted for, using multiple sessions / procedures. In patients with BARL lengths of < 2 cm a repeat EBRL is usually adequate. Longer BARL lengths may require a septotomy to dissect the previously contracted IJS and allow the suturing device to access deeper levels of the IJS, 3) patients without an IJS, or patients with abnormally thick IJS may not be optimally suited for this procedure. This is due to the inability to efficiently capture IJS length with currently available suturing devices in such patients.

CONCLUSION:

Surgical resection of the BARL remains the gold standard for treatment of CCS but can be cost prohibitive and highly morbid. Our study demonstrates that EBLR with or without septotomy provides a safe, effective and minimally invasive alternative to surgery and potentially paves the way for non-surgical destination therapy for carefully selected patients with CCS. Despite promising outcomes, further multicenter studies on larger patient cohorts with long-term follow up is warranted to establish the procedures efficacy and safety.

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