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PII: S2666-2507(22)00546-6
DOI: https://doi.org/10.1016/j.xjtc.2022.11.001
Reference: XJTC 1279

To appear in: JTCVS Techniques

Received Date: 12 August 2022
Accepted Date: 4 November 2022

Please cite this article as: Nahi S, Holmstrom A, Snyder M, Odell D, Use of intraoperative FLIP to guide decision making in an open achalasia case: Converting an esophagectomy to a more conservative open Heller myotomy with Dor fundoplication, JTCVS Techniques (2022), doi: https://doi.org/10.1016/j.xjtc.2022.11.001.

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Use of intraoperative FLIP to guide decision making in an open achalasia case: Converting an esophagectomy to a more conservative open Heller myotomy with Dor fundoplication

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COI: The authors declare no disclosures nor relevant or material financial interests that relate to the research described in this paper.

Funding:
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Central Picture: Real-time intraoperative FLIP measurements with initial and final distensibility index (DI) measures

Central Message: Intraoperatively FLIP in this case allowed for surgical decision making to be based on the most precise esophageal wall and esophagogastric junction metrics achievable, improving the patient’s outcome.

Word Count: 838
Glossary of Abbreviations

FLIP: functional luminal imaging probe
SMA Syndrome: superior mesenteric artery syndrome
GOO: gastric outlet obstruction
GE junction: gastroesophageal junction
POEM: peroral endoscopic myotomy
DI: Distensibility Index
POD: post operative day
EGJ: Esophagogastric junction
Intro/Abstract:
The functional luminal imaging probe (FLIP), a device developed and pioneered at Northwestern Medicine, is a diagnostic tool utilized to measure esophageal and sphincter physiology. Since its development, its use has expanded both intra- and post-operatively to directly evaluate treatment effect. However, utilization of this tool in an open esophageal case to provide real-time diameter, volumetric and pressure data, allowing for a tailored surgical intervention, has not been established in the literature. We present a novel case that demonstrates innovative use of an established diagnostic instrument that has the capacity to provide surgeons with valuable real-time intra-operative data. The authors propose intra-operative use of FLIP can support real-time surgical decision making and optimize clinical care.

Clinical Summary:
46-year-old man with past medical history notable for achalasia and superior mesenteric artery syndrome (SMA syndrome) complicated by gastric outlet obstruction (GOO), who presented after duodenojejunal bypass surgery for surgical evaluation of Type I achalasia. The severity of the patient’s achalasia symptoms was extensively impacting his quality of life. He underwent both Botox injections and attempted dilations of the GE junction which were only temporarily effective. An esophagram had demonstrated severe achalasia without mega esophagus (Figure 2). Shortly thereafter, he underwent peroral endoscopic myotomy (POEM) with only brief relief of symptoms. Typically creating a submucosal tunnel from the middle esophagus to the proximal stomach, followed by total or partial myotomy of the muscle, POEM differs from a classic myotomy procedure in that it does not involve an anti-reflux valve system confection or fundoplication at the time of the myotomy.¹ POEM was noted to be technically difficult due to
dense submucosal fibrosis with fusion of the submucosa and muscularis propria, and only a partial myotomy was performed, yielding an Eckardt score of 4 post-POEM. He underwent additional rounds of both Botox injections and attempted dilations which were only temporarily effective. In August 2021, the patient’s Interventional GI physician discussed the case with the Thoracic Surgery team. Given the severe nature of the patient’s achalasia and multiple failed interventions, esophagectomy was recommended for definitive treatment. Preoperatively, all options were discussed with the patient, and collaboratively a plan was decided upon, which included a likely esophagectomy unless a less invasive approach was deemed feasible. The patient provided his informed consent. IRB approval was not required, per institution.

In October 2021, at the major academic center where the patient received care, he underwent an exploratory laparotomy and lysis of adhesions with plans for an open esophagectomy. During the dissection and mobilization of the distal esophagus at the hiatus, less fibrosis and scarring was encountered than expected. Reconsidering the surgical options, colleagues from GI foregut surgery performed an intra-operative FLIP to assess if a more conservative surgical approach would be feasible. The initial FLIP measurement showed a DI of 1.5mm²/mmHg with a diameter of 7mm (Figure 1). With these data, the attending thoracic surgeon determined the patient was suitable for a more conservative approach of myotomy instead of the esophagectomy. Subsequently, an open hiatal hernia repair with Heller myotomy and Dor fundoplication was performed. The FLIP catheter was kept in place with the balloon inflated during the myotomy to allow for real-time monitoring. At the completion of the myotomy the DI was 9.1mm²/mmHg with a diameter of 13mm, which is greater than the literature supported value of 2.9mm²/mmHg.
and more than triple the starting value.² The case was uncomplicated and the patient was transferred to the floor in stable condition. Barium swallow study performed on post op day (POD) 2 showed no evidence of extraluminal contrast to suggest leak. The patient was transitioned to oral pain medications and advanced to a full liquid diet. The patient was discharged home on POD 3. At subsequent follow up visits, the patient has been asymptomatic, tolerating an oral diet well, and returning to work as a cook.

Discussion:

In the setting of specific pathology, namely achalasia, gastroesophageal reflux disease, esophageal stricture, and eosinophilic esophagitis, FLIP assessments have established their role in confirming diagnoses and assessing treatment efficacy.³⁴ FLIP compliments high-resolution manometry in allowing for work up of disease and assessment of medical versus surgical intervention.⁵ However, beyond this use, surgeons at the forefront of this technology have published data demonstrating further functionality. Namely, demonstrating EGJ distensibility measurements with FLIP as predictive of postoperative symptomatic outcomes.⁶⁷

This case emphasizes a novel application of this evolving tool: use of FLIP intraoperatively in an open case to allow for surgical decision making to be based on the most precise esophageal wall and esophagogastric junction metrics achievable (Video 1). In this case, the real time data provided by FLIP allowed the surgical team to proceed with a less invasive myotomy procedure, as compared to an esophagectomy, thereby improving the anticipated long term outcome for the patient.⁸ This innovative use of intraoperative FLIP did not require additional resources or training at our institution, and as such, represents an achievable opportunity for increased
implementation. For those institutions without intra-operative FLIP use and training, this case presents a possible space for expansion with opportunity to improve quality of care provided.
References:


Legend

Central Picture, Figure 1: Real-time intraoperative functional luminal imaging probe (FLIP) measurements with initial and final distensibility index (DI) measures.

Figure 2: Patient esophagram image taken 10 minutes after contrast drink, demonstrating severe achalasia.

Video 1: Discussion of intraoperative functional luminal imaging probe (FLIP) use and functionality between Skylar Nahi (Northwestern University Feinberg School of Medicine fourth year medical student), and Dr. Matthew Snyder (Northwestern Medicine General Surgery Chief Resident).