

Use of intraoperative functional luminal imaging probe 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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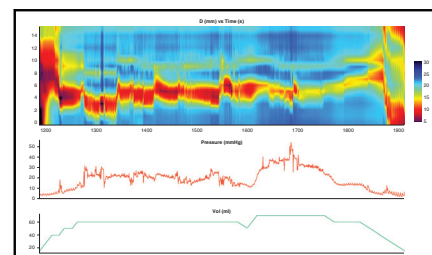
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Real-time intraop FLIP measurements with initial and final distensibility index measures.

CENTRAL MESSAGE

Intraoperative 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 outcome.

▶ Video clip is available online.

The functional luminal imaging probe (FLIP), a device developed and pioneered at Northwestern Medicine, is a diagnostic tool used to measure esophageal and sphincter physiology. Since its development, its use has expanded both intra- and postoperatively to directly evaluate treatment effect. However, the use 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 the innovative use of an established diagnostic instrument that has the capacity to provide surgeons with valuable real-time intraoperative data. The authors propose that intraoperative use of FLIP can support real-time surgical decision-making and optimize clinical care.

CLINICAL SUMMARY

A 46-year-old man with a medical history notable for achalasia and superior mesenteric artery syndrome complicated by gastric outlet obstruction 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 gastroesophageal junction, which were only temporarily effective. An esophagram had demonstrated severe achalasia without megaesophagus (Figure 1). Shortly thereafter, he underwent peroral endoscopic myotomy (POEM), with only brief relief of symptoms reported. 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 antireflux 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.

The patient underwent additional rounds of both Botox injections and attempted dilations, which were only temporarily effective. In August 2021, the patient's interventional gastrointestinal physician discussed the case with the thoracic

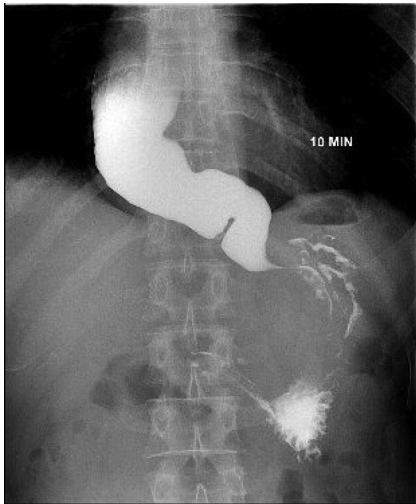


FIGURE 1. Patient esophagram image taken 10 minutes after a contrast drink, demonstrating severe achalasia.

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, which included a likely esophagectomy unless a less-invasive approach was deemed feasible. The patient provided his informed consent. Institutional review board approval was not required, per the 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 gastrointestinal foregut surgery performed an intraoperative FLIP to assess whether a more conservative surgical approach would be feasible. The initial FLIP measurement showed a distensibility index of $1.5 \text{ mm}^2/\text{mm Hg}$ with a diameter of 7 mm (Figure 2). 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 distensibility index was $9.1 \text{ mm}^2/\text{mm Hg}$ with a diameter of 13 mm, which is greater than the literature supported value of $2.9 \text{ mm}^2/\text{mm Hg}$ 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 postoperative day 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

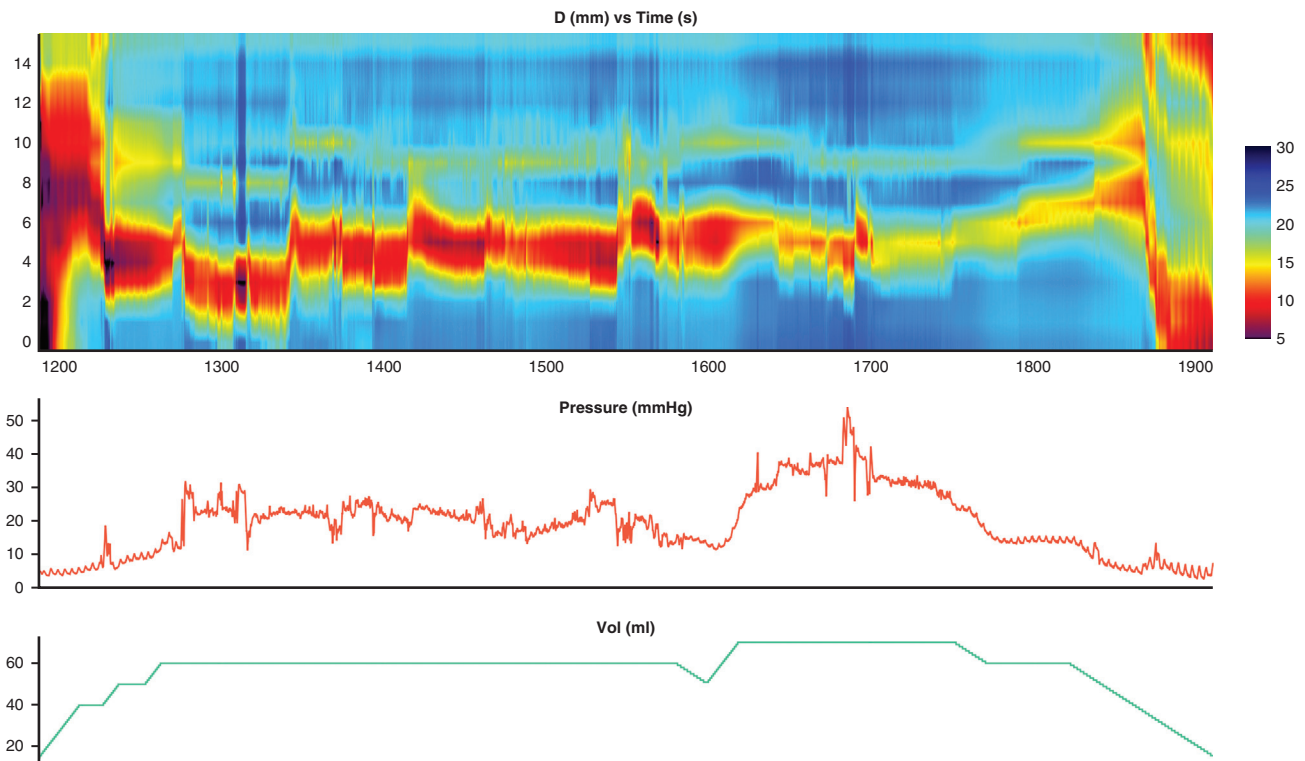


FIGURE 2. Real-time intraoperative functional luminal imaging probe (FLIP) measurements with initial and final distensibility index (DI) measures.



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). Video available at: [https://www.jtcvs.org/article/S2666-2507\(22\)00546-6/fulltext](https://www.jtcvs.org/article/S2666-2507(22)00546-6/fulltext).

home on postoperative day 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.^{3,4} FLIP compliments high-resolution manometry in allowing for workup 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 esophagogastric junction distensibility measurements with FLIP as predictive of postoperative symptomatic outcomes.^{6,7}

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 intraoperative FLIP use and training, this case presents a possible space for expansion with opportunity to improve quality of care provided.

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