Change in Distensibility Index with the change in volume in EndoFLIP is Associated with Postoperative Dysphagia during Hiatal Hernia Repair

Anuj Shah, MD[1], Duc T. Nguyen, MD, PhD, Leonora M. Meisenbach NP[1], Ray Chihara, MD, PhD [1,2], Edward Y Chan, MD[1,2], Edward A Graviss, PhD, MPH, Min P Kim, MD[1,2]

[1]Division of Thoracic Surgery, Department of Surgery, Houston Methodist Hospital, Houston, TX; [2]Department of Surgery and Cardiothoracic Surgery, Weill Cornell Medical College, Houston Methodist Hospital, Houston, TX; [3]Department of Pathology and Genomic Medicine, Houston Methodist Hospital, Houston, TX

Introduction

- EndoFlip is a measuring device that provides objective data about the minimal diameter (Dmin), cross-sectional area (CSA), and the distensibility index(DI) when it is placed across the gastroesophageal junction and filled to different volumes. This data can be obtained while performing hiatal hernia repair.
- Here, we postulated that decrease in the DI with increase in volume during hiatal hernia repair is associated with decrease in postoperative dysphagia since the esophagus has the ability to push through the barrier.

Patient Characteristics

Table 1. Patient characteristics

	Total (N=103)
Age (years), median (IQR)	64.0 (55.0, 71.0)
Male gender, n (%)	25 (24.3)
BMI (kg/m2), median (IQR)	29.6 (26.6, 33.6)
Ethinicity, n (%)	
White	95 (92.2)
Black	4 (3.9)
Hispanic	4 (3.9)
Procedure, n (%)	
Nissen	19 (18.4)
Toupet	56 (54.4)
LINX	28 (27.2)
LINX size	16.0 (15.0, 17.0)
Redo repair, n (%)	10 (9.7)
Hiatal hernia type, n (%)	
No hernia	5 (4.9)
Type I	42 (40.8)
Type II	1 (1.0)
Type III	55 (53.4)
Manometry (%), median (IQR)	0.9 (0.5, 1.0)
IRP, median (IQR)	4.6 (1.4, 8.3)
Demeester Score, median (IQR)	22.6 (10.8, 40.8)
Initial GERD-HRQL score, median (IQR)	23.0 (13.0, 29.0)
Initial Dysphagia score, median (IQR)	1.0 (0.0, 3.0)
Initial bloating score, median (IQR)	3.0 (1.0, 4.0)
Initial patient satisfaction, n (%)	
Satisfied	2 (2.0)
Neutral	13 (12.7)
Dissatisfied	87 (85.3)
Initial heartburn medications	97 (94.2)

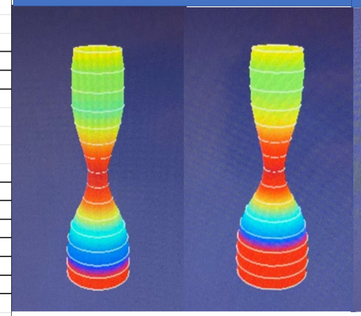
IQR, interquartile range; SD, standard deviation;
DI, distensibility index

Methods

- Included patients had undergone primary minimally invasive gastroesophageal reflux surgery with or without hiatal hernia repair at our institute between 2018 and 2020 with on of three procedures (Nissen, Toupet, Linx)
- All operations were performed with the assistance of the Da Vinci Xi Robot System (Intuitive Surgical, Sunnyvale, CA).
- EndoFlip measurements at the gastroesophageal junction were obtained at the beginning of the case, after crus closure, after barrier creation by inflating the balloon to 30mL. After completing the barrier creation, an additional measurement was obtained by inflating the balloon to 30mL and 40mL while the patient was in flat supine position.

Change in DI with increase in Balloon Volume

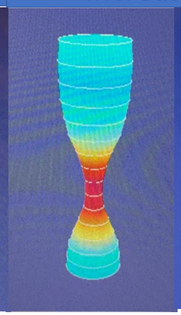
Decrease in DI



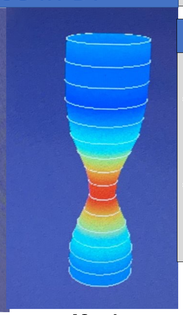
30 mL
Dmin 7,
DI 1.8
Pressure 21.6

40 mL
Dmin 6.9
DI 1.2
Pressure 31.6

Increase in DI



30 mL
Dmin 6.1
DI 1.1
Pressure 26.3



40 mL
Dmin 8.9
DI 1.3
Pressure 47.1

Results

Table 3. Outcomes

	Total (N=103)	DI change from flat 30 to flat 40		p-value
		Decrease or no change (*n*=37)	Increase (*n*=66)	
GERD-HRQL score, median (IQR)				
1 month after surgery	4.0 (2.0, 7.0)	3.0 (2.0, 5.0)	4.0 (2.0, 7.0)	0.21
Change from prior to surgery to 1 month after surger	-18.0 (-24.0, -6.0)	-18.0 (-25.0, -10.0)	-17.5 (-23.0, -5.0)	0.43
Dysphagia score, median (IQR)				
1 month after surgery	0.0 (0.0, 2.0)	0.0 (0.0, 1.0)	1.0 (0.0, 2.0)	0.08
Change from prior to surgery to 1 month after surger	0.0 (-2.0, 1.0)	-2.0 (-2.0, 0.0)	0.0 (-1.0, 1.0)	0.04
Bloating score, median (IQR)				
1 month after surgery	2.0 (1.0, 3.0)	2.0 (1.0, 3.0)	2.0 (1.0, 3.0)	0.79
Change from prior to surgery to 1 month after surger	-1.0 (-2.0, 1.0)	-1.0 (-2.0, 0.0)	0.0 (-2.0, 1.0)	0.26
Patient satisfaction at 1 month, n (%)				1.00
Satisfied	89 (88.1)	32 (88.9)	57 (87.7)	
Neutral	5 (5.0)	2 (5.6)	3 (4.6)	
Dissatisfied	7 (6.9)	2 (5.6)	5 (7.7)	
Heartburn medications 1 month after surgery, n (%)	35 (34.0)	13 (35.1)	22 (33.3)	0.85

IQR, interquartile range; SD, standard deviation;
Dmin (mm), minimum esophageal diameter; CSA (mm2), cross-sectional area; DI, distensibility index

- The analysis showed there was no correlation between absolute DI values with different volumes in the balloon and clinical outcomes.
- However, the patient who had a decrease or no change the DI with an increase in balloon volume from 30 cc to 40 cc had a significant decrease in dysphagia score by 2 points from before surgery to 1 month after surgery (scale 0-5) while a patient who had an increase in DI had no change in dysphagia score (p=0.04).

Conclusion

- The decrease in the DI with an increase in the volume in the balloon after the formation of the barrier is associated with a significant reduction in dysphagia after surgery.
- Being able to monitor this higher pressure which might be a marker for esophageal function suggests that EndoFlip might be a new marker to predict short term outcomes in Hiatal hernia Repair

HOUSTON Methodist LEADING MEDICINE