Quantifying Effect of Increasing Endoflip Balloon Volume on Gastroesophageal Junction Distensibility

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Background

- Intraoperative Endoflip is gaining popularity as a method of quantifying changes to the gastroesophageal junction (GEJ) during anti-reflux surgery (ARS).
- These measurements have been shown to differ depending on intraoperative variables[1,2].
- **Aim**: To further quantify changes in GEJ distensibility index (DI) with increasing Endoflip balloon volumes (BV).

Methods

- A retrospective review of a prospectively maintained ARS database was conducted between 2020-2023, including patients who underwent hiatal hernia (HH) repair and fundoplication with intraoperative Endoflip by a single surgeon.
- Patients were included if they had Endoflip measurements at more than one balloon fill volume (30, 40, or 50ml) at 10mmHg pneumoperitoneum.
- Endoflip measurements of minimum diameter (Dmin), intra-balloon pressure (IBP), cross sectional area (CSA), high pressure zone length (HPZ) and DI were compared at each BV using Kurskal-Wallis tests. Linear regression analysis was performed for DI measurements.

References:

[1] Su, B., Attaar, M., Wong, H., Callahan, Z. M., Kuchta, K., Stearns, S., ... & Ujiki, M. B. (2021). Using a standardized intra-operative endoflip protocol during fundoplication to identify factors that affect distensibility. *Surgical Endoscopy*, *35*, 5717-5723.

[2] Liu, M., Stefanova, D. I., Finnerty, B. M., Schnoll-Sussman, F. H., Katz, P. O., Fahey, T. J., & Zarnegar, R. (2022). The impact of pneumoperitoneum on esophagogastric junction distensibility during anti-reflux surgery. *Surgical Endoscopy*, 1-8.

Results

Patient demographics and operative details

	N = 106
Sex	
Male [N (%)]	44 (41.51)
Age at surgery [Median (IQR)]	60.41 (64.67)
BMI [Median (IQR)]	27.10 (24.80)
Prior Foregut Surgery [N (%)]	13 (12.26)
Fundoplication Type [N (%)]	
Hill	7 (6.60)
Nissen	1 (0.94)
Toupet	85 (80.19)
Linx	3 (2.83)
TIF	8 (7.55)
Mesh [N (%)]	67 (63.21)

Intraoperative Endoflip measurements

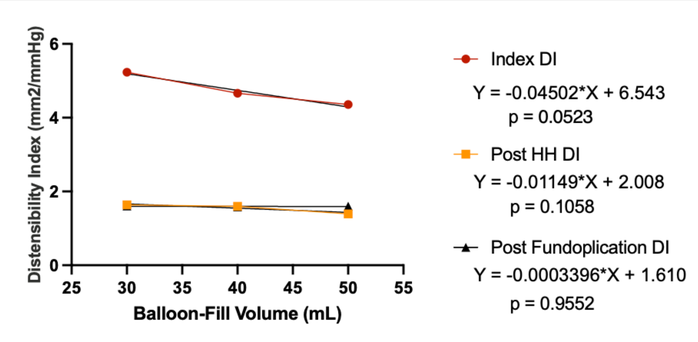
Timepoint	Measurement	30ml Balloon Fill Volume Median (IQR)	40ml Balloon Fill Volume Median (IQR)	50ml Balloon Fill Volume Median (IQR)
Preoperative	N	100	96	60
	Dmin (mm)*	11 (12)	12.70 (22.3)	15.35 (14.46)
	IBP (mmHg)*	18.75 (39.6)	29.40 (63.5)	48.0 (68.60)
	CSA (mm^2)*	94.5 (210.4)	127 (252)	185 (325)
	DI (mm^2/mmHg)	4.90 (18.97)	4.38 (12.23)	3.76 (10.50)
	HPZ (cm)*	1.5 (5.5)	1.00 (4.00)	0.5 (2.5)
Post HH Repair	N	92	89	53
	Dmin (mm)*	6.70 (8.10)	8.70 (9.50)	9.90 (8.20)
	IBP (mmHg)*	27.15 (32.80)	41.10 (47.40)	62.10 (63.80)
	CSA (mm^2)*	35.50 (113)	59.00 (150)	77.00 (136)
	DI (mm^2/mmHg)	1.37 (6.98)	1.34 (5.17)	1.23 (2.93)
	HPZ (cm)*	2.50 (3.0)	2.00 (3.50)	1.50 (3.0)
Post Fundoplication	N	95	92	56
	Dmin (mm)*	7.20 (6.30)	9.30 (9.2)	10.75 (9.30)
	IBP (mmHg)*	29.80 (45.00)	45.40 (81.10)	64.80 (91.90)
	CSA (mm^2)*	41.00 (79.00)	68.00 (137)	91.00 (161.0)
	DI (mm^2/mmHg)	1.44 (3.54)	1.46 (4.26)	1.28 (3.07)
	HPZ (cm)*	3.00 (4.5)	2.25 (5.00)	1.50 (4.50)

* P values <0.001 on Kurskal-Wallis test

Median Changes in CSA and IBP with Increasing Balloon Volume

		From 30ml-40ml	From 40ml-50ml
Preoperative	**ΔCSA (%)**	32.00mm^2 (39.3)	62.00mm^2 (50.00)
	ΔIBP (%)	8.60mmHg (48.25)	19.10mmHg(69.23)
	ΔDI (%)	-0.11 (-3.96)	-0.21 (-5.18)
Post HH Repair	**ΔCSA (%)**	21.50mm^2 (52.50)	22.00mm^2 (36.36)
	ΔIBP (%)	14.60mmHg (56.25)	19.30mmHg(45.22)
	ΔDI (%)	-0.03 (-2.46)	-0.08 (-5.16)
Post Fundoplication	**ΔCSA (%)**	20.50mm^2 (49.50)	22.50mm^2 (34.60)
	ΔIBP (%)	14.95mmHg (49.29)	18.85mmHg(40.04)
	ΔDI (%)	-0.01 (-1.39)	-0.04 (-3.18)

Linear Regression of DI with Increasing Balloon Volume



Conclusions

- While DI appeared to trend negatively with increases in balloon fill volume at 30, 40, and 50mL this did not reach statistical significance at any stage of the operation.
- On linear regression analysis, slopes were not statistically significantly different from zero.
- These findings suggest a proportional increase in cross sectional area and intra-balloon pressure with increases in balloon volume.
- Moreover, this suggests that post-fundoplication measurements of DI may be compared regardless of the balloon volume at which it was obtained.