TAILORED FUNDOPLICATION FOR GERD WITH IMPEDANCE PLANIMETRY (ENDOFLIP™)

Hoover Wu, Sara Ungerleider, Mikhail Attaar, Harry J Wong, Kristine Kuchta, Woody Denham, John Linn, Michael B Ujiki

2021 Annual Meeting

The American Foregut Society presents

AFS 2021: We're Back... Together!
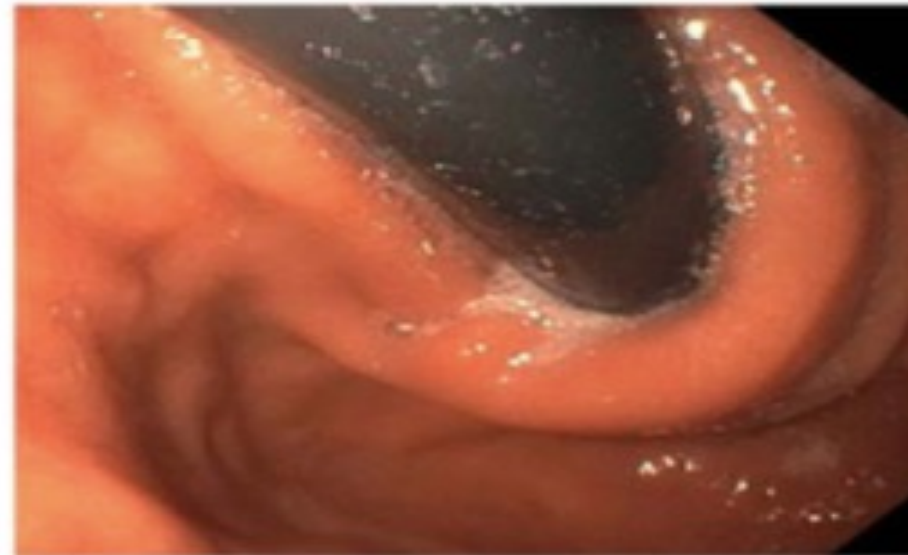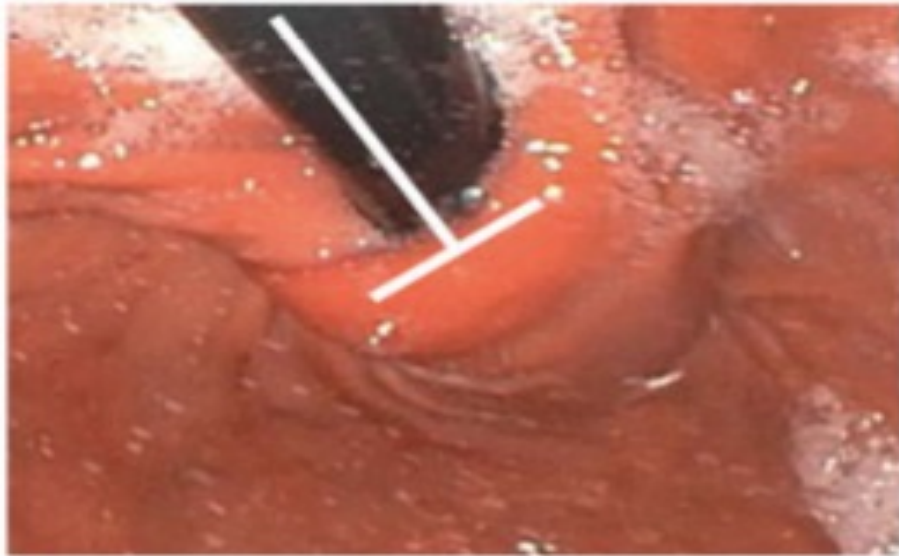
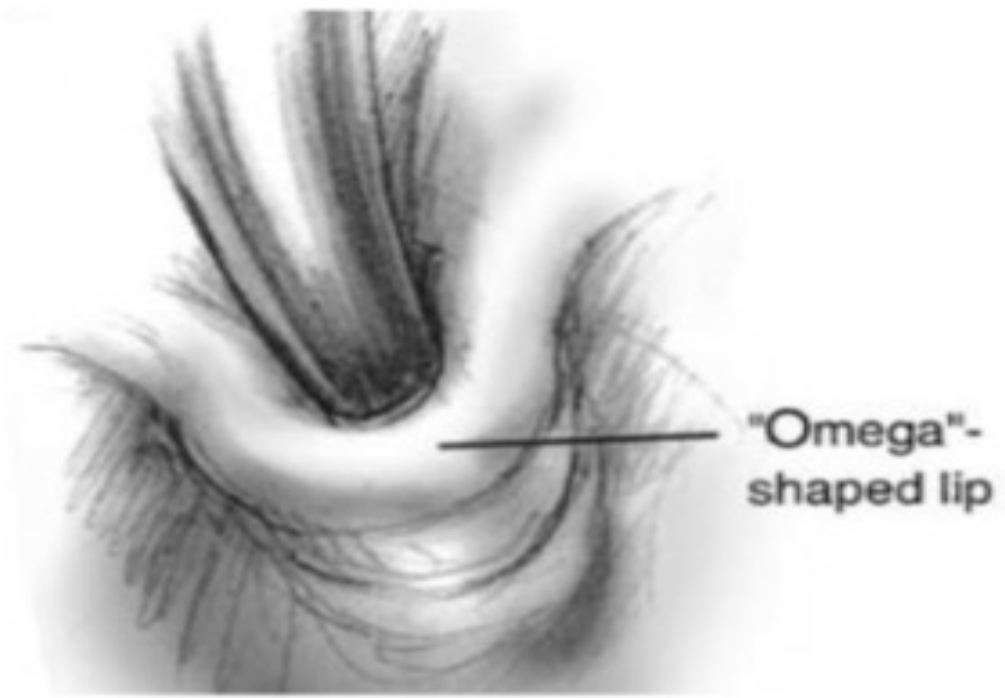*Gaylord Opryland | Nashville, TN*

September 23–26, 2021

Disclosures

Presenter has no disclosures

Co-Authors:
Mikhail Attaar receives grant funding from The Intuitive Foundation.

John Linn is a lecturer for Gore.

Michael B Ujiki is a board member for Boston Scientific, is a paid consultant for Olympus and Cook, is a lecturer for Medtronic, Erbe, and Gore, and receives grant funding from Medtronic.

Scope
Ant. groove
Lip
Post. groove
Body of valve "stacked coils"
"Omega"-shaped lip

1. Yadlapati R, et al. American Journal of Gastroenterology. 2018
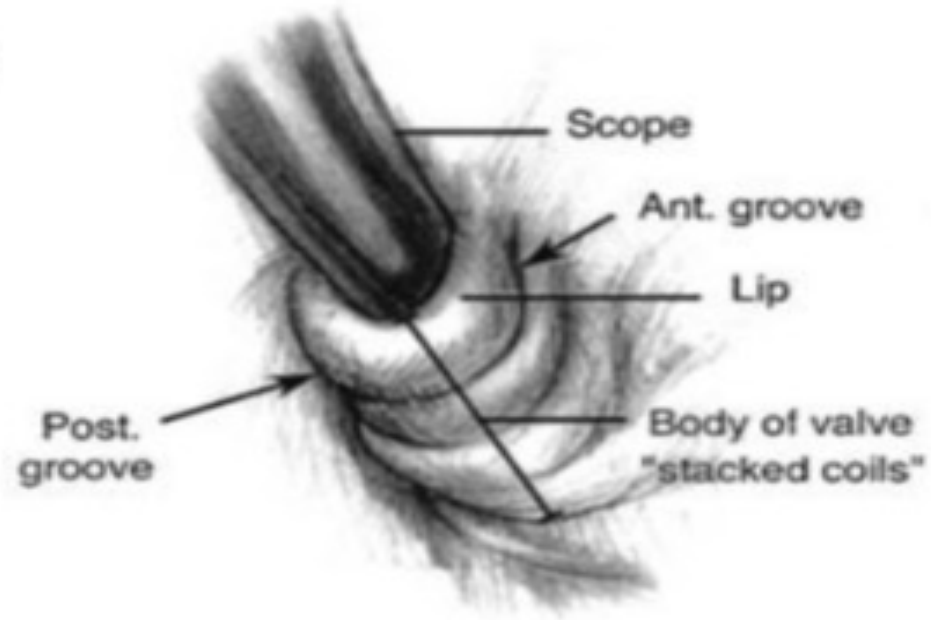
Impedance Planimetry
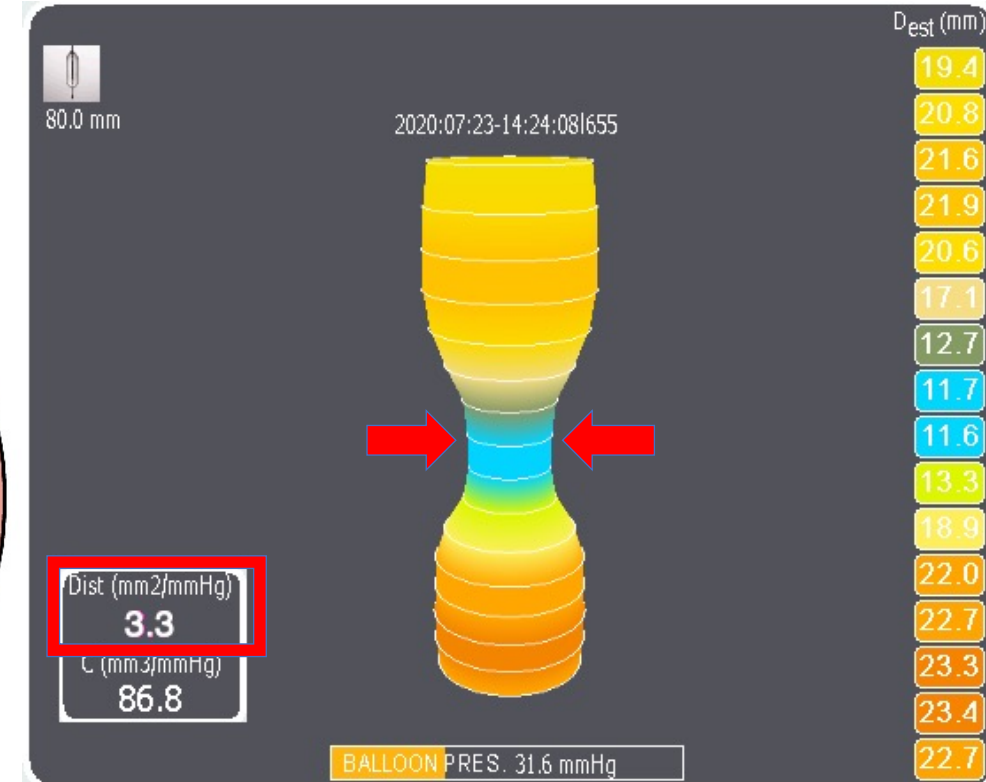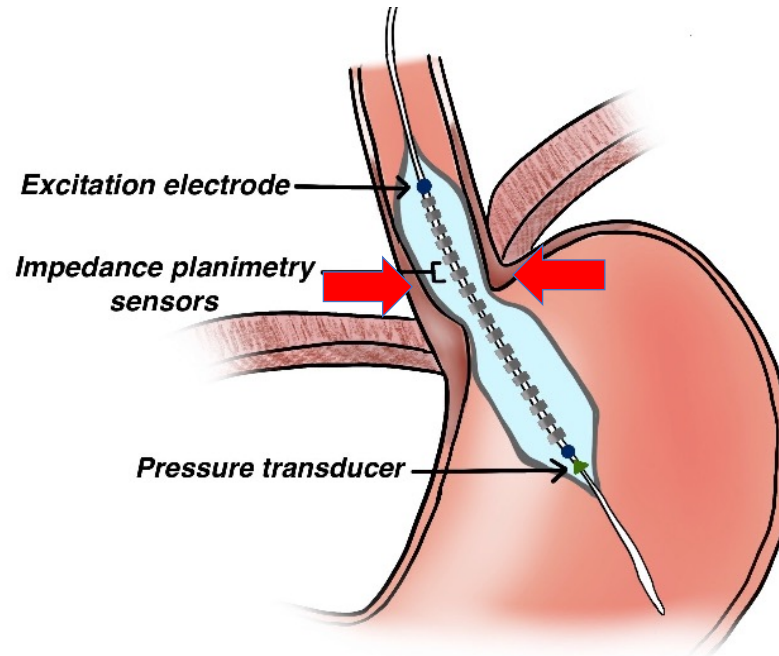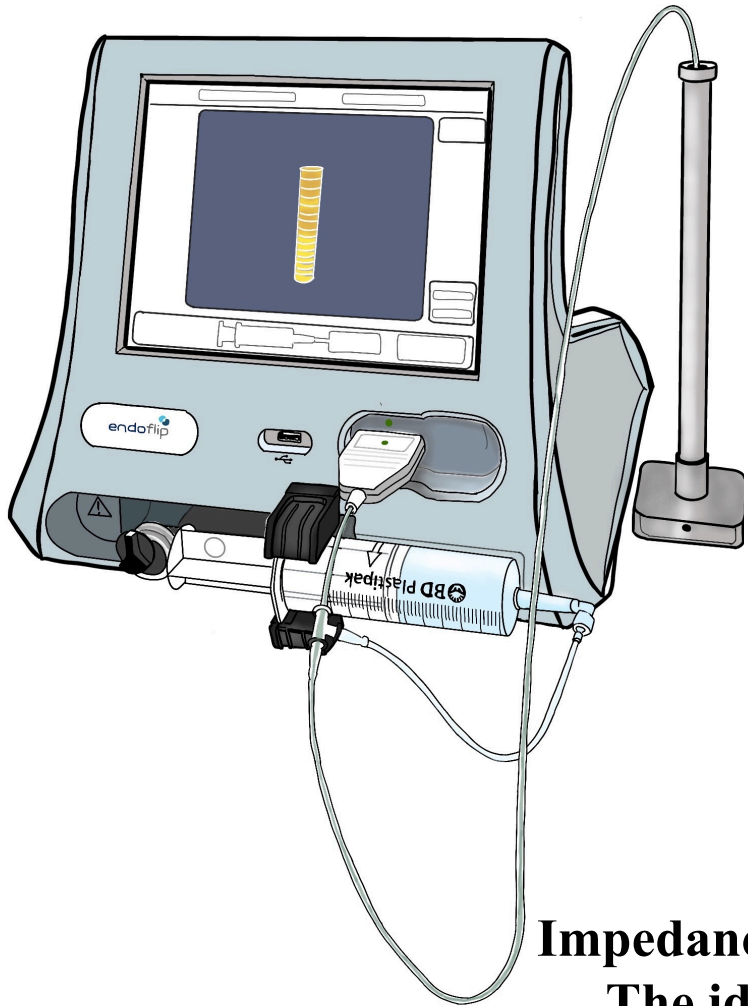
Impedance planimetry measurements predict patient outcomes.
The ideal fundoplication range of *2.0 – 3.5 mm²/mmHg*.[1,2]

1. Su B, et al. Surgical Endoscopy. 2020
2. Turner B, et al. Surgical Endoscopy. 2020

Objective

We aim to describe our institutional experience with a comprehensive algorithm that utilizes intraoperative impedance planimetry after hiatal dissection to decide whether a patient will undergo Nissen or Toupet fundoplication

Methods

- Data collection: Patients who underwent laparoscopic fundoplication 2008 to June 2021 were evaluated. Single surgeon, standard technique, stiff bougie. Non-FLIP group 2008 to December 2016 (N=248). FLIP group January 2017 to June 2021 (N=109).

- FLIP protocol: measurements were recorded at 40 mL balloon fill, no pneumoperitoneum

- Patient reported outcomes:
  - Reflux Symptom Index
  - GERD-health related quality of life questionnaire
    - Gas-bloat score
  - Dysphagia score
  - Satisfaction score

FLIP Algorithm
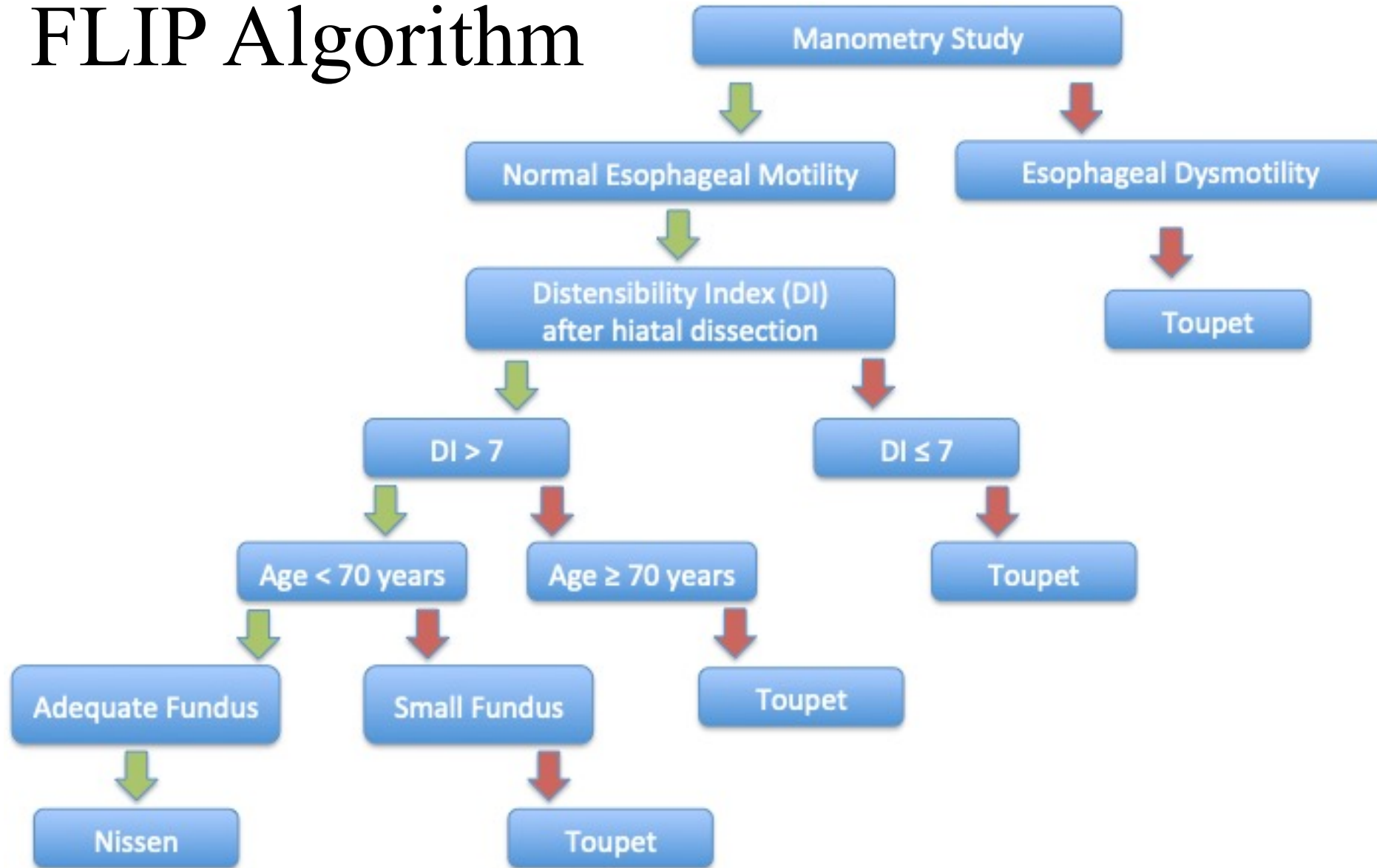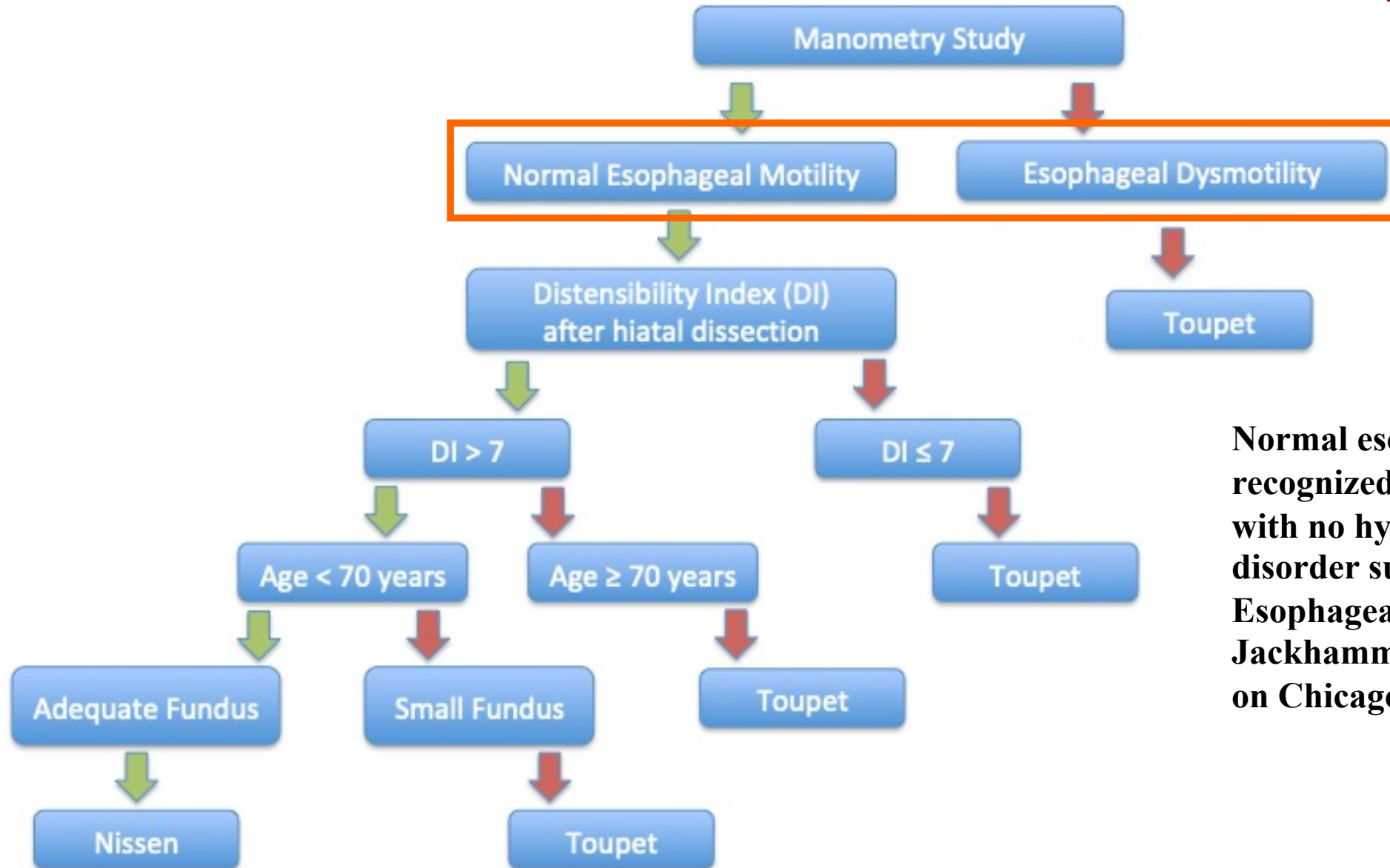
Normal esophageal motility was recognized as peristalsis > 70%, with no hypercontractile disorder such as Diffuse Esophageal Spasm or Jackhammer Esophagus based on Chicago Classification v3.0.

FLIP Measurements by Group
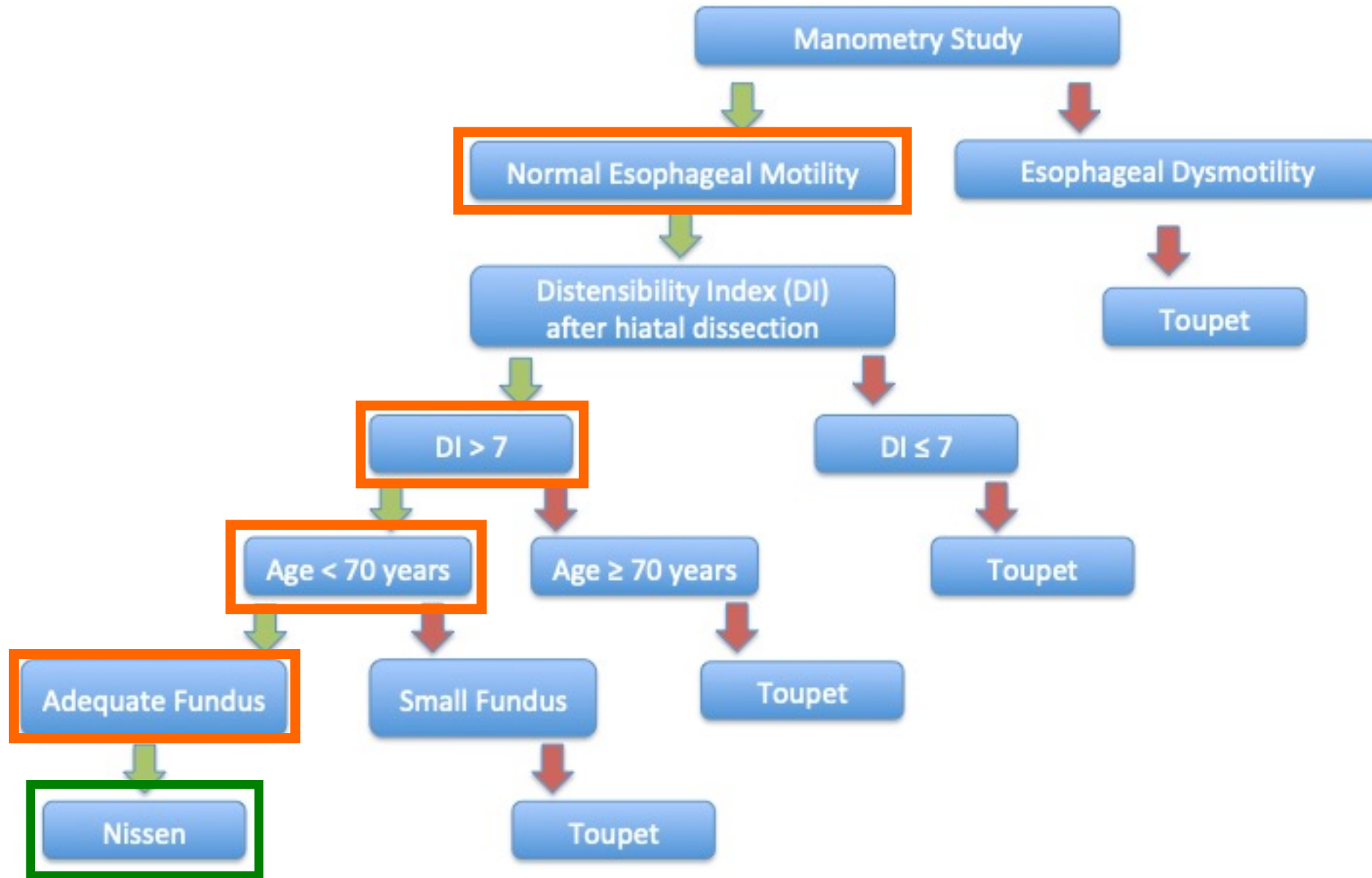
Timepoint	Measurement	Nissen and Toupet	Nissen	Normal Motility Toupet	Dysmotility Toupet	Raw p-value	Adjusted p-value[‡]
Timepoint	*Measurement*	*Mean ± SD*	*Mean ± SD*	*Mean ± SD*	*Mean ± SD*	-	-
Hernia Reduction	N	N=80	N=18	N=43	N=19		
	Dmin, mm	13.0 ± 2.9	14.7 ± 2.0	12.3 ± 2.7	13.0 ± 3.3	0.006^a	$0.018^{a,b}$
	Pressure, mmHg	33 ± 10	30 ± 12	33 ± 10	35 ± 9	0.045^b	0.061
	CSA, mm^2	140 ± 57	174 ± 46	125 ± 52	142 ± 65	0.006^a	$0.016^{a,b}$
	DI, mm^2/mmHg	4.7 ± 2.4	6.5 ± 2.4	4.0 ± 2.1	4.4 ± 2.4	$0.002^{a,b}$	$<0.0001^{a,b}$
Fundoplication	N	N=83	N=19	N=44	N=20		
	Dmin, mm	11.9 ± 1.6	11.4 ± 1.5	12.2 ± 1.6	11.8 ± 1.8	0.185	0.389
	Pressure, mmHg	45 ± 11	48 ± 14	44 ± 9	46 ± 12	0.780	0.983
	CSA, mm^2	112 ± 32	104 ± 27	118 ± 29	107 ± 41	0.176	0.439
	DI, mm^2/mmHg	2.7 ± 0.8	2.4 ± 0.8	2.8 ± 0.7	2.6 ± 0.8	0.297	0.609

[‡]Multivariable p-values are adjusted for: Hernia Type, [a]Nissen vs. Normal Motility Toupet, [b]Nissen vs. Dysmotility Toupet
Dmin (Minimum Diameter), CSA (Cross Sectional Area), DI (Distensibility Index), SD (standard deviation)

FLIP Measurements by Group

Timepoint	Measurement	Nissen and Toupet Mean ± SD	Nissen Mean ± SD	Normal Motility Toupet Mean ± SD	Dysmotility Toupet Mean ± SD	Raw p-value -	Adjusted p-value‡ -
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Quality of Life by Group

	Non-FLIP	FLIP	Unadjusted p-value	Adjusted p-value‡
	Mean ± SD	Mean ± SD	-	-
Preop	**N=122**	**N=62**		
RSI	17.4 ± 11.6	17.1 ± 10.0	0.954	0.988
GERD-HRQL	14.0 ± 11.9	13.6 ± 9.2	0.695	0.895
Gas/Bloat	2.2 ± 1.6	1.9 ± 1.4	0.369	0.497
Dysphagia Score	1.2 ± 0.6	1.3 ± 0.7	0.757	0.897
Satisfaction	1.3 ± 0.6	1.2 ± 0.5	0.200	0.077
1 Year	**N=94**	**N=30**		
RSI	8.2 ± 8.2	8.2 ± 8.7	0.998	0.855
GERD-HRQL	4.2 ± 5.3	3.9 ± 4.5	0.802	0.851
Gas/Bloat	1.6 ± 1.3	1.7 ± 1.3	0.529	0.381
Dysphagia Score	1.1 ± 0.5	1.3 ± 0.5	0.005	0.547
Satisfaction	2.5 ± 0.8	2.6 ± 0.6	0.714	0.886
2 Years	**N=100**	**N=20**		
RSI	8.7 ± 8.8	6.7 ± 9.1	0.252	0.296
GERD-HRQL	4.6 ± 5.7	3.3 ± 4.9	0.044	0.244
Gas/Bloat	1.8 ± 1.4	0.9 ± 1.1	0.006	0.010
Dysphagia Score	1.1 ± 0.4	1.2 ± 0.5	0.518	0.813
Satisfaction	2.4 ± 0.8	2.5 ± 0.8	0.769	0.754

‡Multivariable p-values are adjusted for: Fundoplication Type, Hernia Type, and Motility. RSI (Reflux Symptom Index), GERD-HRQL (Gastroesophageal Reflux Disease - Health Related Quality of Life), SD (standard deviation), YPO (years postoperatively)

Quality of Life by Group, Normal Motility Patients Only

	Non-FLIP	FLIP	Unadjusted p-value
	Mean ± SD	Mean ± SD	-
Preop	**N=97**	**N=51**	
RSI	17.3 ± 12.2	16.7 ± 10.1	0.902
GERD-HRQL	13.6 ± 12.4	13.8 ± 9.7	0.455
Gas/Bloat	2.2 ± 1.7	2.0 ± 1.5	0.605
Dysphagia Score	1.2 ± 0.7	1.2 ± 0.6	0.880
Satisfaction	1.3 ± 0.7	1.2 ± 0.5	0.098
1 Year	**N=74**	**N=23**	
RSI	7.6 ± 7.6	7.5 ± 7.6	0.888
GERD-HRQL	3.7 ± 4.1	3.8 ± 4.9	0.695
Gas/Bloat	1.5 ± 1.3	1.6 ± 1.3	0.727
Dysphagia Score	1.1 ± 0.6	1.2 ± 0.4	0.052
Satisfaction	2.5 ± 0.8	2.7 ± 0.6	0.358
2 Years	**N=82**	**N=16**	
RSI	8.7 ± 8.5	7.2 ± 10.1	0.240
GERD-HRQL	4.8 ± 5.9	3.6 ± 5.5	0.072
Gas/Bloat	1.9 ± 1.4	0.9 ± 1.1	0.008
Dysphagia Score	1.1 ± 0.4	1.2 ± 0.5	0.374
Satisfaction	2.5 ± 0.8	2.4 ± 0.8	0.920

RSI (Reflux Symptom Index), GERD-HRQL (Gastroesophageal Reflux Disease - Health Related Quality of Life), SD (standard deviation), YPO (years postoperatively)

Limitations

- Retrospective review of prospective database at a single institution

- Varying response rates for quality of life surveys and small sample

- Surgical technique variation

- Collection of objective data in the resolution of GERD

Conclusion

- Incorporating FLIP into a tailored fundoplication algorithm led to less gas-bloat symptoms at two years.

- Patients younger than 70 years old with normal esophageal motility who demonstrate a DI > 7 mm^2/mmHg after hiatal dissection should be considered for a Nissen fundoplication after adequate fundus mobilization.

- Thoughtful patient selection for an anti-reflux operation is paramount for optimal outcomes.

- Continued research is warranted since impedance planimetry is a potentially versatile tool that can enhance postoperative quality of life after anti-reflux surgery.

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Table 1. Preoperative Characteristics by Group

	Non-FLIP	FLIP	p-value
Total Patients, N	248	109	-
Age, years [Mean ± SD]	66 ± 13	67 ± 11	0.329
Body Mass Index [Mean ± SD]	29.3 ± 5.1	29.6 ± 4.1	0.609
Male [N (%)]	72 (29.0)	28 (25.7)	0.517
Smoking Status [N (%)]			0.753
Never	139 (56.0)	63 (57.8)	
Former	101 (40.7)	44 (40.4)	
Current	8 (3.2)	2 (1.8)	
Prior Medical History [N (%)]			
Myocardial Infarction/Coronary Artery Disease	23 (9.3)	8 (7.3)	0.550
Hypertension requiring Medication	17 (6.9)	38 (34.9)	<0.001
Pneumonia	14 (5.6)	10 (9.2)	0.220
Chronic Obstruction Pulmonary Disease	15 (6.0)	6 (5.5)	0.841
Diabetes	26 (10.5)	9 (8.3)	0.515
Preoperative Symptoms [N (%)]			
Reflux	219 (88.3)	93 (85.3)	0.434
Heartburn	165 (66.5)	87 (79.8)	0.011
Regurgitation	159 (64.1)	74 (67.9)	0.490
Dysphagia	106 (42.7)	34 (31.2)	0.040
Cough	81 (32.7)	35 (32.1)	0.918
Epigastric/Chest Pain	89 (35.9)	30 (27.5)	0.123
Preoperative proton pump inhibitor use [N (%)]	212 (85.5)	95 (87.2)	0.675
Normal Motility [N (%)]	198 (79.8)	82 (75.2)	0.330
ASA Class 3 or 4 [N (%)]	97 (39.1)	48 (44.0)	0.383
Hiatal Hernia Type [N (%)]			<0.001
None	18 (7.3)	30 (27.5)	
I	69 (27.8)	13 (11.9)	
II	3 (1.2)	1 (0.9)	
III	134 (54.0)	62 (56.9)	
IV	24 (9.7)	3 (2.8)	
Preoperative DeMeester score [Median (Q1–Q3)]	41 (33-17)	37 (18-53)	0.740

Table 2. Peri- and Postoperative Characteristics by Group

	Non-FLIP	FLIP	p-value
Total Patients, N	248	109	-
Nissen Fundoplication [N (%)]	202 (81.5)	35 (32.1)	<0.001
Operating Room Time, minutes [Mean ± SD]	128 ± 43	121 ± 32	0.093
Estimated Blood Loss, ml [Median (Q1-Q3)]	25 (5-50)	10 (5-20)	<0.001
Mesh Use [N (%)]	157 (63.3)	67 (61.5)	0.741
Intraoperative Complication [N (%)]	8 (3.2)	0 (0.0)	0.112
Length of stay, days [Median (Q1-Q3)]	2 (1-3)	1 (0-1)	<0.001
Pain at Discharge, VAS [Median (Q1-Q3)]	2 (1-4)	2 (0-3)	0.062
Medication Stopped, days [Median (Q1-Q3)]	3 (1-7)	1 (1-3)	<0.001
Return to ADL, days [Median (Q1-Q3)]	5 (2-8)	4 (2-7)	0.155
30-Day Mortality [N (%)]	3 (1.2)	0 (0.0)	0.556
30-Day Complication [N (%)]	30 (12.1)	6 (5.5)	0.057
30-Day ED Visit [N (%)]	46 (18.5)	10 (9.2)	0.025
30-Day Readmission [N (%)]	26 (10.5)	6 (5.5)	0.129
Off Proton Pump Inhibitor [N (%)]	194 (90.7)	92 (92.0)	0.697
All Symptoms Resolved at FU1 [N (%)]	93 (60.8)	56 (67.5)	0.309
Follow-up, months [Median (Q1-Q3)]	20 (3-49)	4 (1-10)	<0.001