MAYO CLINIC

IFSO NAPOLI 2023

Why and How I do Robotic Sleeve Gastrectomy?

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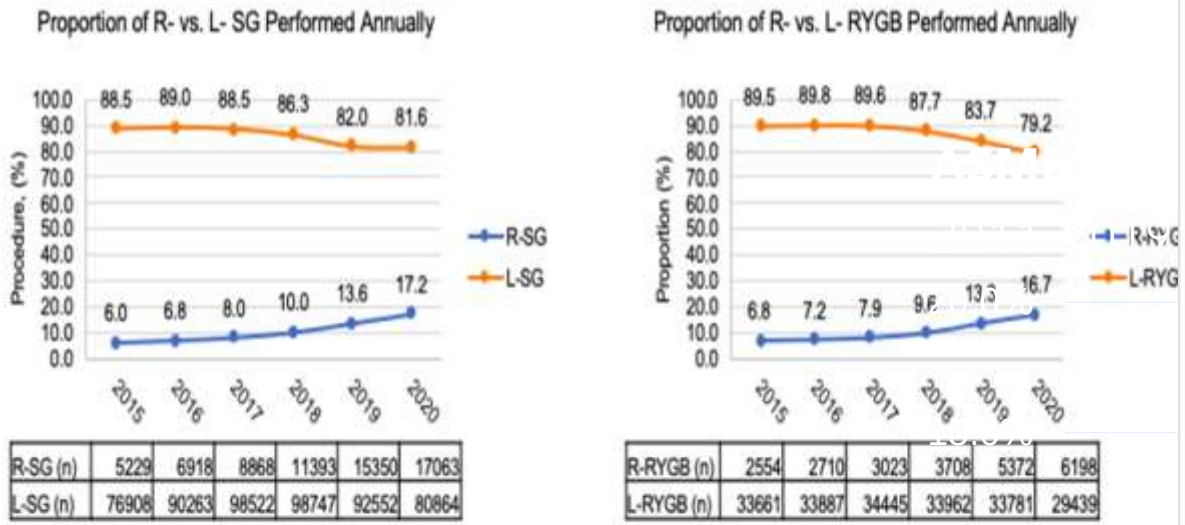
DISCLOSURE

- I don’t routinely perform robotic sleeve gastrectomy
- Sleeve gastrectomy is 10% of my practice
- I do perform robotic sleeve in certain patients
  - SADI/ Duodenal Switch
  - Complex patients
  - High BMIs

OBJECTIVES

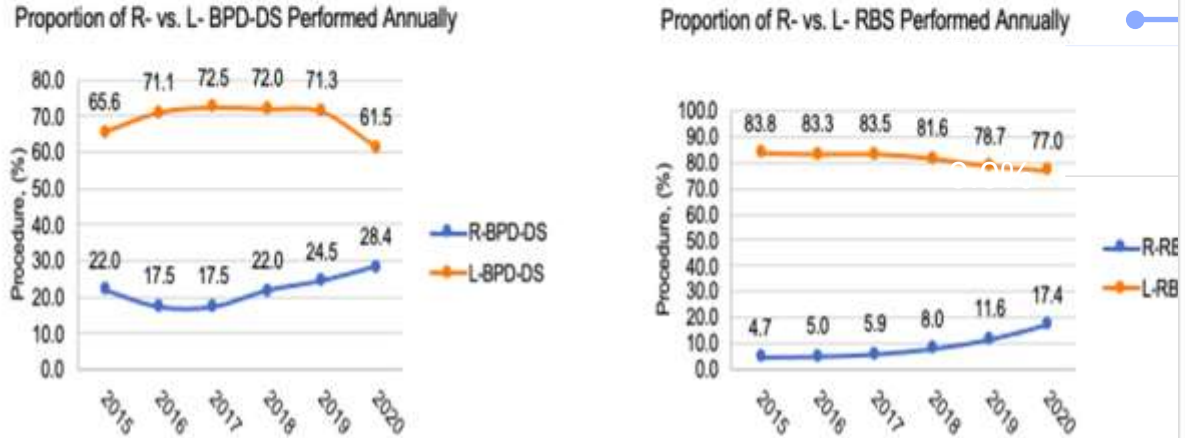
- Trends and Technique
- Patient outcomes
- Cost-effectiveness
- Surgeon benefits

Current Trends in the Utilization of a Robotic Approach in the Field of Bariatric Surgery. Wayne B. Bauerle et al. *Obesity Surgery 2023; (33):482-91*



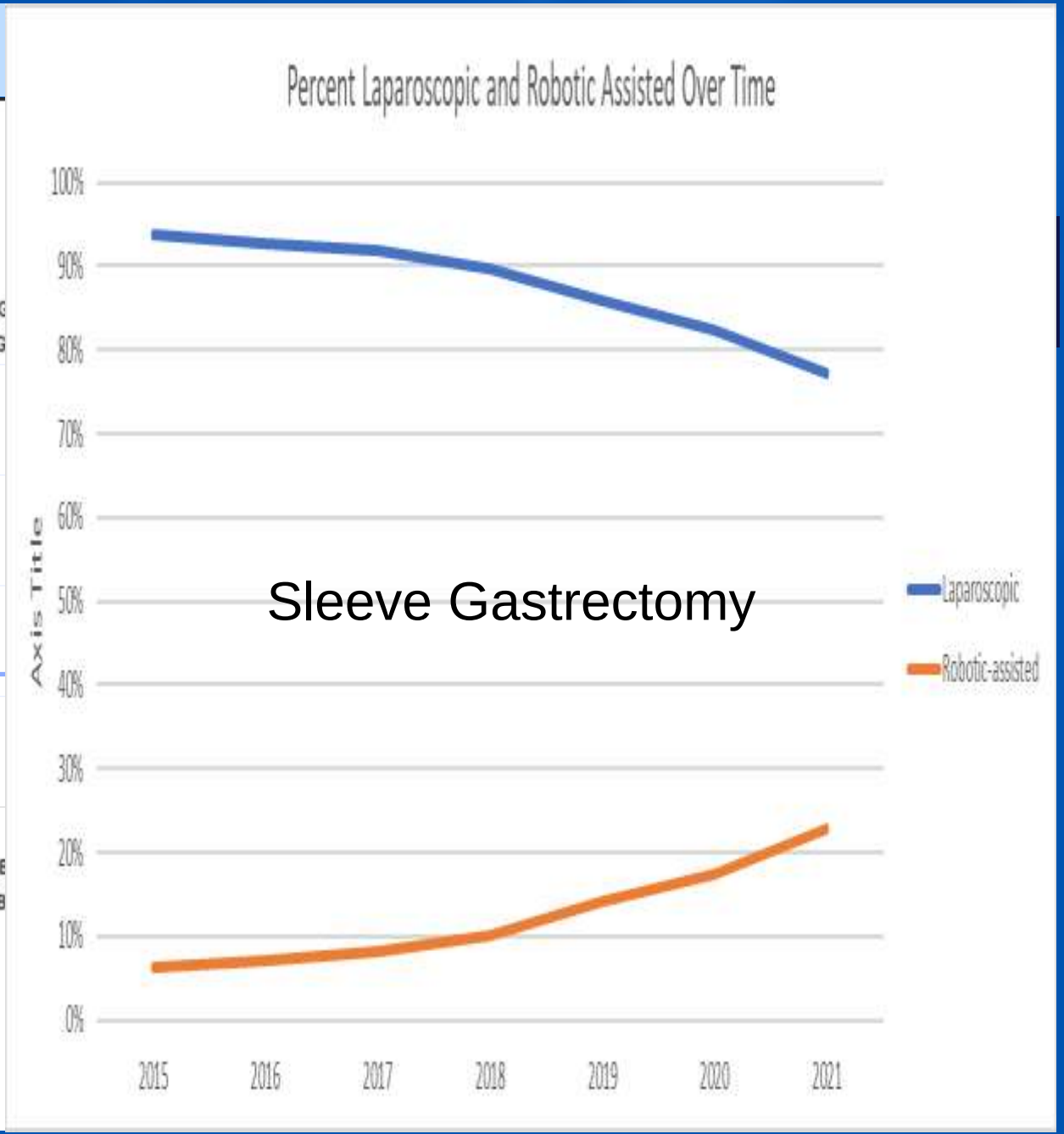
	2015	2016	2017	2018	2019	2020
R-SG (n)	5229	6918	8868	11393	15350	17063
L-SG (n)	76908	90263	98522	98747	92552	80864

	2015	2016	2017	2018	2019	2020
R-RYGB (n)	2554	2710	3023	3708	5372	6198
L-RYGB (n)	33661	33887	34445	33962	33781	29439



	2015	2016	2017	2018	2019	2020
R-BPD-DS (n)	221	205	272	447	506	393
L-BPD-DS (n)	659	832	1123	1465	1472	852

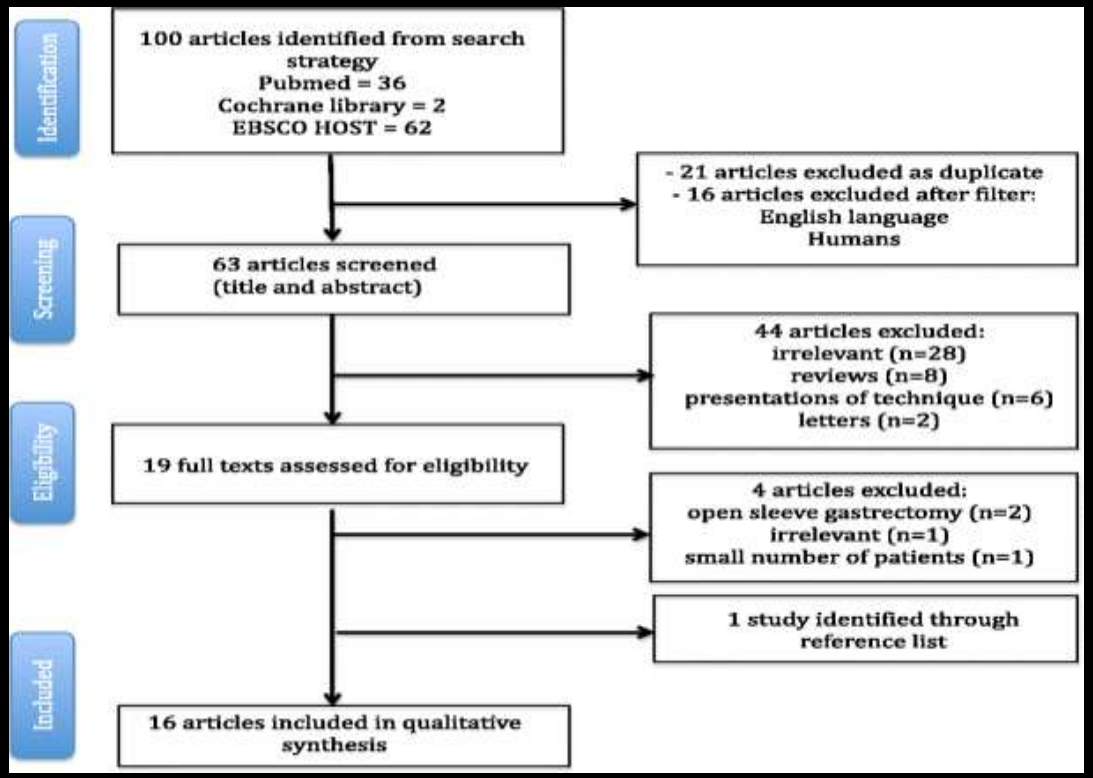
	2015	2016	2017	2018	2019	2020
R-RBS (n)	993	1199	1585	2257	3435	3386
L-RBS (n)	17737	20053	22364	23011	23330	14964



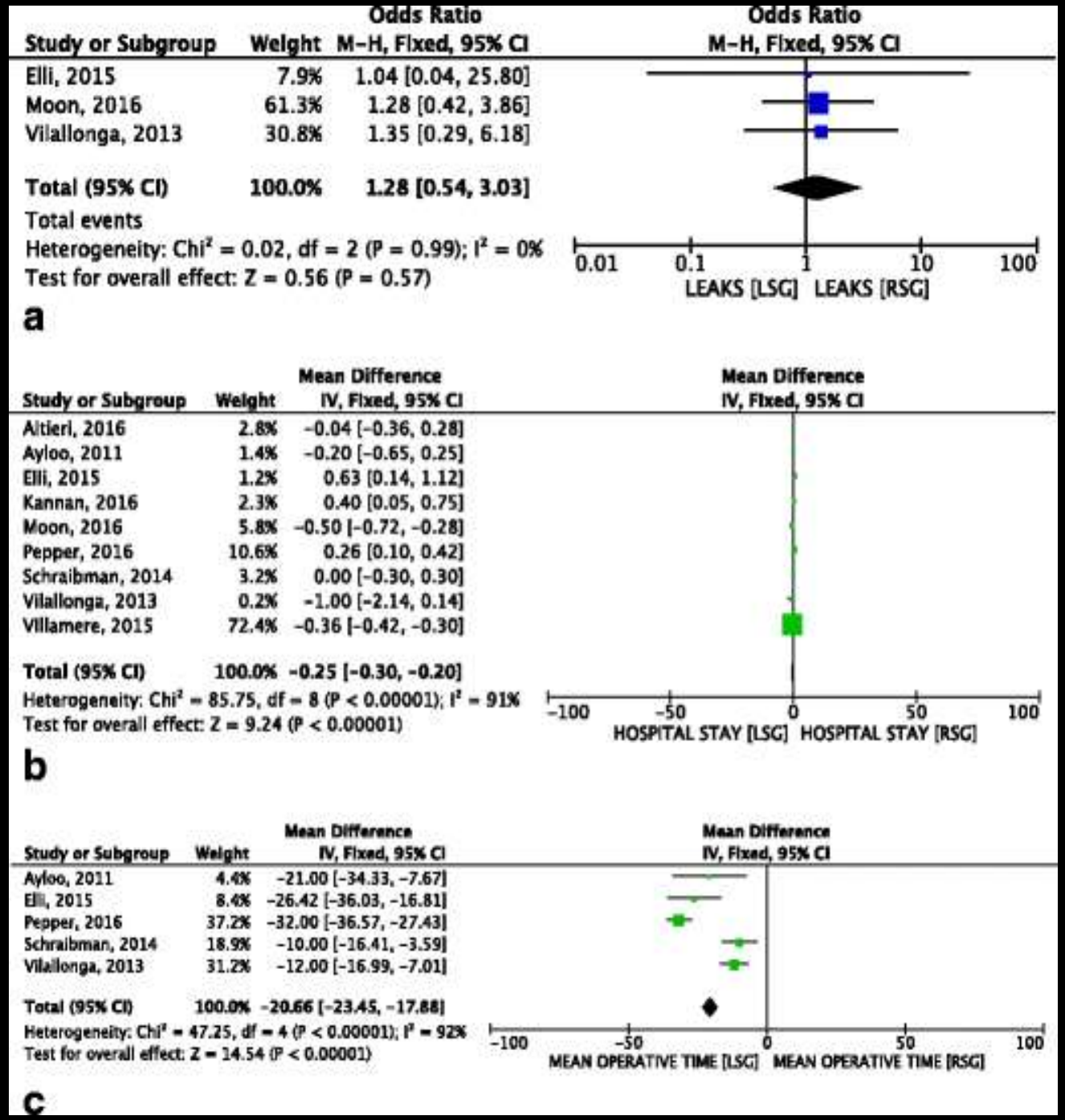
PATIENT OUTCOMES

Robotic versus Laparoscopic Sleeve Gastrectomy for Morbid Obesity: a Systematic Review and Meta-analysis

Dimitrios E. Magouliotis, Vasiliki S. Tasiopoulou, Eleni Sioka & Dimitrios Zacharoulis. *Obesity Surgery 2017;* **(27)**:245–253



- Sample
  - LSG: 29,787
  - RSG: 2,252
- Procedure Dates
  - Jan 2004-Dec 2014



Categorical outcomes	**OR (95% CI)**	**Heterogeneity**	
		I^2	*p*
Wound infection	4.19 (0.20, 89.46)	N/A	0.36
Bleeding	1.76 (0.38, 8.09)	0%	0.47
Other complications	0.93 (0.51, 1.69)	0%	0.81
Continuous outcomes	WMD (95% CI)	I^2	*p*
Operative time	−20.66 (−23.45, −17.88)	**92%**	<0.0001
Length of hospital stay	−0.25 (−0.30, −0.20)	**91%**	<0.0001

OBES SURG (2015) 25:967–974
DOI 10.1007/s11695-014-1499-0

ORIGINAL CONTRIBUTIONS

Laparoscopic and Robotic Sleeve Gastrectomy: Short- and Long-Term Results

Enrique Elli · Raquel Gonzalez-Heredia · Shravan Sarvepalli · Mario Masrur

2015

106 Robotic vs 304 laparoscopic

Table 2 Perioperative parameters

Perioperative	Robot-assisted (n=105)	Laparoscopic (n=304)	p value
Bougie size 36	3 (2.9 %)	113 (37.2 %)	
Bougie size 38	2 (1.9 %)	157 (51.6 %)	
Bougie size 40	99 (94.3 %)	34 (11.2 %)	
Mean OR time	110.6 (SD=48.27)	84.18 (SD=23.83)	0.009
Required hiatal hernia repair	8 (7.6 %)	139 (45.7 %)	0.001
Perioperative mortality	0	0	–
Perioperative complications	0	2	–
Postoperative mortality	0	0	
Mean length of stay in days	2.44 (SD=0.746)	3.07 (SD=4.17)	0.628

SD standard deviation

Table 3 Operative time with different approach in super obese patients (BMI >50 kg/m^2)

Mean operative time	RASG	LASG	p value
BMI <50 kg/m^2	113 (SD=61)	83 (SD=25)	0.02
BMI >50 kg/m^2	129 (SD=20)	143 (SD=24)	0.26

SD Standard deviation

Conclusion

In conclusion, the results from this study reveal that there is no clear clinical advantage for RASG versus LSG. It is also associated to longer operative time in the RASG.

Future studies would be valuable using larger sample sizes to compare the effectiveness and long-term outcomes of the RASG procedure.

Robotic vs. Laparoscopic Metabolic and Bariatric Surgery, Outcomes over 5 Years in Nearly 800,000 Patients

R. Wesley Vosburg[1,2] · Omar Haque[1,3] · Eve Roth[1,3]

Received: 27 February 2022 / Revised: 14 April 2022 / Accepted: 20 April 2022 / Published online: 2 May 2022

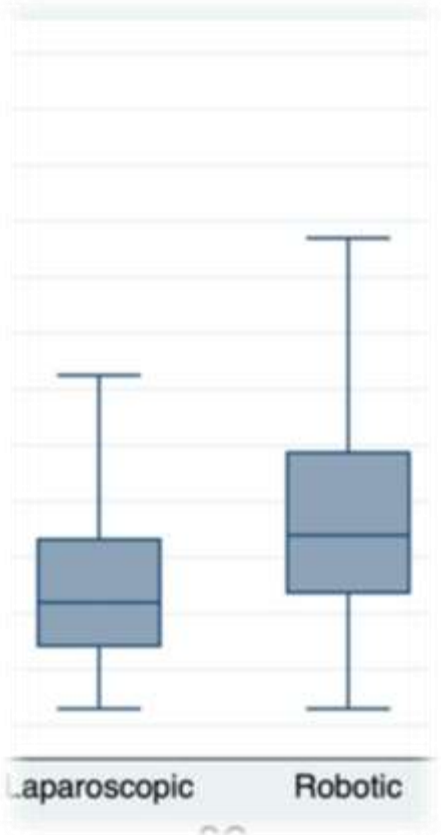
Table 1 Case numbers for laparoscopic and robotic sleeve gastrectomy (

Year	total SG	laparoscopic SG	% lap of SG	robotic SG	% robotic of SG
2015	98,292	87,085	88.6	5,878	6.0
2016	114,251	101,721	89.0	7,733	6.8
2017	125,518	111,236	88.6	9,854	7.9
2018	128,209	110,704	86.3	12,681	9.9
2019	127,078	104,151	82.0	17,402	13.7

Conclusions

SG had an average increased operative time of about 26 min for each robotic case which representing a 37% increase over laparoscopic SG. Robotic SG does not appear to change the risk of 30-day VTE complications or organ dysfunction complications. Finally, robotic SG slightly increases the risk for 30-day readmissions and reoperations over laparoscopic SG.

2022 National Data Base



Operative time

Review Minerva Chir. 2018 Feb;73(1):55-63.
Robotic versus laparoscopic sleeve gastrectomy: a review of the current evidence
Vasiliki S Tasiopoulou et al.

16 studies N = 29,787 patients

- RSG associated with significantly increased
  - Mean operative time
  - Length of hospital stay
- Similar incidence of
  - Leak
  - Bleeding
  - Wound infection
- Similar excess weight loss
- Studies assessing cost found higher charges in RSG

Surgical Endoscopy (2019) 33:917–922

Robotic versus laparoscopic sleeve gastrectomy: a 2015 MBSAQIP analysis

Reza Fazl Alizadeh[1] · Shiri Li[1] · Colette S. Inaba[1] · Andreea I. Dinicu[1] · Marcelo W. Hinojosa[1] · Brian R. Smith[1] ·Michael J. Stamos[1] · Ninh T. Nguyen[1]

N = 70, 298 vs. 4,781

❑ Operative time	102 ± 43 vs.74 ± 36 min	*P* < 0.01
❑ Higher serious morbidity	**AOR 1.40**	*P* < 0.01
❑ Higher leak	**AOR 3.14**	*P* < 0.01
❑ Higher SSI	**AOR 1.55**	*P* = 0.01
❑ Reoperation	**AOR 1.34**	P = 0.04
❑ Readmissions	**AOR 1.27**	P < 0.01

Outcomes in conventional **laparoscopic versus robotic-assisted revisional** bariatric surgery: a retrospective, case-controlled study of the MBSAQIP database.Acevedo E, Mazzei M, Zhao H, Lu X, Edwards MA. Surg Endosc. 2020 Apr;34(4):1573-1584

- ❑MBSAQIP 2015-2016
- ❑26,404
- ❑1:1 Case-matched

Sleeve gastrectomy: Matched cohort outcomes			
	LSG (n = 389)	**RSG (n = 389)**	**P value**
OL (mean ± SD)	106.9 ± 47.4	143.8 ± 56.6	**< 0.0001**
LOS (mean ± SD)	1.8 ± 3.3	1. 9 ± 1.3	0.43
30-day outcomes, no. (%)			
Reoperation	3 (0.8)	10 (2.6)	**0.05**
Readmission	11 (2.8)	16 (4.1)	0.33
Intervention	4 (1.0)	10 (2.6)	0.11
Mortality	2 (0.5)	–	0.16
Perioperative complications, no. (%)			
Anticoagulation	1 (0.3)	2 (0.5)	0.56
Transfusion	1 (0.3)	4 (1.0)	0.18
Intubation	1 (0.3)	–	0.32
Sepsis	–	4 (1.0)	**0.04**
Superficial SSI	4 (1.0)	1 (0.3)	0.18
Deep SSI	–	1 (0.3)	0.32
Organ space SSI	1 (0.3)	6 (1.5)	**0.06**
Aggregate complications, no. (%)			
Leak	4 (1.0)	5 (1.3)	0.74
Bleeding	–	2 (0.5)	0.16
VTE	1 (0.3)	2 (0.5)	0.56
SSI	5 (1.3)	9 (2.3)	0.28

Limitations of Early Comparative Literature?

1. Early robotic experience
2. No data on stapling technology used
3. No data on providers learning curve
4. **No differentiation between hybrid vs non-hybrid techniques**

Intuitive Staple Technology

HYBRID PERIOD

EW 45

Q4 2016

Sunset

Q2 2022

SureForm 60

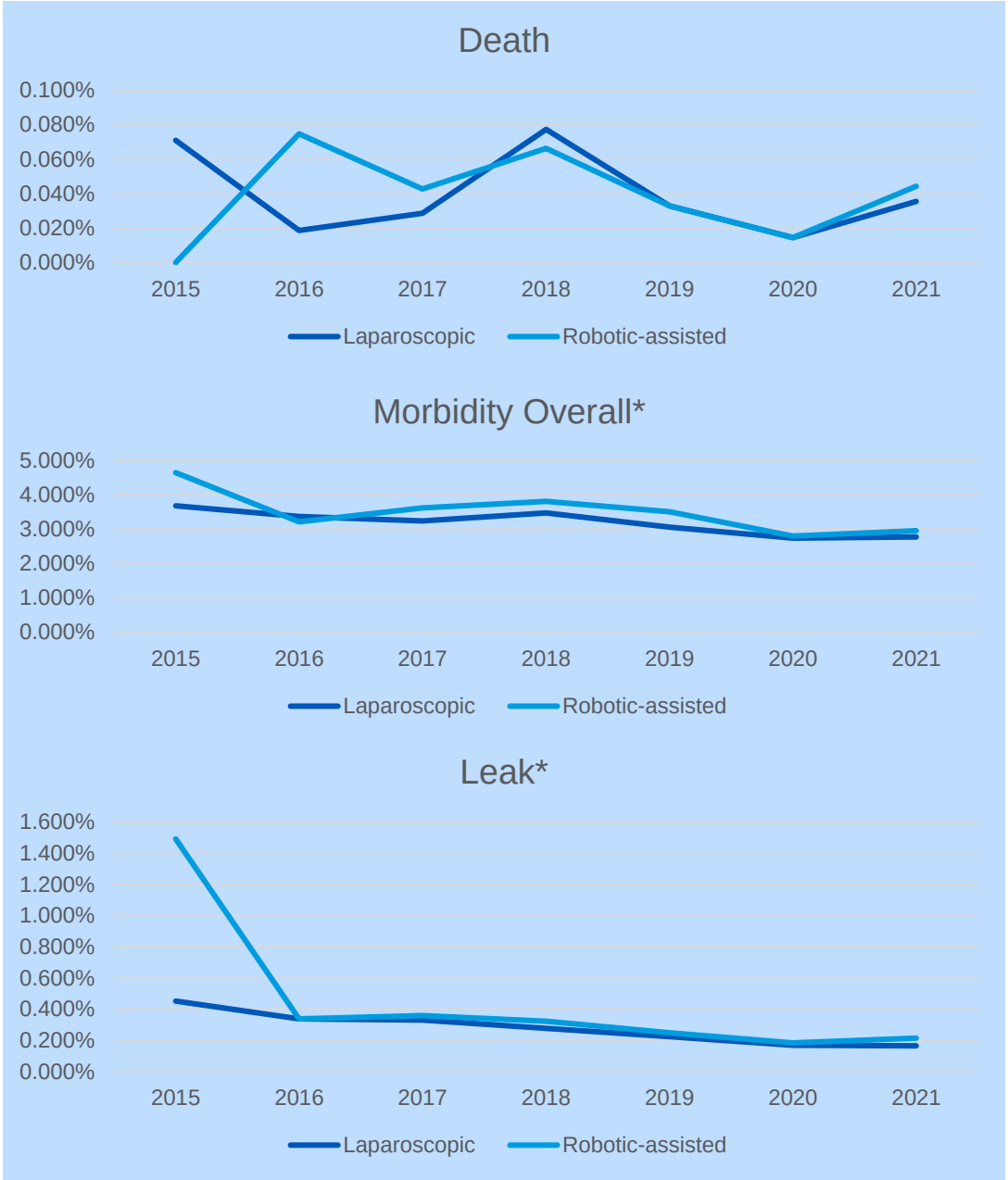
Q2/Q3 2018

2019…

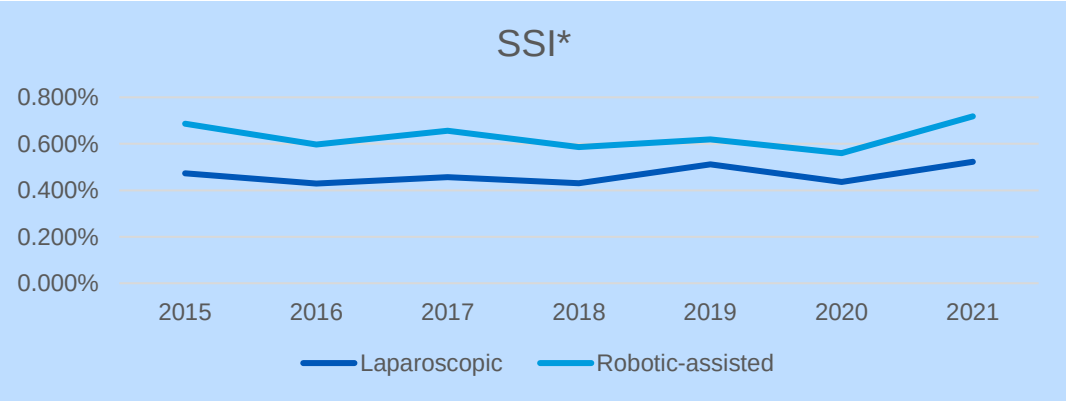
CONSISTENT UTILIZATION OF STAPLING TECHNOLOGY

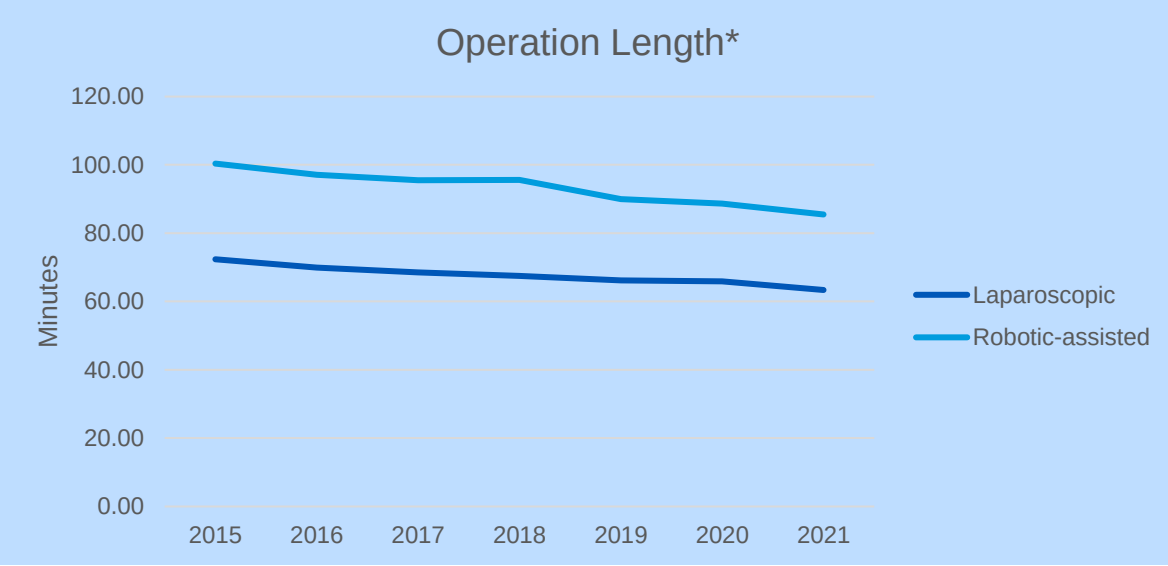
Contemporary Outcomes Trends of RSG vs LSG: MBSAQIP 2015-2021

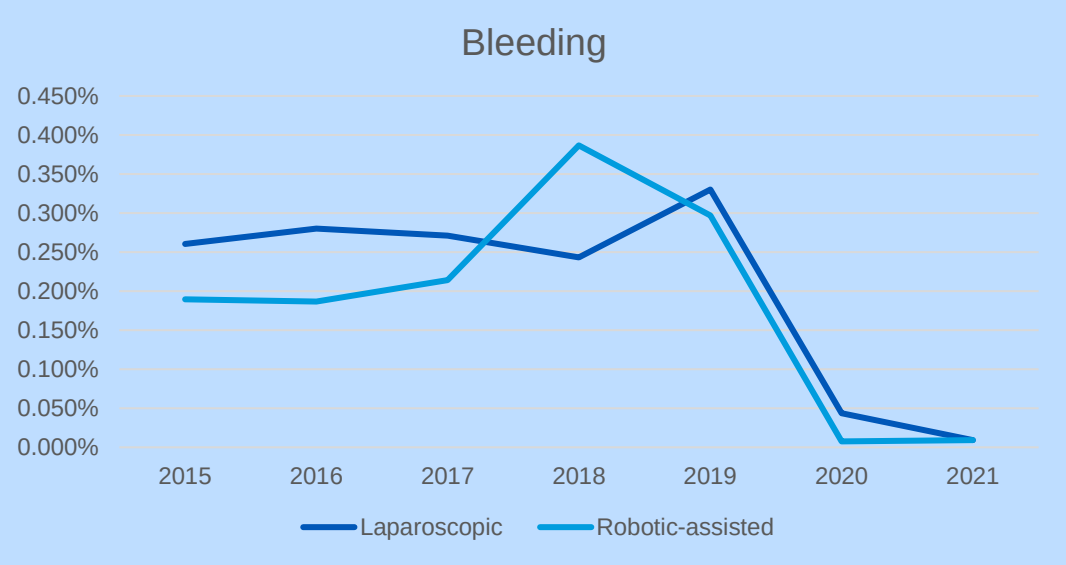
Outcome	LSG (77k)	RSG (77k)	P-value
Mortality	0.36%	0.039%	0.789
Morbidity	3.03%	**3.29%**	0.004
Leak	0.23%	**0.32%**	0.001
Bleeding	0.15%	0.14%	0.591
SSI	0.47%	**0.64%**	<0.001
VTE	0.46%	0.44%	0.615
ORL	66 min	**90min**	<0.001
LOS	1.35 days	**1.4 days**	<0.001

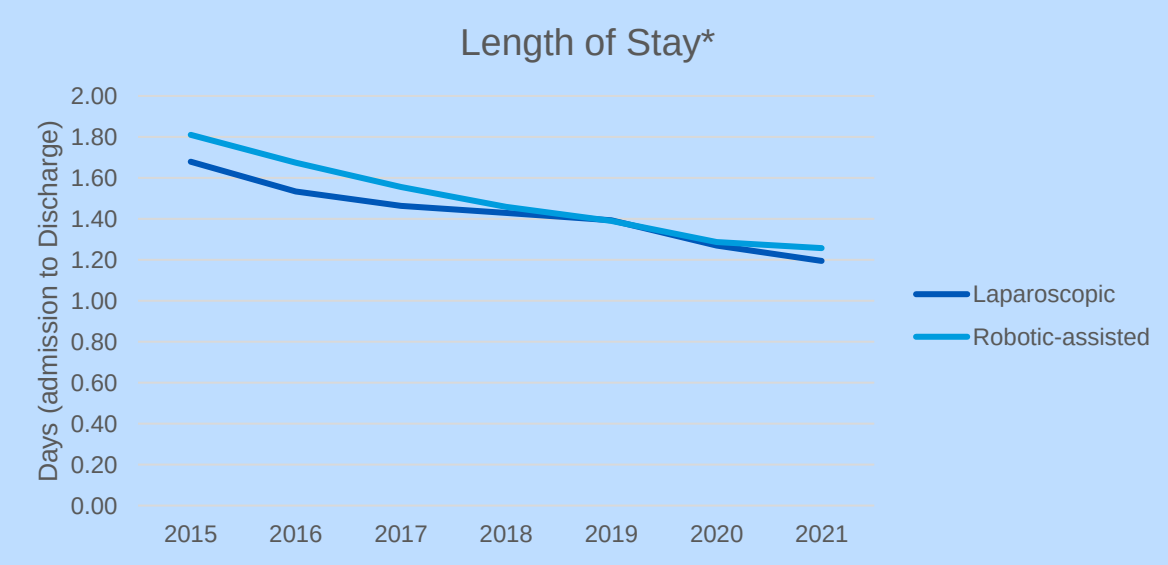


RSG vs LSG: Contemporary Outcomes Trend









Contemporary Outcomes Trends of RSG vs LSG: MBSAQIP 2015-2018 vs. 2019-2021

2015 -2018 Matched Cohorts		95%CI		
	OR	LCL	UCL	p-value
Death	0.65	0.32	1.03	0.227
VTE	0.97	0.75	1.24	0.798
Leak	1.53	1.17	2	0.002
SSI	1.22	0.97	1.54	0.089
Bleeding	0.91	0.65	1.26	0.558
Morbidity Overall	1.1	1	1.2	0.051
	Estimate	LCL	UCL	p-value
Operation Length	27.61	26.94	28.28	<0.001
Length of Stay	0.08	0.06	0.1	<0.001

2019-2021 Matched Cohorts		95%CI		
	OR	LCL	UCL	p-value
Death	1.25	0.59	2.67	0.565
VTE	0.97	0.8	1.18	0.769
Leak	1.36	1.01	1.82	0.044
SSI	1.46	1.23	1.74	<0.001
Bleeding	0.76	0.51	1.14	0.188
Morbidity Overall	1.11	1.03	1.2	0.007
	Estimate	LCL	UCL	p-value
Operation Length	22.55	22.1	23	<0.001
Length of Stay	0.04	0.03	0.05	<0.001

Is rSG Cost-effective?

1. Most studies report higher cost
2. Most are poorly designed
3. Fail to assess all components of healthcare cost
4. Significant heterogeneity in techniques and equipment utilized, study design and data source

Zhamak Khorgami *et al*. Cost of bariatric surgery and factors associated with increased cost: an analysis of national inpatient sample. SOARD 2017

- ❑ 2012-2013 HCUP-NIS database
- ❑ Hospital cost
  - ➢ RAS independently increase cost (OR 3.58, CI:3.22-3.97)

Cost-effectiveness Studies

Cost-Effectiveness of Robotic vs. Laparoscopic Surgery for Different Surgical Procedures: Protocol for a Prospective, Multicentric Study (ROBOCOSTES)

Front Surg . 2022 May 6;9:866041

Benedetto Ielpo[1†], Mauro Podda[2†], Fernando Burdio[1], Patricia Sanchez-Velazquez[1], Maria-Alejandra Guerrero[1], Javier Nuñez[3], Miguel Toledano[4], Salvador Morales-Conde[5], Julio Mayol[6], Manuel Lopez-Cano[7], Eloy Espin-Basany[8], Gianluca Pellino[8,9] and the ROBOCOSTES Study Collaborators*

Study Aim

- **Is robotic surgery more cost-effective than laparoscopic surgery in several surgical conditions and patient populations?**
  - Evaluate the incremental cost per quality-adjusted life year (QALY) gained
  - Explore the difference between groups concerning
    - Assessment of Efficacy
      - Hospital stay
      - Pain
      - Proportion and time to uptake of chemotherapy
    - Measures of safety
      - Adverse health events

Inclusion

- Distal pancreatectomy
- Gastrectomy
- **Sleeve gastrectomy**
- Inguinal hernioplasty
- Rectal resection for cancer
- Heller cardiomyotomy
- Nissen procedure

Cost Data Analyzed

- ❑Spanish Hospital Costs Network (RECH)
- ❑ Per-patient cost of hospital care
- ❑Overall direct hospital costs, excluding
  - ➢ Robotic acquisition/maintenance cost exclude
  - ➢ Screening preadmission charges excluded
- ❑Readmission-related costs added to the total hospital expenses

Healthcare Cost-Effectiveness Analysis

- ❑Model-based Cost–utility Analyses
  - ➢Endpoint: Mean cost, QALYs per patient, cost per QALYs gained
  - ➢Analysis: A stochastic cost-utility analysis
  - ➢Incremental Cost-effectiveness ratio (ICER) estimate overall cost
  - ➢Incremental Net Benefit (INB) to determine decision makers willingness to pay (WTP)

❖Adopt treatment if the INB >0

Surgeon Benefits?

1. Reduced Physical Workload
2. Reduced Mental workload
3. Surgeon Impact
   - Physical health
   - Mental health
   - Longevity

The International Journal of Medical Robotics and Computer Assisted Surgery 2020. A systematic review of the true benefit of robotic surgery: Ergonomics. Ian Jun Yan Wee, Li-Jen Kuo, James Chi-Yong Ngu

- Objective Measures
  - Maximal voluntary contraction (MVC)
  - Rapid upper limb assessment (RULA)
  - Job strain index (JSI)
  - National aeronautics and space administration task load index (NASA-TLX)
- Survey studies
  - Prevalence of physical pain or discomfort as reported by individual survey results

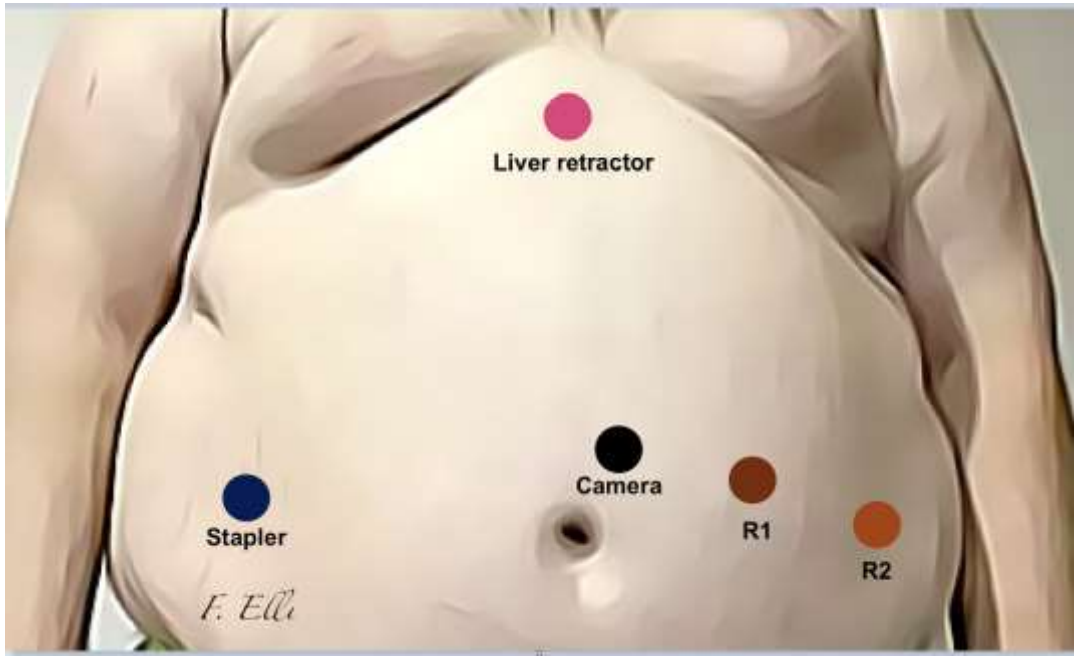
Franasiak et al.

Impact of Structured Ergonomic Program

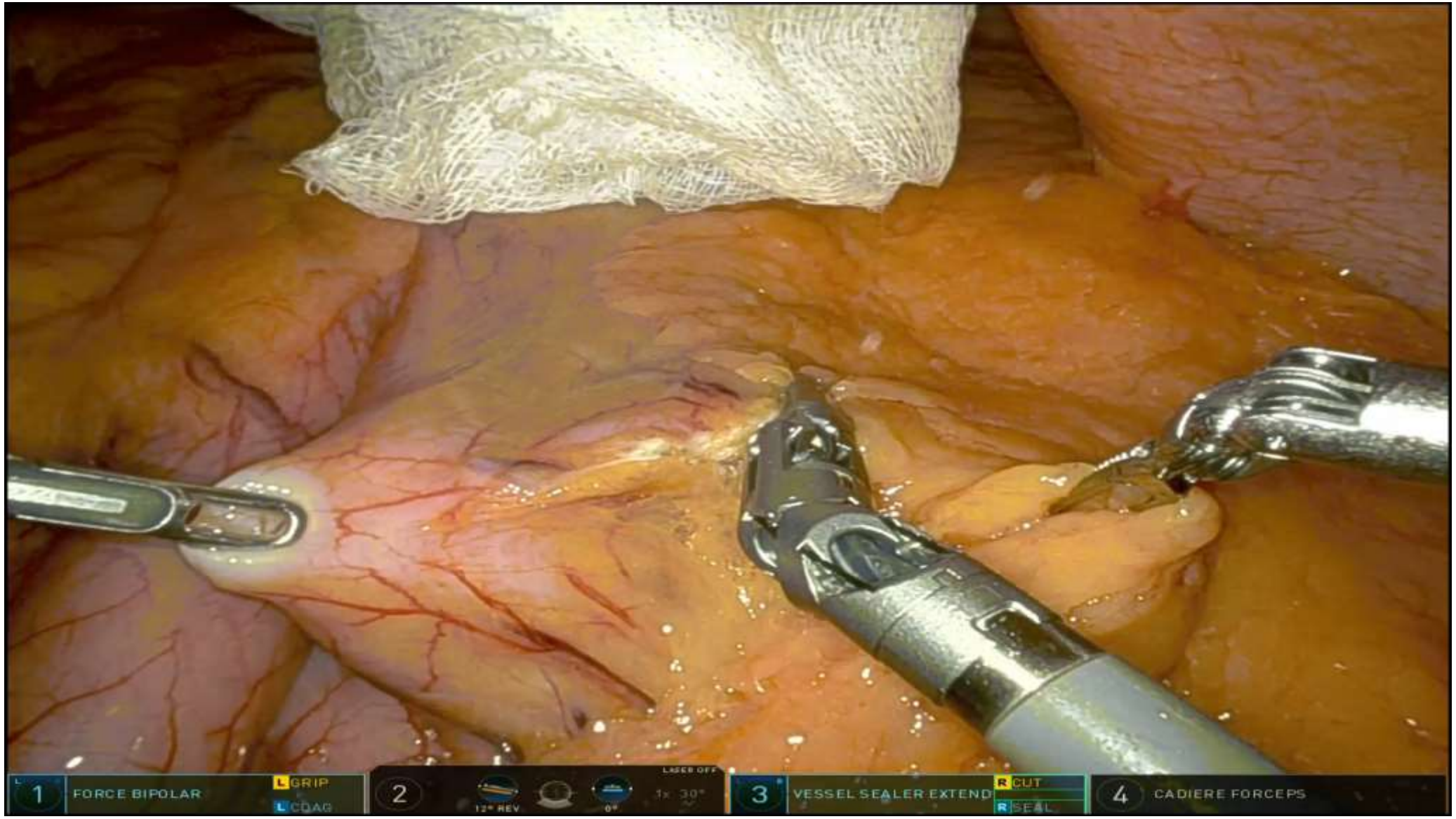
- 75% ensured 90° knee flexion
- 68% adjusted the armrest
- 68% adjusted head tilt to <20° neck flexion
- 43% increased clutching frequency

Robotic Sleeve Gastrectomy Technique

Trocar Placement



ROBOTIC SLEEVE TECHNIQUE



Robotic-assisted sleeve gastrectomy in a liver transplant patient

- 50 years-old female
- PMH: Hypertension, T2DM, Hepatitis C
- PSH:
  - Orthotopic Liver Transplant 3 years ago
- Normal Liver function
- BMI: 47 Kg/m^2
- Diet and medical treatment without results
- Patient was offered to undergo Robotic-assisted sleeve gastrectomy

Objectives/Questions

❑ Does rSG improved patient outcomes?	❑ Based on current data. NO! ❑ Trend is in right direction
❑ Are there specific patient cohorts who may benefit from rSG?	❑ Maybe higher BMI patients ❑ Maybe revisional cases
❑ Is rSG cost-effective?	❑ Based on hospital cost, NO! ❑ Need quality cost-effectiveness studies
❑ Does rSG benefit the bariatric surgeon?	❑ YES!!! ❑ Should be a quality metric for future studies ❑ Workforce, revenue & safety implications
❑ Does rSG has training implications for Resident/Fellow education?	❑ Based on limited studies, Unknown

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THANK YOU!