Laparoscopic Sleeve Gastrectomy (LSG) versus Robotic Sleeve Gastrectomy (RSG): studio comparativo degli outcomes perioperatori
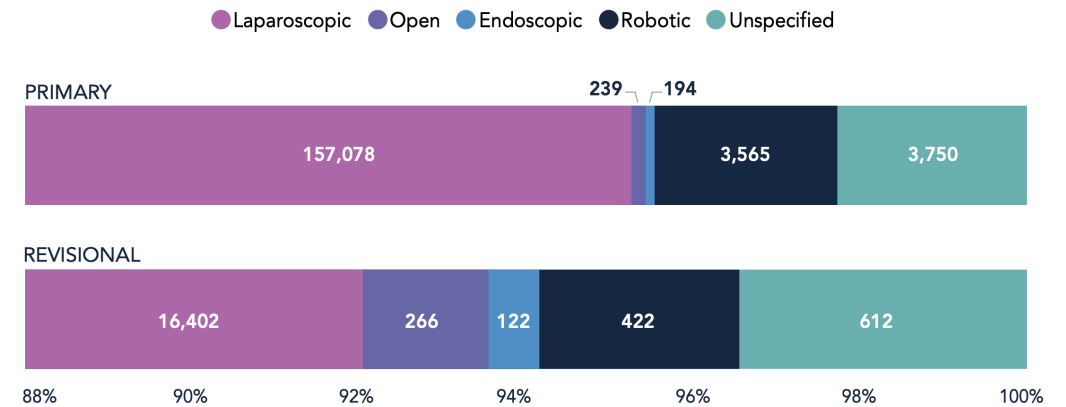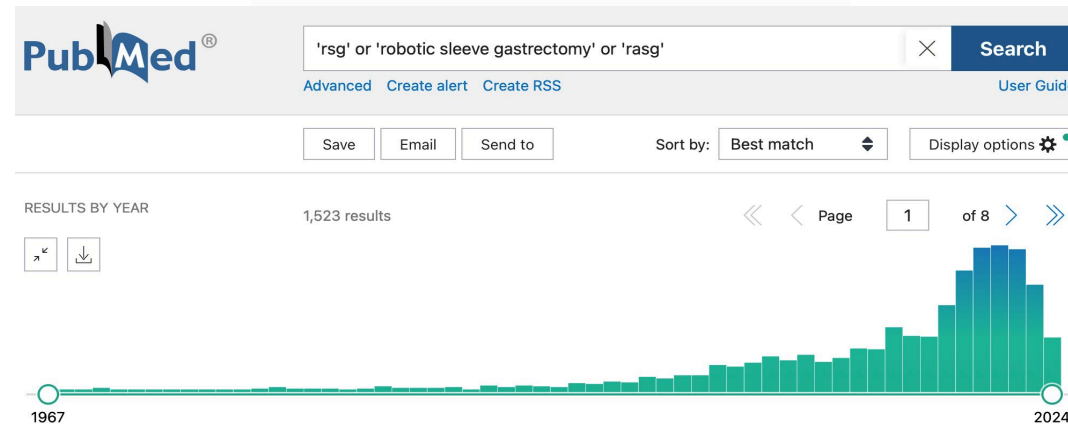
ANTONIO FRANZESE, MD

UNIVERSITA' DEGLI STUDI DI NAPOLI FEDERICO II

SCUOLA DI SPECIALIZZAZIONE IN CHIRURGIA GENERALE

U.O.C. CHIRURGIA GENERALE AD INDIRIZZO BARIATRICO ENDOCRINO-METABOLICO E SENOLOGIA, PROF. M. MUSELLA

# Background

8TH GLOBAL REGISTRY REPORT

- The majority of operations are performed laparoscopically, although it is noted that the uptake robotic surgery continues to increase particularly in the revisional setting.

Background

REVIEW ARTICLE

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

Dimitrios E. Magouliotis[1] · Vasiliki S. Tasiopoulou[1] · Eleni Sioka[2] ·
Dimitrios Zacharoulis[2]

Fig. 2 Forest plot describing the differences in **a** incidence of leaks, **b** length of hospital stay and **c** mean operative time between robotic and standard laparoscopic sleeve gastrectomy. **a** Incidence of leaks was not significantly different between the robotic and the standard laparoscopic group. **b** Length of hospital stay was significantly greater in robotic than in standard laparoscopic sleeve gastrectomy. **c** Mean operative time was significantly greater in robotic than in standard laparoscopic sleeve gastrectomy
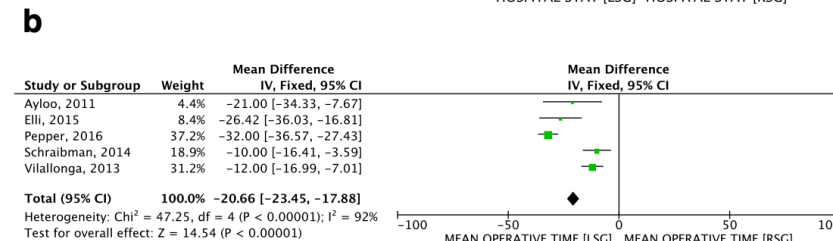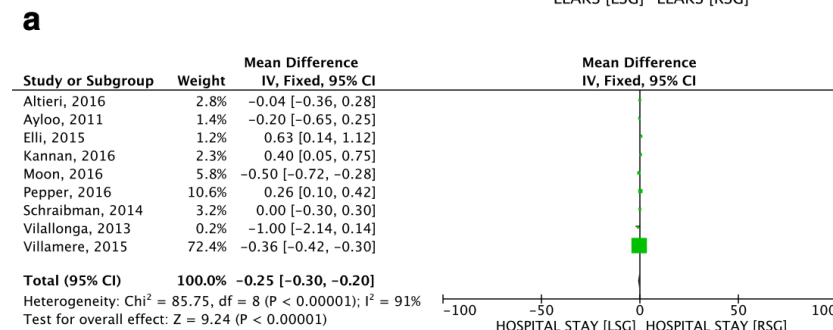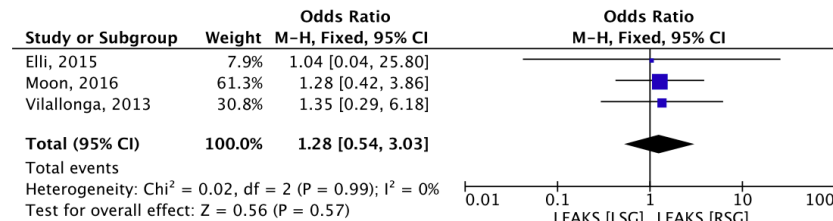
Conclusion

This meta-analysis identified 16 unique peer-reviewed studies of LSG and RSG procedures with patient outcome data. These studies suggest that LSG and RSG are associated with comparable clinical outcomes, complications and %EWL. Mean operative time and length of hospital stay were significantly greater in the RSG group. The majority of studies showed significantly higher charges for RSG. These results should be interpreted with caution due to the lack of randomized controlled studies. Future studies with greater clarity in significant outcomes, as the %EWL, complications and charges are

Background

ORIGINAL CONTRIBUTIONS

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

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

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

Estimated weight loss — %EWL by Postoperative months (Laparoscopic SG, Robotic SG)
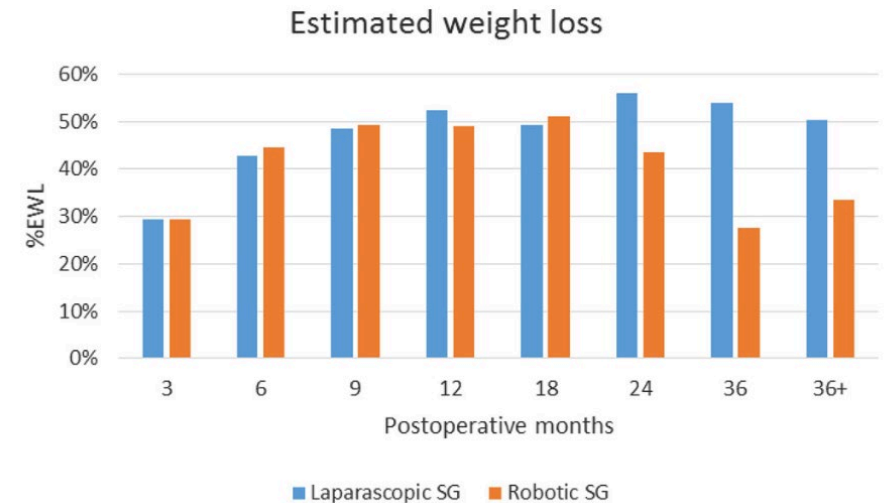
In conclusion, the results from this study reveal that there is no clear clinical advantage for RASG versus LSG. It is also associated to longer operative time in the RASG.

Where is the problem?
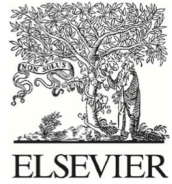
SURGERY FOR OBESITY AND RELATED DISEASES

Original article

Cost analysis of robotic sleeve gastrectomy (R-SG) compared with laparoscopic sleeve gastrectomy (L-SG) in a single academic center: debunking a myth!

Maher El Chaar, M.D., F.A.C.S., F.A.S.M.B.S.[a,b,*], Jacob Gacke[b], Samuel Ringold[c], Jill Stoltzfus, Ph.D.[b,d]

[a]St. Luke's University Health Network, Allentown, Pennsylvania
[b]Temple University/St Luke's University Health Network, School of Medicine, Allentown, Pennsylvania
[c]University of Michigan College of Engineering, Ann Arbor, Michigan
[d]Research Institute, St. Luke's University Health Network, Allentown, Pennsylvania

The overall cost for R-SG and L-SG was not statistically different (mean total cost for R-SG and L-SG was $5308.99 and $4918.88, respectively). Operating time cost was significantly higher for R-SG compared with L-SG ($1340 versus $112 for R-SG and L-SG, respectively). R-SG had a shorter length of stay compared with L-SG (1.4 versus 1.5 d, respectively).

Table 4
OR time costs

	Robotic SG	Laparoscopic SG
Cost per case	$1314.00	$1112.00
Average time per case	2:08	1:43
Distribution of OR time		
1.0–1.5 hr	0%	22.0%
1.5–2.0 hr	33.3%	57.6%
2.0–2.5 hr	56.4%	20.3%
2.5–3.0 hr	7.7%	0%
3.0–3.5 hr	2.6%	0%

SG = sleeve gastrectomy; OR = operating room.

Table 2
Cost data

	Robotic SG (n = 39)	Laparoscopic SG (n = 59)	P	Total (n = 98)
LOS Direct cost	$704.60	$687.48	NS	$694.29
OR time direct cost	$1340.65	$1111.83	<.0001	$1202.89
Supplies direct Cost	$3263.75	$3119.57	NS	$3176.95
Total costs	$5308.99	$4918.88	NS	$5074.13

SG = sleeve gastrectomy; LOS = length of stay; NS = nonsignificant; OR = operating room.
Based on separate Mann-Whitney rank sum tests due to the skewed distributions, with P < .05 denoting statistical significance, and no adjustment for multiple testing.

Table 3
Hospital LOS costs

	Robotic SG	Laparoscopic SG
Cost per case	$705.00	$687.00
Average d per case	1.41	1.51
Distribution of LOS		
1 d	64.1%	59.3%
2 d	30.8%	33.9%
3 d	5.1%	3.4%
4 day	0%	3.4%

SG = sleeve gastrectomy; LOS = length of stay.

Where is the problem?

RESEARCH

Robot-assisted vs laparoscopic bariatric procedures in super-obese patients: clinical and economic outcomes

Giuseppe Marincola[1] · Priscilla Francesca Procopio[1,2] · Francesco Pennestrì[1,2] · Pierpaolo Gallucci[1] · Nikolaos Voloudakis[1,2] · Luigi Ciccoritti[1] · Francesco Greco[1] · Giulia Salvi[1,2] · Francesca Prioli[1] · Carmela De Crea[1,2] · Marco Raffaelli[1,2]

In conclusion, robotic and laparoscopic approaches to bariatric surgery are comparable in terms of post-operative complications in SO and SSO patients. Nevertheless, despite the higher costs, robotic surgery may add a noteworthy value for the treatment of challenging patients, especially in an economically sustainable model. Although we believe that our results may be promising, larger studies with wider sample size and longer follow-up are necessary to draw definitive conclusions.
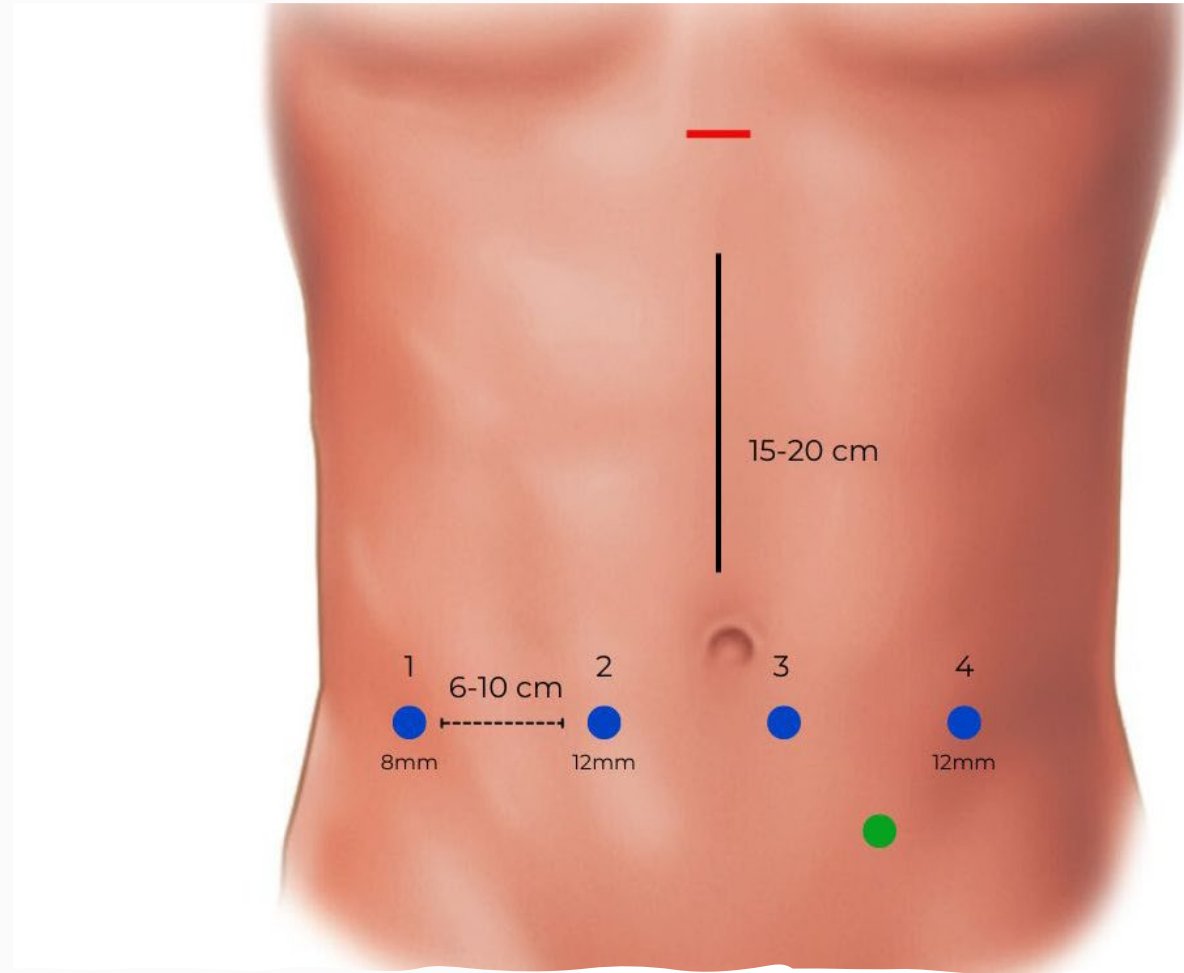
Table 1 Clinicopathological characteristics and post-operative outcome between Laparoscopic Group and Robot-assisted Group in super-obese patients after propensity matching score analysis

	Total	Laparoscopic group	Robot-assisted group	p value*
Number of patients	88	44	44	
Mean age (±SD), years	44.5±9.6	44.2±9.3	44.7±10.1	0.809
Male/female	49 (55.7%)/39 (44.3%)	24 (54.5%)/20 (45.5%)	25 (56.8%)/19 (43.2%)	0.831
Mean BMI (±SD), kg/m^2	55.6±4.8	56.1±5.2	55.1±4.7	0.346
SO (BMI 50–59.9 kg/m^2)	74 (84.1%)	37 (84.1%)	37 (84.1%)	
SSO (BMI ≥ 60 kg/m^2)	14 (15.9%)	7 (15.9%)	7 (15.9%)	1
Preoperative comorbidity (yes/no)	56 (63.6%)/32 (36.4%)	28 (63.6%)/16 (36.4%)	28 (63.6%)/16 (36.4%)	1
OSAS (yes/no)	40 (45.5%)/48 (54.5%)	19 (43.2%)/25 (56.8%)	21 (44.7%)/23 (52.3%)	0.669
Hypertension (yes/no)	39 (44.3%)/49 (55.7%)	19 (43.2%)/25 (56.8%)	20 (45.5%)/24 (54.5%)	0.831
Type 2 diabetes mellitus (yes/no)	28 (31.2%)/60 (68.2%)	12 (27.3%)/32 (72.7%)	16 (36.4%)/28 (63.6%)	0.362
Previous abdominal surgery (yes/no)	31 (35.3%)/57 (64.7%)	15 (34.1%)/29 (65.9%)	16 (36.4%)/28 (63.6%)	0.824
Procedure:				
RYGB	36 (40.9%)	18 (40.9%)	18 (40.9%)	1
SADI-S	52 (59.1%)	26 (59.1%)	26 (59.1%)	
Mean operative time (±SD) min	154.3±45.1	109.5±39.1	199.1±65.7	< 0.001
Intraoperative complications (yes/no)	0	0	0	1
Post-operative total complications (yes/no)	5 (5.7%)/83 (94.3%)	1 (2.3%)/43 (97.7%)	4 (9.1%)/40 (90.9%)	0.359
Post-operative minor complications (yes/no)	2 (2.3%)/86 (97.7%)	0	2 (4.5%)/42 (95.5%)	0.493
Post-operative major complications (yes/no)	3 (3.4%)/85 (96.6%)	1 (2.3%)/43 (97.7%)	2 (4.5%)/42 (95.5%)	0.999
Post-operative ICU (yes/no)	4 (4.5%)/84 (95.5%)	0	4 (9.1%)/40 (90.9%)	0.116
Median post-operative hospital stay (IQR) days	3 (2–4)	3 (3–4)	3 (2–4)	0.469
Readmissions (yes/no)	0	0	0	1
Mean overall cost (±SD), euros	5692.8±1123.3	3313.1±911.8	8052.6±1234.7	< 0.001

SD Standard deviation, *IQR* 75% interquartile range, *BMI* Body mass index, *SO* Super-obese, *SSO* Super super-obese, *OSAS* Obstructive sleep apnea syndrome, *ICU* Intensive care unit, *RYGB* Roux-en-Y gastric bypass, *SADI-S* Single anastomosis duodeno-ileal bypass with sleeve gastrectomy, *p* values refer to comparison between Laparoscopic group and Robotic group
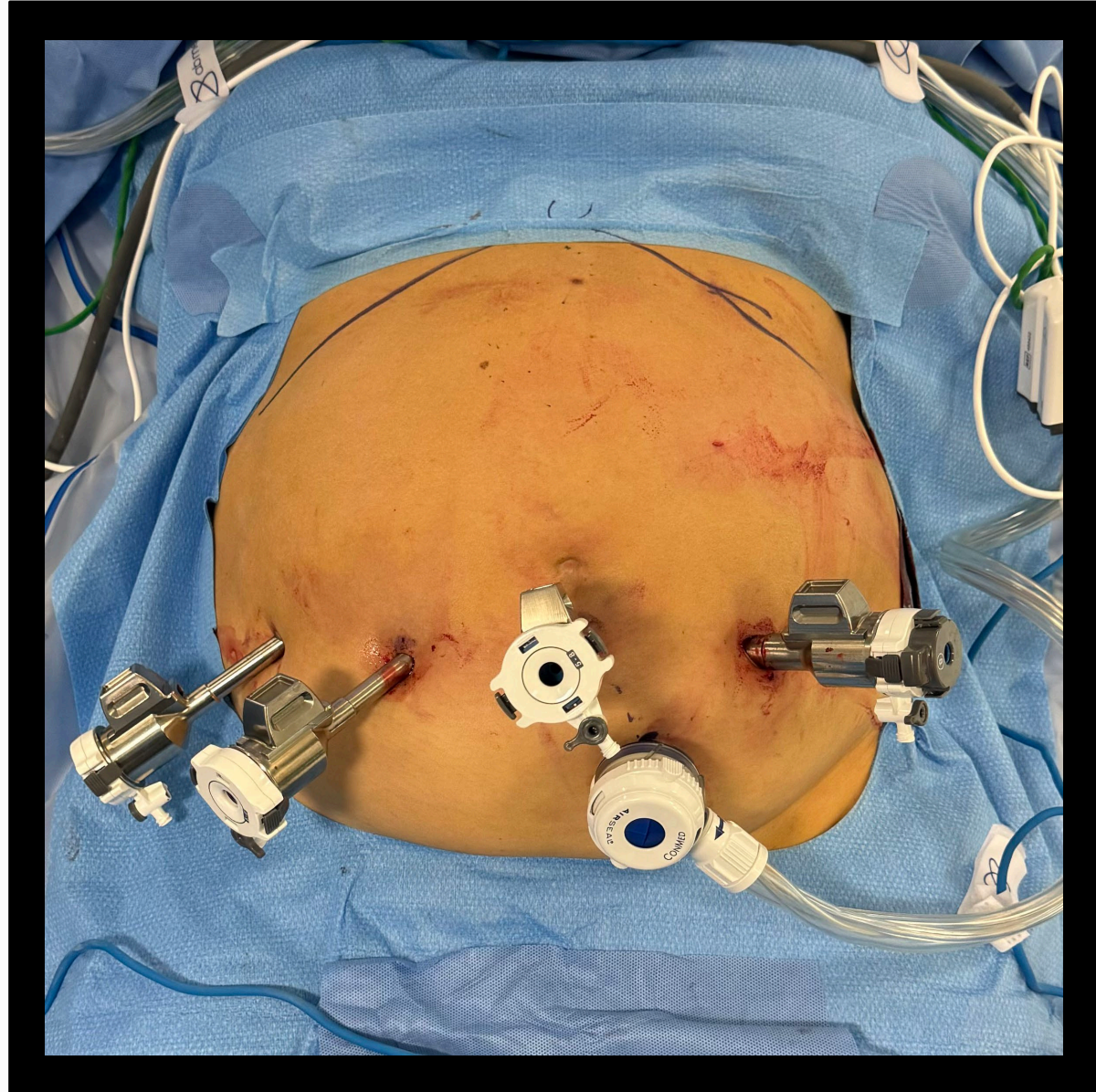
RSG: How we do it

- Trocars placement and docking

- Targeting

- Dissection of the greater curvature

- 36FR Bougie

- Vertical gastrectomy

- Methylene-blue test

- Abdominal Drain

RSG: How we do it

- Trocars placement and docking

- Targeting

- Dissection of the greater curvature

- 36FR Bougie

- Vertical gastrectomy

- Methylene-blue test

- Abdominal Drain

RSG: How we do it

- Trocars placement and docking

- Targeting

- Dissection of the greater curvature

- 36FR Bougie

- Vertical gastrectomy
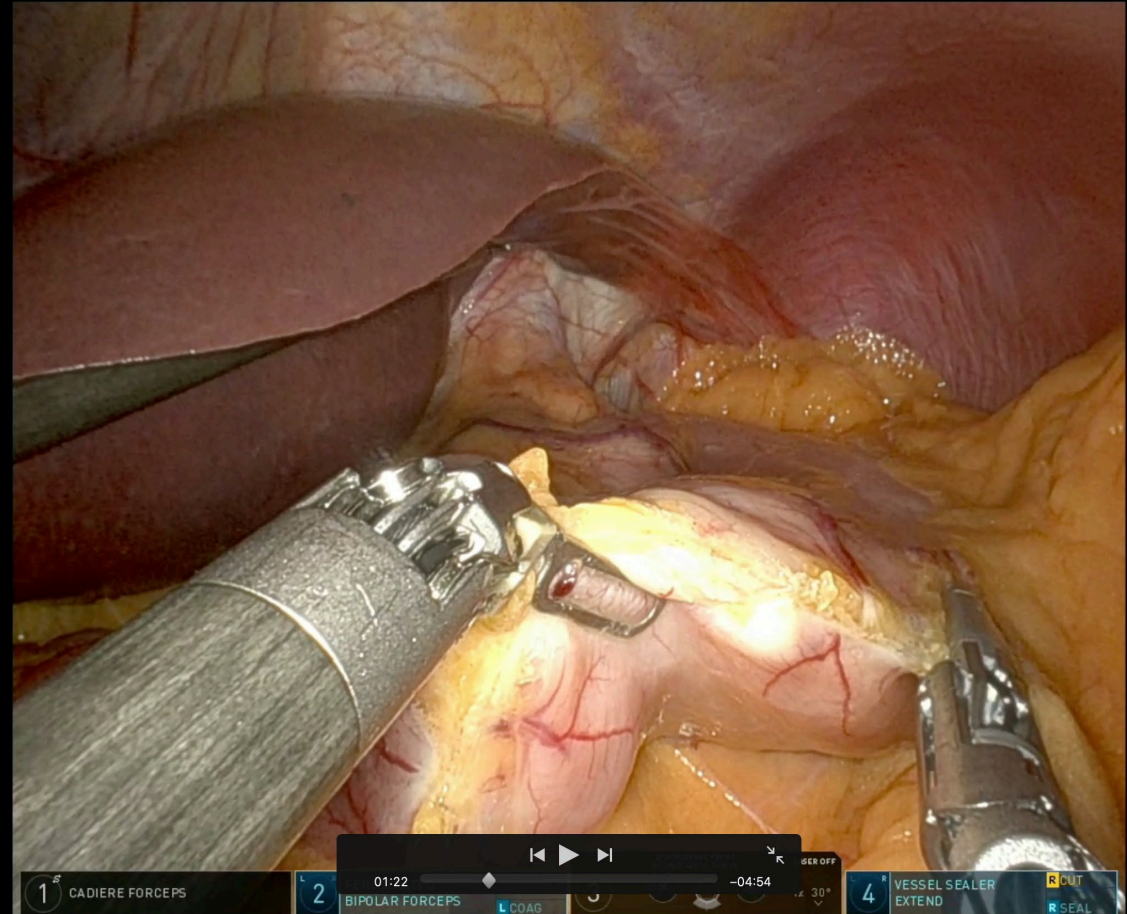
- Methylene-blue test

- Abdominal Drain

RSG: How we do it

- Trocars placement and docking

- Targeting

- Dissection of the greater curvature

- 36FR Bougie

- Vertical gastrectomy
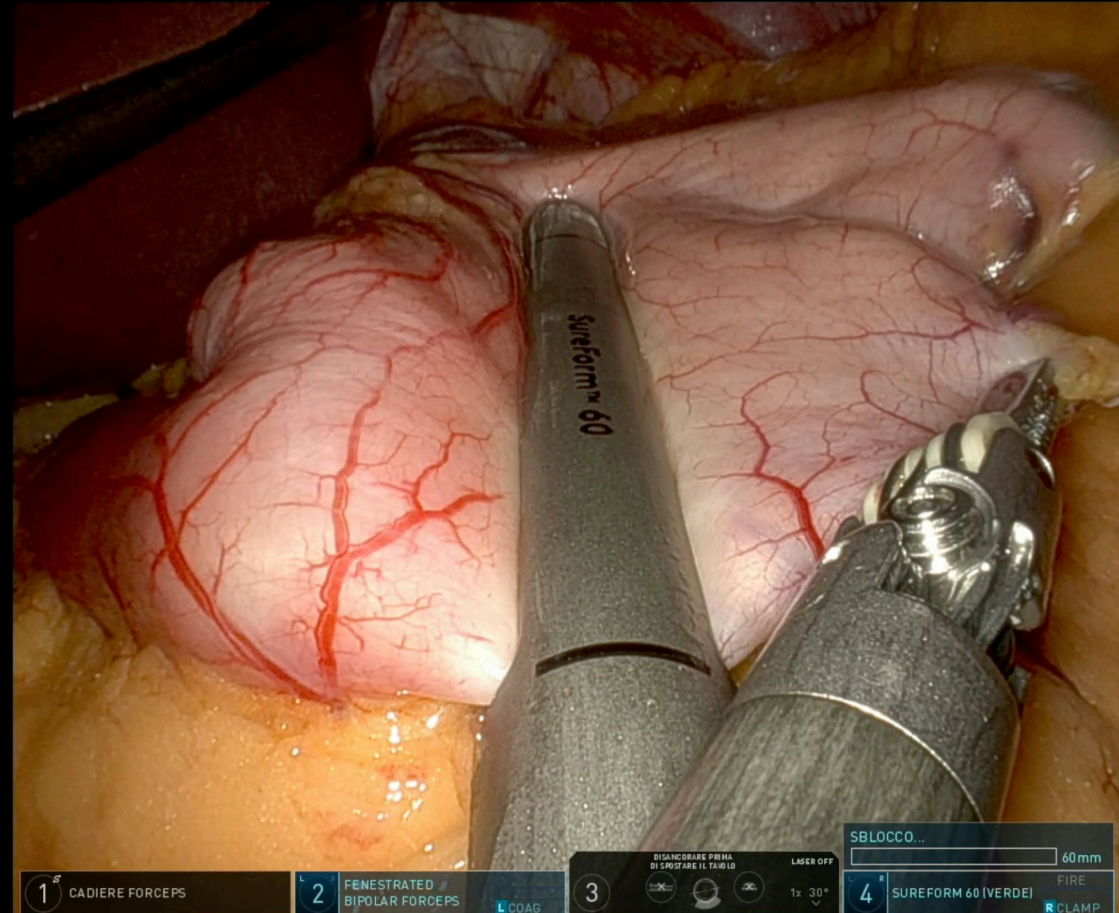
- Methylene-blue test

- Abdominal Drain
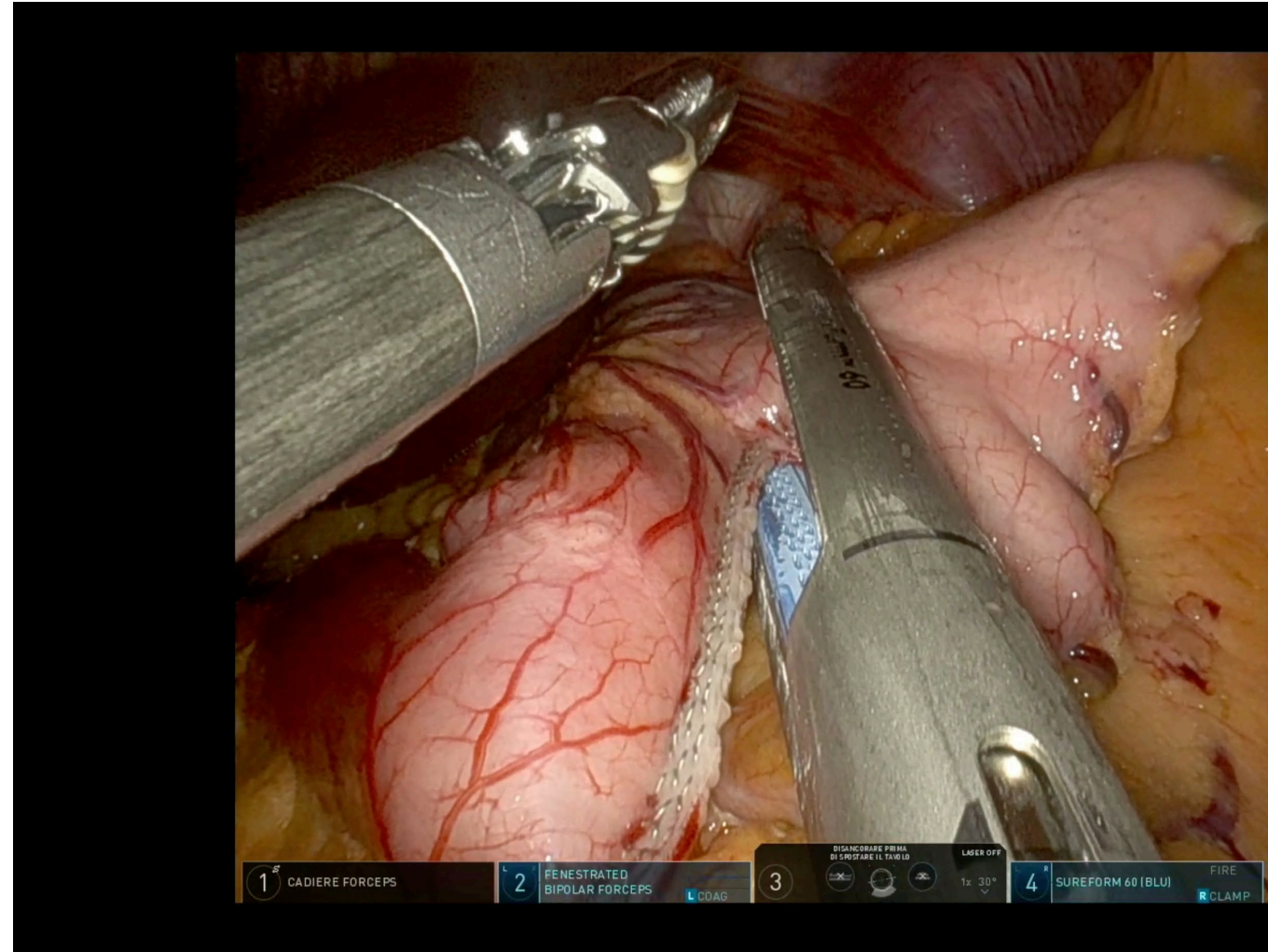
RSG: How we do it

- Trocars placement and docking

- Targeting

- Dissection of the greater curvature

- 36FR Bougie

- Vertical gastrectomy

- Methylene-blue test

- Abdominal Drain

RSG: How we do it

- Trocars placement and docking

- Targeting

- Dissection of the greater curvature

- 36FR Bougie

- Vertical gastrectomy

- Methylene-blue test

- Abdominal Drain

Methods

- The study was a non-randomized retrospective review of 64 patients treated at the "AOU Policlinico Federico II Advanced Biomedical Sciences Department - Federico II University

- Data from our first RSG experiences were retrospectively collected from July 2021 trought December 2023

- Such data were compared with LSG performed trought same period

- The study included 32 RSG (Da Vinci Xi surgical system®) vs 32 LSG

- Demographic data, duration of surgery, conversion rate, postoperative pain, loss rate, postoperative morbidity and mortality, and length of hospital stay were examined.

- A cost analysis was not conducted.

Results

	All	LSG	RSG	p value
Number of patients, (%)	64 (100)	32 (50)	32 (50)	NA
Age, mean (± SD)	38.25 ± 8.83	38.06 ± 9.92	38.44 ± 7.91	0.8660
BMI, kg/m², mean (± SD)	39.72 ± 3.77	40.75 ± 3.94	38.69 ± 3.40	**0.0287**
Docking time, min, mean (± SD)	14.06 ± 3.53	0 (0)	14.06 ± 3.53	**0.0001**
Operative time, min, mean (± SD)	52.81 ± 17.68	55.75 ± 19.7	49.88 ± 15.47	0.1898
Conversion to laparoscopy, n.ro (%)	1 (3.12)	0 (0)	1 (6.25)	1.0000
PONV, mean (± SD)				
- POD 0	1.84 ± 0.85	1.81 ± 0.98	1.87 ± 0.72	0.7811
- POD 1	0.69 ± 0.59	0.62 ± 0.62	0.75 ± 0.58	0.3897
- POD 2	0.31 ± 0.47	0.37 ± 0.50	0.25 ± 0.45	0.3168
VAS, mean (± SD)				
- POD 0	6.47 ± 1.74	6.67 ± 1.80	6.56 ± 1.36	0.7836
- POD 1	4.44 ± 1.62	3.75 ± 1.65	5.12 ± 1.31	**0.0005**
- POD 2	1.47 ± 1.27	1.25 ± 1.18	1.69 ± 1.35	0.1701
Abdominal drain, ml, mean (± SD)				
- POD 0	41.41 ± 70.62	59.37 ± 97.26	23.44 ± 12.61	**0.0424**
- POD 1	92.97 ± 27.11	95.31 ± 30.58	90.62 ± 23.93	0.4970
- POD 2	53.12 ± 18.78	53.12 ± 20.15	53.12 ± 17.97	1.0000
Complication, n.ro (%)				
- Abdominal wall bleeding	1 (3.12)	1 (6.25)	0 (0)	1.0000

Abbreviations: LSG, Laparoscopic Sleeve Gastrectomy; RSG, Robotic Sleeve Gastrectomy; SD, Standard Deviation; BMI, Body Mass Index; PONV, Post-operative Nausea and Vomiting; VAS, Visual Analogue Scale; POD, Post-Operative Day; NA, not available.
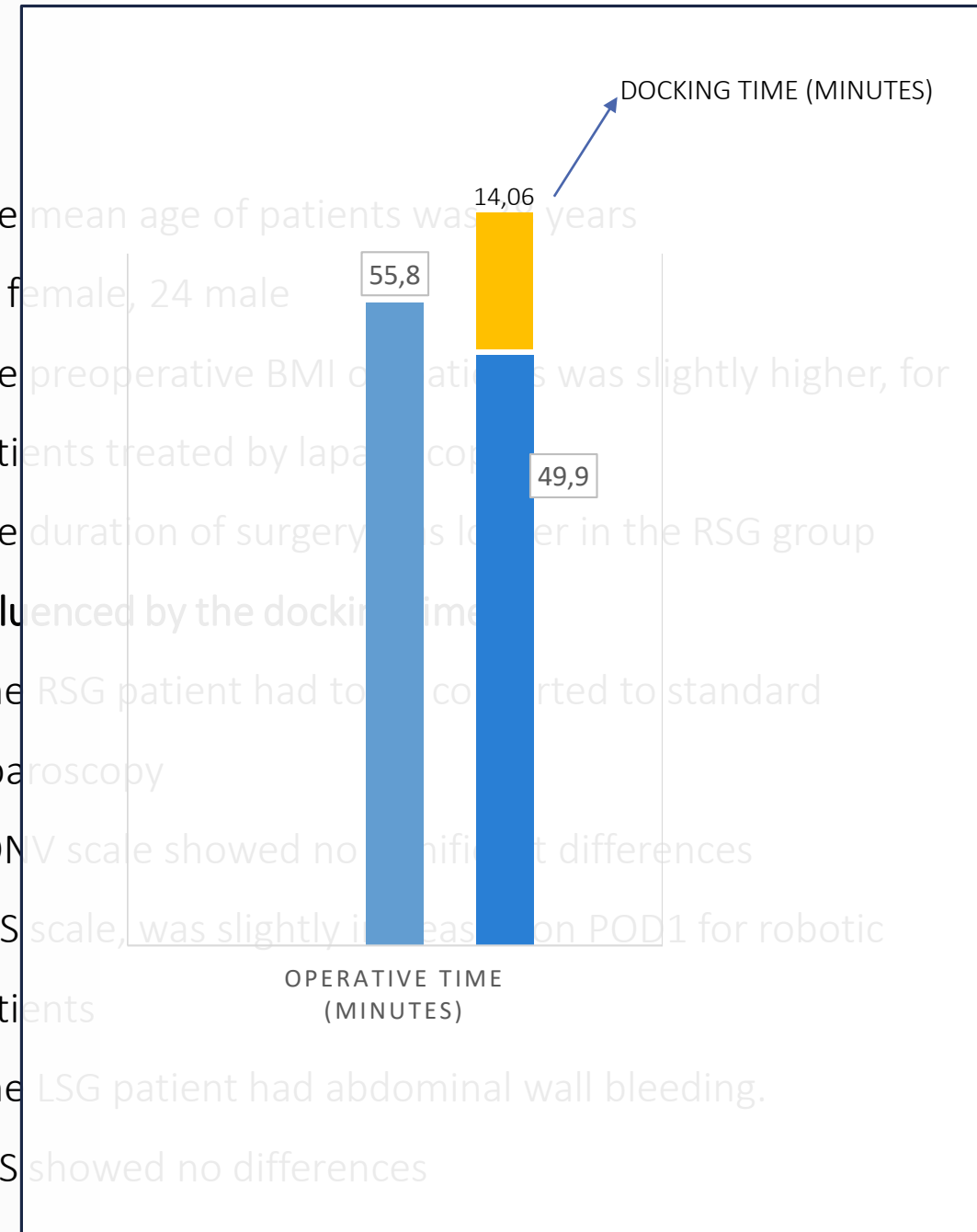
- The mean age of patients was 38 years

- 40 female, 24 male

- The preoperative BMI of patients was slightly higher, for patients treated by laparoscopy

- The duration of surgery was longer in the RSG group **influenced by the docking time**

- One RSG patient had to be converted to standard laparoscopy

- PONV scale showed no significant differences

- VAS scale, was slightly increased on POD1 for robotic patients.

- One LSG patient had abdominal wall bleeding

- LOS showed no differences

Results

	All	LSG	RSG	p value
Number of patients, (%)	64 (100)	32 (50)	32 (50)	NA
Age, mean (± SD)	38.25 ± 8.83	38.06 ± 9.92	38.44 ± 7.91	0.8660
BMI, kg/m², mean (± SD)	39.72 ± 3.77	40.75 ± 3.94	38.69 ± 3.40	**0.0287**
Docking time, min, mean (± SD)	14.06 ± 3.53	0 (0)	14.06 ± 3.53	**0.0001**
Operative time, min, mean (± SD)	52.81± 17.68	55.75± 19.7	49.88 ± 15.47	0.1898
Conversion to laparoscopy, n.ro (%)	1 (3.12)	0 (0)	1 (6.25)	1.0000
PONV, mean (± SD)				
- POD 0	1.84 ± 0.85	1.81 ± 0.98	1.87 ± 0.72	0.7811
- POD 1	0.69 ± 0.59	0.62 ± 0.62	0.75 ± 0.58	0.3897
- POD 2	0.31 ± 0.47	0.37 ± 0.50	0.25 ± 0.45	0.3168
VAS, mean (± SD)				
- POD 0	6.47 ± 1.74	6.67 ± 1.80	6.56 ± 1.36	0.7836
- POD 1	4.44 ± 1.62	3.75 ± 1.65	5.12 ± 1.31	**0.0005**
- POD 2	1.47 ± 1.27	1.25 ± 1.18	1.69 ± 1.35	0.1701
Abdominal drain, ml, mean (± SD)				
- POD 0	41.41 ± 70.62	59.37 ± 97.26	23.44 ± 12.61	**0.0424**
- POD 1	92.97 ± 27.11	95.31 ± 30.58	90.62 ± 23.93	0.4970
- POD 2	53.12 ± 18.78	53.12 ± 20.15	53.12 ± 17.97	1.0000
Complication, n.ro (%)				
- Abdominal wall bleeding	1 (3.12)	1 (6.25)	0 (0)	1.0000

Abbreviations: LSG, Laparoscopic Sleeve Gastrectomy; RSG, Robotic Sleeve Gastrectomy; SD, Standard Deviation; BMI, Body Mass Index; PONV, Post-operative Nausea and Vomiting; VAS, Visual Analogue Scale; POD, Post-Operative Day; NA, not available.

- The mean age of patients was 38 years

- 40 female, 24 male

- The preoperative BMI of patients was slightly higher, for patients treated by laparoscopy

- The duration of surgery was longer in the RSG group **influenced by the docking time**

- One RSG patient had to be converted to standard laparoscopy

- PONV scale showed no significant differences

- VAS scale, was slightly increased on POD1 for robotic patients

- One LSG patient had abdominal wall bleeding.

- LOS showed no differences

DOCKING TIME (MINUTES)

14,06

55,8

49,9

OPERATIVE TIME (MINUTES)

Results

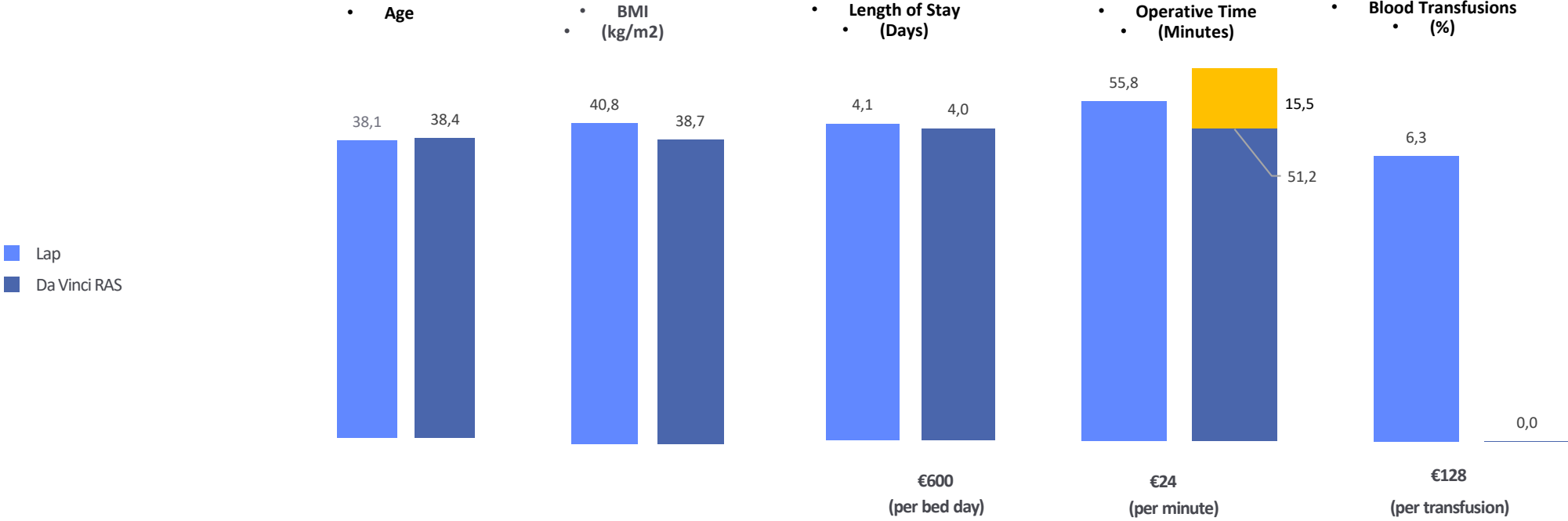|	All	LSG	RSG	p value
Number of patients, (%)	64 (100)	32 (50)	32 (50)	NA
Age, mean (± SD)	38.25 ± 8.83	38.06 ± 9.92	38.44 ± 7.91	0.8660
BMI, kg/m², mean (± SD)	39.72 ± 3.77	40.75 ± 3.94	38.69 ± 3.40	*0.0287*
Docking time, min, mean (± SD)	14.06 ± 3.53	0 (0)	14.06 ± 3.53	*0.0001*
Operative time, min, mean (± SD)	52.81± 17.68	55.75± 19.7	49.88 ± 15.47	0.1898
Conversion to laparoscopy, n.ro (%)	1 (3.12)	0 (0)	1 (6.25)	1.0000
PONV, mean (± SD)				
- POD 0	1.84 ± 0.85	1.81 ± 0.98	1.87 ± 0.72	0.7811
- POD 1	0.69 ± 0.59	0.62 ± 0.62	0.75 ± 0.58	0.3897
- POD 2	0.31 ± 0.47	0.37 ± 0.50	0.25 ± 0.45	0.3168
VAS, mean (± SD)				
- POD 0	6.47 ± 1.74	6.67 ± 1.80	6.56 ± 1.36	0.7836
- POD 1	4.44 ± 1.62	3.75 ± 1.65	5.12 ± 1.31	*0.0005*
- POD 2	1.47 ± 1.27	1.25 ± 1.18	1.69 ± 1.35	0.1701
Abdominal drain, ml, mean (± SD)				
- POD 0	41.41 ± 70.62	59.37 ± 97.26	23.44 ± 12.61	*0.0424*
- POD 1	92.97 ± 27.11	95.31 ± 30.58	90.62 ± 23.93	0.4970
- POD 2	53.12 ± 18.78	53.12 ± 20.15	53.12 ± 17.97	1.0000
Complication, n.ro (%)				
- Abdominal wall bleeding	1 (3.12)	1 (6.25)	0 (0)	1.0000

Abbreviations: LSG, Laparoscopic Sleeve Gastrectomy; RSG, Robotic Sleeve Gastrectomy; SD, Standard Deviation; BMI, Body Mass Index; PONV, Post-operative Nausea and Vomiting; VAS, Visual Analogue Scale; POD, Post-Operative Day; NA, not available.

- The mean age of patients was 38 years

- 40 female, 24 male

- The preoperative BMI of patients was slightly higher, for patients treated by laparoscopy

- The duration of surgery was longer in the RSG group **influenced by the docking time**

- One RSG patient had to be converted to standard laparoscopy

- PONV scale showed no significant differences

- VAS scale, was slightly increased on POD1 for robotic patients.

- One LSG patient had abdominal wall bleeding

- LOS showed no differences

CLINICAL OUTCOMES WITH ESTIMATED COST SAVINGS

Single surgeon unpublished experience – Dr. Mario Musella: Surgeon's own da Vinci and lap data

Bariatric Sleeve

■ Lap
■ Da Vinci RAS

	Age	BMI (kg/m2)	Length of Stay (Days)	Operative Time (Minutes)	Blood Transfusions (%)
Lap	38,1	40,8	4,1	55,8	6,3
Da Vinci RAS	38,4	38,7	4,0	51,2 / 15,5	0,0

€600 (per bed day)   €24 (per minute)   €128 (per transfusion)

Cost

Potential savings with da Vinci RAS per procedure: results from cost modeling

Estimated Cost Savings Per Procedure
€153 vs. Lap

Estimated Total Cost Savings
€2,911 vs. Lap

Conclusions

- RSG is a safe alternative to LSG

- Comparable clinical outcomes

- RSG has longer surgery times

- It is essential to work with a skilled team on robotic platforms

- RSG has higher postoperative pain

- RSG represents a promising procedure for gaining proficiency with

  robotic platforms.

- It is essential to identify procedures and types of patients who would

  benefit most from robotic surgery, both clinically and economically.

Grazie per l'attenzione

antoniofranzese@hotmail.it