National University Hospital

The Transplant Colloquium 2022
INCORPORATING
THE LIVER TRANSPLANT SYMPOSIUM

Dealing with Bariatric Surgery and Liver Transplantation: What are the Strategies

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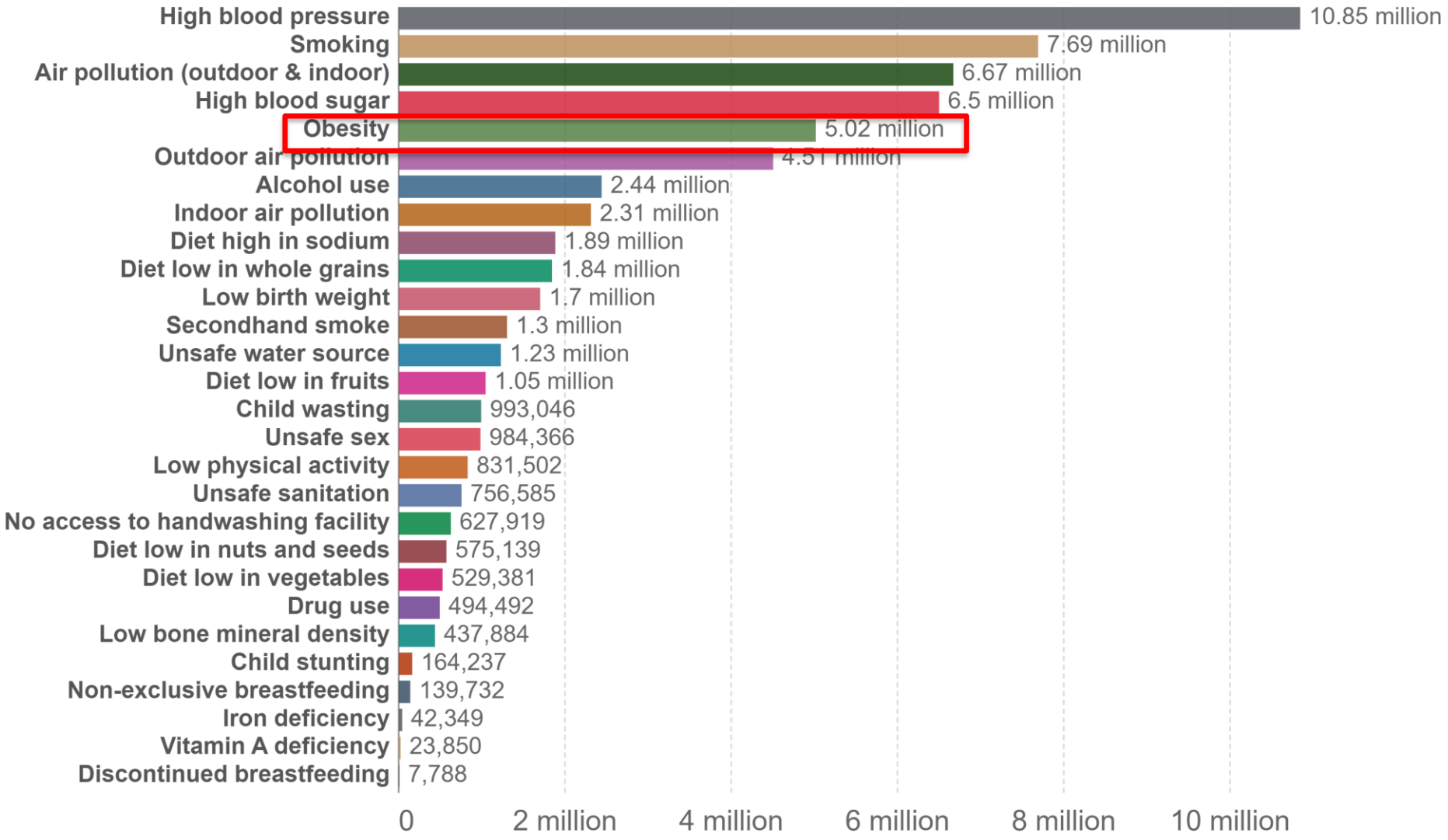
Number of deaths by risk factor, World, 2019

Total annual number of deaths by risk factor, measured across all age groups and both sexes.



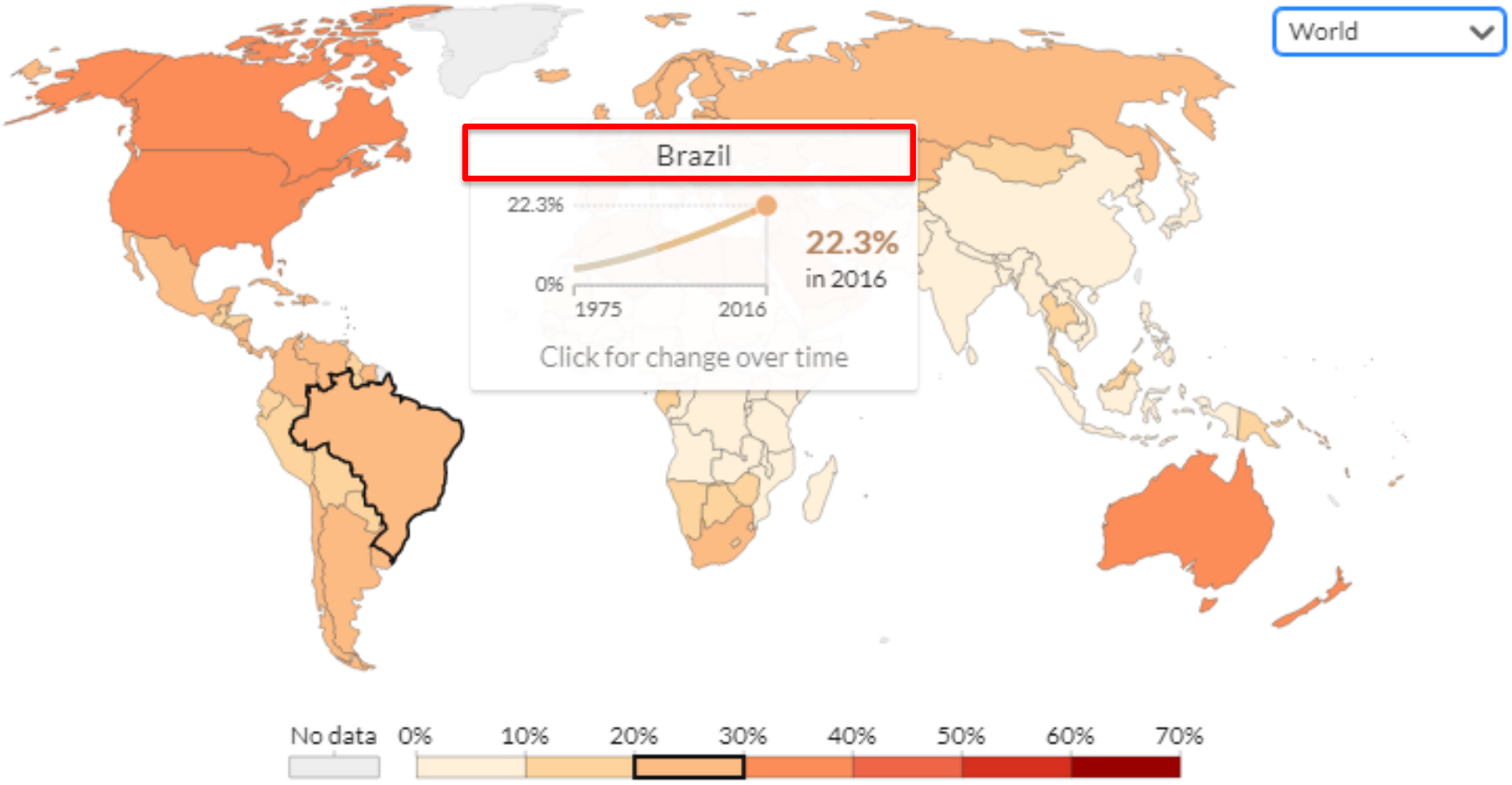
Source: IHME, Global Burden of Disease (2019)

OurWorldInData.org/causes-of-death • CC BY

Share of adults that are obese, 2016

Obesity is defined as having a body-mass index (BMI) equal to, or greater than, 30. BMI is a person's weight (in kilograms) divided by their height (in meters) squared.

Our World in Data



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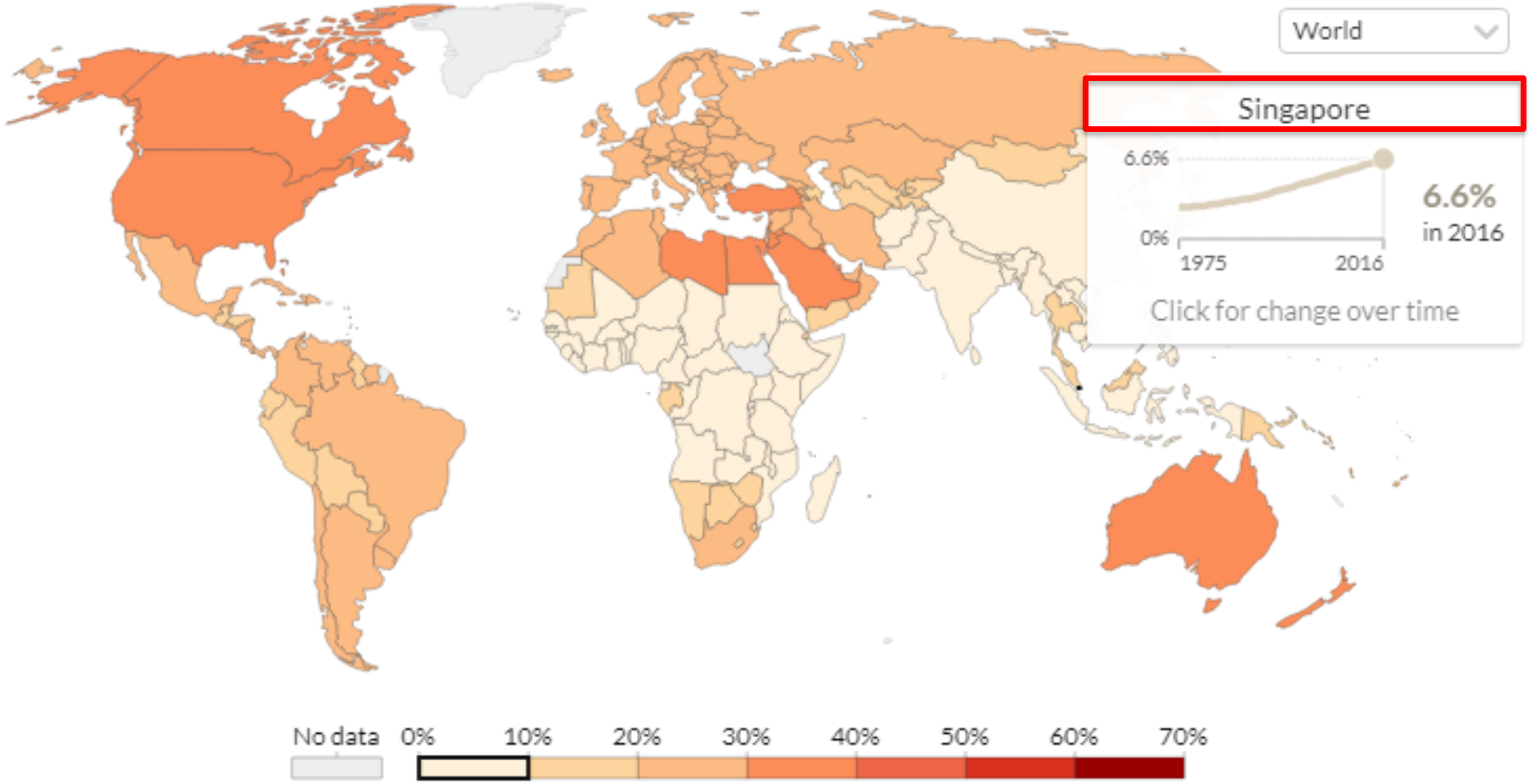
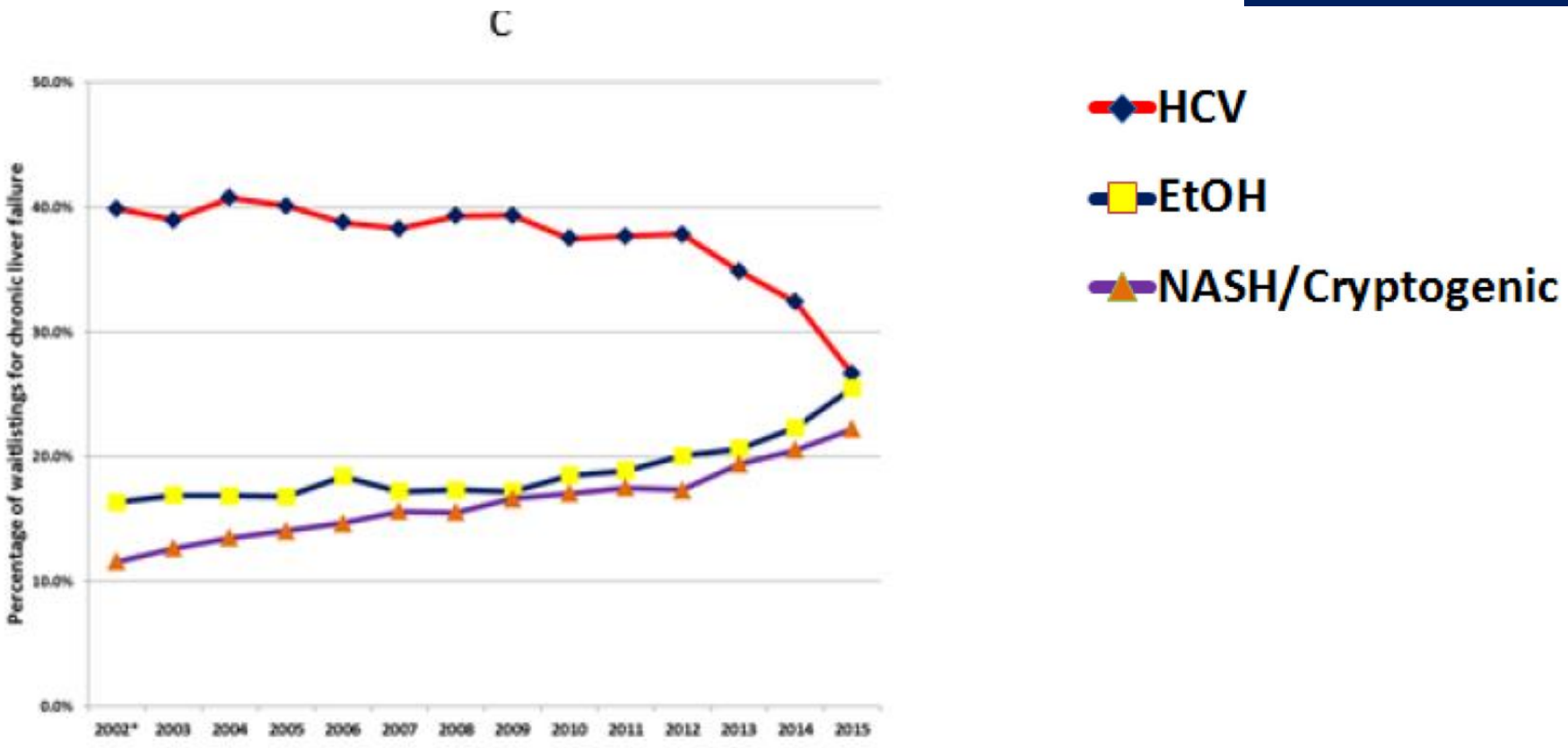


Changes in the Prevalence of Hepatitis C Virus Infection, Non-alcoholic Steatohepatitis, and Alcoholic Liver Disease Among Patients with Cirrhosis or Liver Failure on the Waitlist for Liver Transplantation

HCV - ↓
NASH - ↑
EtOH - ↑



Goldberg D, et al. Gastroenterology 2017;152:1090–9

HEPATOLOGY
Official Journal of the American Association for the Study of Liver Diseases

Patients Transplanted for Nonalcoholic Steatohepatitis Are at Increased Risk for Postoperative Cardiovascular Events

Table 3. CV Events in Patients Transplanted for NASH Versus ETOH Cirrhosis

Characteristic	NASH (N = 115)	ETOH (N = 127)	NASH Versus ETOH, OR* (95% CI)	*P* Value†
Any CV event‡ within 1 year of transplant, no. (%)	30 (26)	10 (8)	4.12 (1.91-8.90)	**<0.001**
Acute pulmonary edema	21 (18)	30 (16)	0.73 (0.39-1.37)	0.33
New-onset atrial fibrillation	11 (10)	10 (8)	1.26 (0.52-3.09)	0.61
Cardiac arrest	9 (8)	2 (1)	5.37 (1.13-25.39)	**<0.05**
Acute heart failure	3 (3)	10 (8)	0.31 (0.08-1.16)	0.07
Stroke	6 (5)	7 (6)	0.95 (0.31-2.90)	0.92
Stable ventricular tachycardia	2 (2)	0 (0)	1.02 (0.99-1.04)	0.14
Supraventricular tachycardia	2 (2)	1 (1)	2.23 (0.20-24.98)	0.92
Non-ST elevation myocardial infarction	2 (2)	3 (2)	0.73 (0.12-4.47)	0.74
ST elevation myocardial infarction	1 (1)	2 (1)	0.73 (0.12-4.47)	0.74

*Adjusted for recipient age, sex, smoking status, pretransplant diabetes, CV disease, and the presence of metabolic syndrome.
†*t* test for continuous variables; chi-square test or logistic regression for categorical variables.
‡Some patients had more than one cardiac complication; only the first event is counted here.

VanWagner LB, et al. Hepatology 2012

Bariatric procedures in candidates for liver transplant

Table 1 Baseline demographic, clinical characteristics and features of bariatric procedures of the patients included in the meta-analysis

Author	Year	n	Age (years)	Gender	MELD	Etiology	BS respect LT (before, after or during)	Time form BS and LT (months)	Bariatric surgery	Hospital stay	Graft rejection
Al-Nowaylati	2013	7	55.4	4 M 3 F	–	4 VHC; 1 OH; 1 NASH; 1 HMG	After	26.57	RYGB	–	0
Lin	2013	9	56.8	3 M 6 F	–	–	After	70.8	SG	5.3	–
Lin	2013	20	56	–	11	–	Before	16.6	RYGB	4.2	–
Khoraki	2016	5	56	4 M 1 F	–	1VHC; 3 NASH; 1 CBP	After	51.6	SG	–	0
Tsamalaidze	2018	12	56.6	7 M 5 F	–	5 VHC; 1 OH; 4 NASH; 1 AIH; 1 CC	After	63.1	SG	3.1	–
Zamora-Valdes	2018	29	45.5	12 M 17 M	32	10 NAFLD; 1 VHC; 1 NASH; 2 AIH; 1 HHT; 7 A1AT; 1 SLF; 4 HCC; 1 ALD; 1HPS*	During	0	SG	–	0
Osseis	2018	6	57.8	4 M 2 F	–	3 OH; 2 NASH; 1 AAH	After	48.4	SG	9	0
Garcia-Sesma	2019	8	53.6	2 M 6 F	–	5 NASH; 2 VHC; 1 OH	Before	–	SG	–	–

M: male; F: Female; N: number of patients; *LT* liver transplant; *BS* bariatric surgery; *RYGB* Roux-en-Y gastric bypass; *SG* Sleeve gastrectomy; *VHC* hepatitis C virus; *OH* alcoholic cirrhosis; *NASH* non-alcoholic steatohepatitis; *HMG* Hemangioendothelioma; *CBP* primary biliary cirrhosis; *AAH* Acute alcohohol hepatitis; *AIH* auotinmmune hepatitis; *CC* cryptogenic cirrhosis; *HHT* Hereditary Hemorrhagic Telangiectasia; *A1AT* Alpha1 antitrypsin; *SLF* Subfulminant liver failure; *HCC* hepatocarcinoma; *HPS* Hepatopulmonary Syndrome; *ALD* Alcoholic liver disease

*13 patients also present NAFLD

Lopez-Lopez V, et al. Obes Surg 2020

When?

Table 1. Timing of bariatric surgery in the liver transplant setting.

	PRE	DURING	POST
PROS	-Potential for improvement of liver function and delisting -Potential for decreasing risk of post-LT complications associated with obesity -Weight loss in order to achieve a certain BMI in centers where obesity is a contraindication for LT	-Single intervention and single recovery phase -Less risk of perioperative complications associated with portal hypertension	-Patient is more stable and without portal hypertension
CONS	-Potential for increased morbidity and mortality in patients with advanced cirrhosis	-Potential increased risk of staple line complications due to high dose steroids -Rapid weight loss may complicate immunosuppression dosing -May worsen intolerance to oral intake in the immediate postoperative period -Increased surgical time -Potential for increased rate of perioperative complications when compared to LT-only procedure -May worsen accelerated loss of bone mass in the first months after LT -May be cumbersome to the patient to learn post-LT care plus post-BS care	-Technically more challenging surgery because of post-LT adhesions -Increased infection risk due to immunosuppression -Steroids can interfere with healing

Based on information from Sharpton [59], García-Sesma [60], Diwan [53]. LT: Liver transplant; BMI: Body mass index; BS: Bariatric surgery.

Moctezuma-Velazquez C, et al. Nutrients 2019;11:2552

Liver Transplantation and Bariatric Surgery

Best Approach

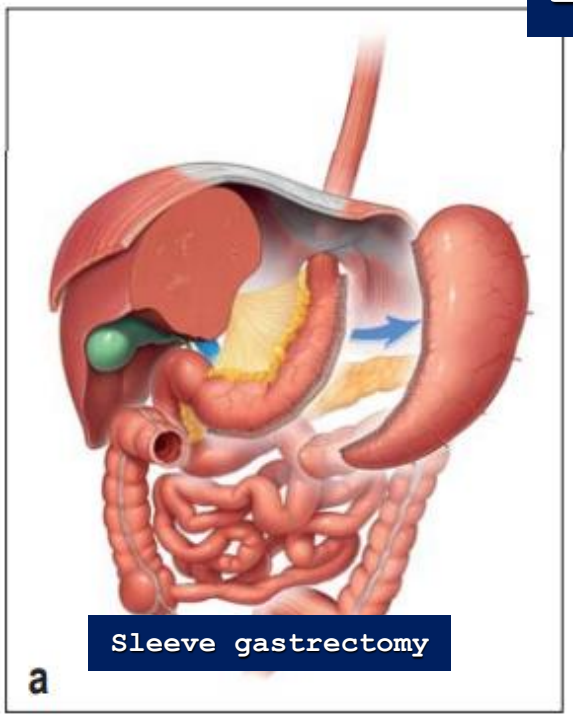
When?

Advantages and disadvantages of timing of bariatric surgery in the setting of liver transplantation

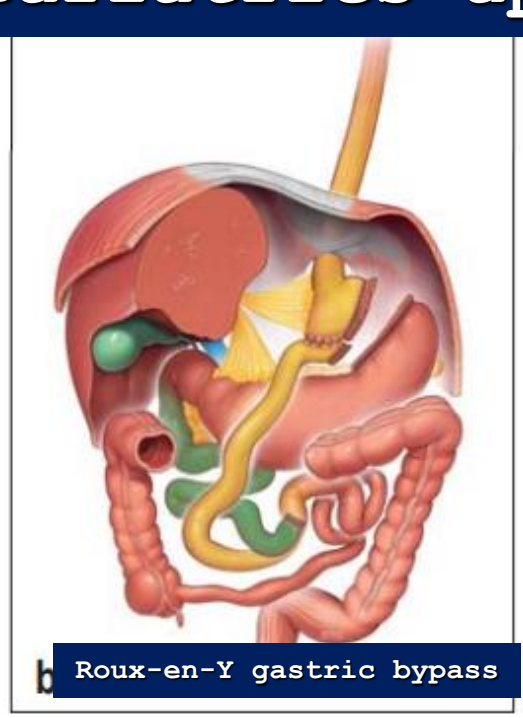
Timing	Advantages	Disadvantages
Before LT	Decreased weight and resolution of comorbidities before LT with benefits remaining after transplant	Increased cost with 2 separate hospitalizations, increased patient discomfort, delay of LT
During LT	Minimizes cost and patient discomfort, resolution of obesity-related comorbidities after LT	Complex procedure
After LT	Decreases obesity related comorbidities after LT	Increased risk of wound dehiscence and infection in the setting of post–LT immunosuppression, increased adhesions

Suraweera D, et al. Clin Liver Dis 2017;21:215-30

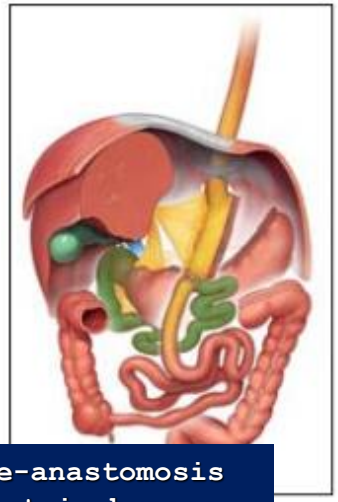
Bariatrics approaches



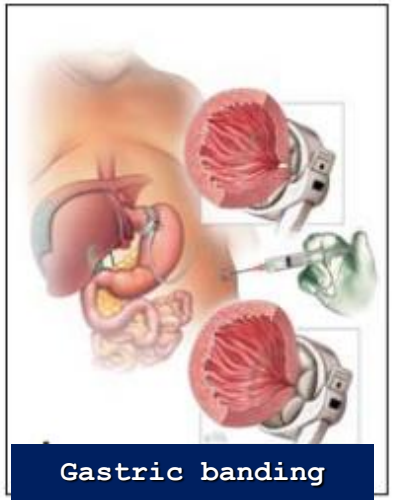
Sleeve gastrectomy



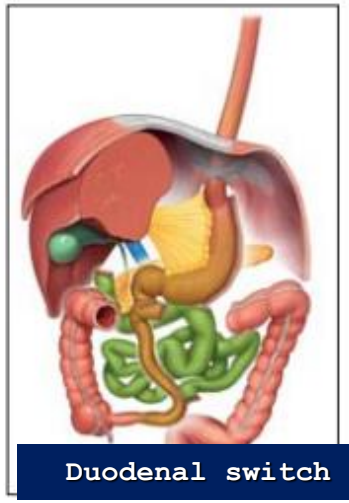
Roux-en-Y gastric bypass



One-anastomosis gastric bypass



Gastric banding



Duodenal switch

Fink J, et al. Dtsch Arztebl Int 2022;119:70–80

Bariatrics approaches

Table 2. Pros, cons, and weight loss of different bariatric approaches in the liver transplant setting.

	Gastric Bypass	Sleeve Gastrectomy	Banding	Intragastric Balloon
PROS	-The most efficient in terms of weight loss	-Does not cause malabsorption, less risk for malnutrition -Less operative time, reducing anesthesia duration -Technically easier -Does not modify pharmacokinetics of tacrolimus or MMF	-The least invasive, requires minimal dissection -Technically speaking is the easiest of the surgical procedures	-Minimally invasive -Can potentially be used in the decompensated patient -Easiest of all the procedures
CONS	-No easy access to the biliary tract or the remnant stomach which may develop variceal bleeding -Potential to lead to malabsorption and undernutrition -Affects the PKs of immunosuppressants -Use of steroids may increase the risk of marginal ulcers	-Risk of perioperative bleeding if there are gastric varices -Risk of bleeding or leakage from staple line	-Risk of complications related to the band (infection, migration) -The least effective in terms of weight loss	-Contraindicated in patients with large esophageal varices, gastric varices, or severe portal gastropathy

MMF: Mycophenolate mofetil; PKs: Pharmacokinetics.

Weight loss
No complications

Moctezuma-Velazquez C, et al. Nutrients 2019;11:2552

Gastric Bypass		
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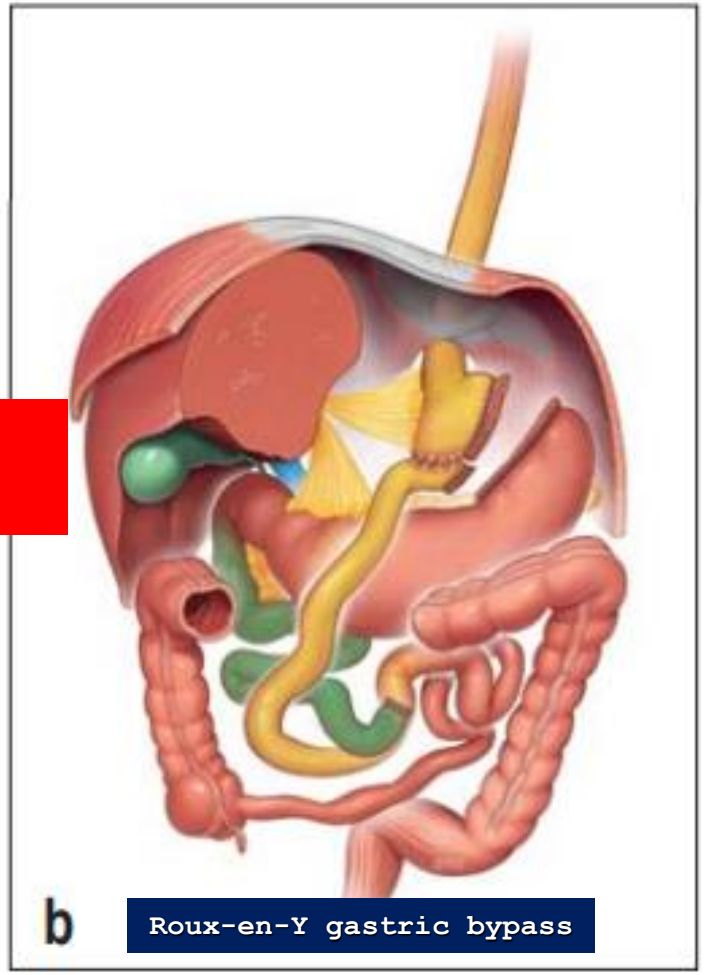
Weight loss
No complications

PKs: Pharmacokinetics



Gastric Bypass

Fink J, et al. Dtsch Arztebl Int 2022;119:70–80

Moctezuma-Velazquez C, et al. Nutrients 2019;11:2552

Banding	
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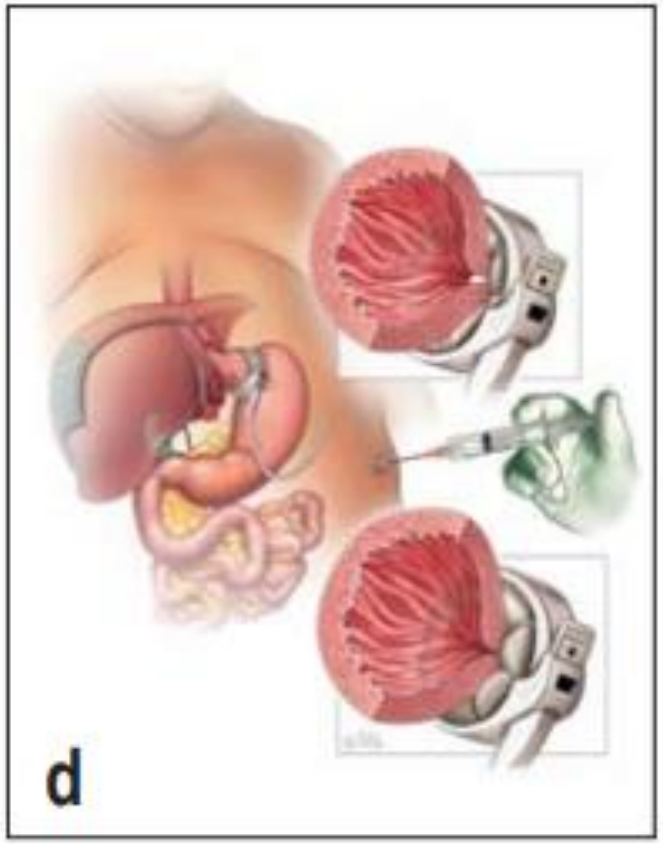
Weight loss
No complications



Gastric banding

Fink J, et al. Dtsch Arztebl Int 2022;119:70–80

Moctezuma-Velazquez C, et al. Nutrients 2019;11:2552

Intragastric Balloon

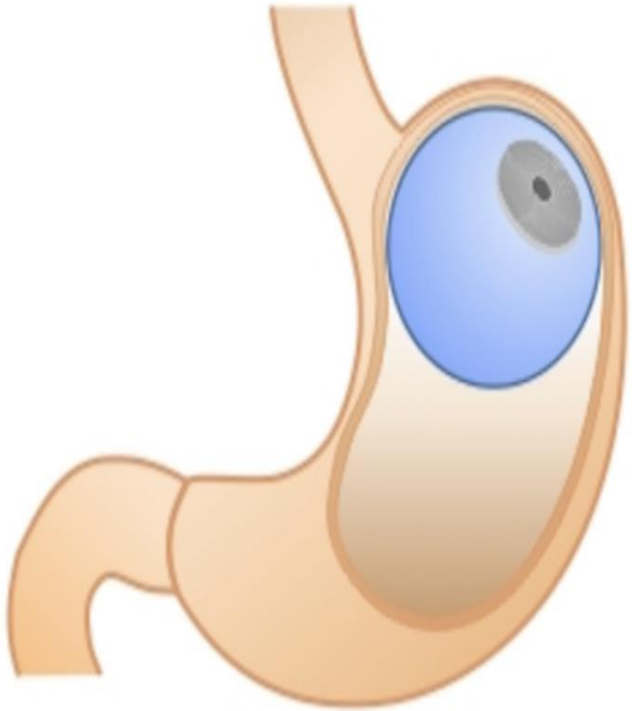
\+

-Minimally invasive
-Can potentially be used in the decompensated patient
-Easiest of all the procedures

Weight loss
No complications

\-

-Contraindicated in patients with large esophageal varices, gastric varices, or severe portal gastropathy



Intragastric Balloon

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Moctezuma-Velazquez C, et al. Nutrients 2019;11:2552

Sleeve Gastrectomy
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Weight loss
No complications

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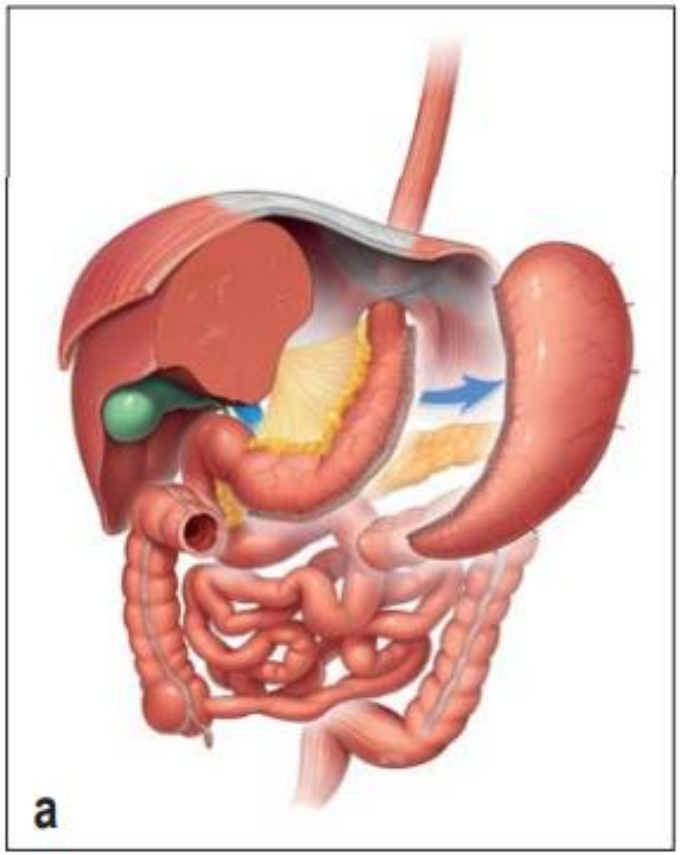

Sleeve gastrectomy

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Sleeve gastrectomy

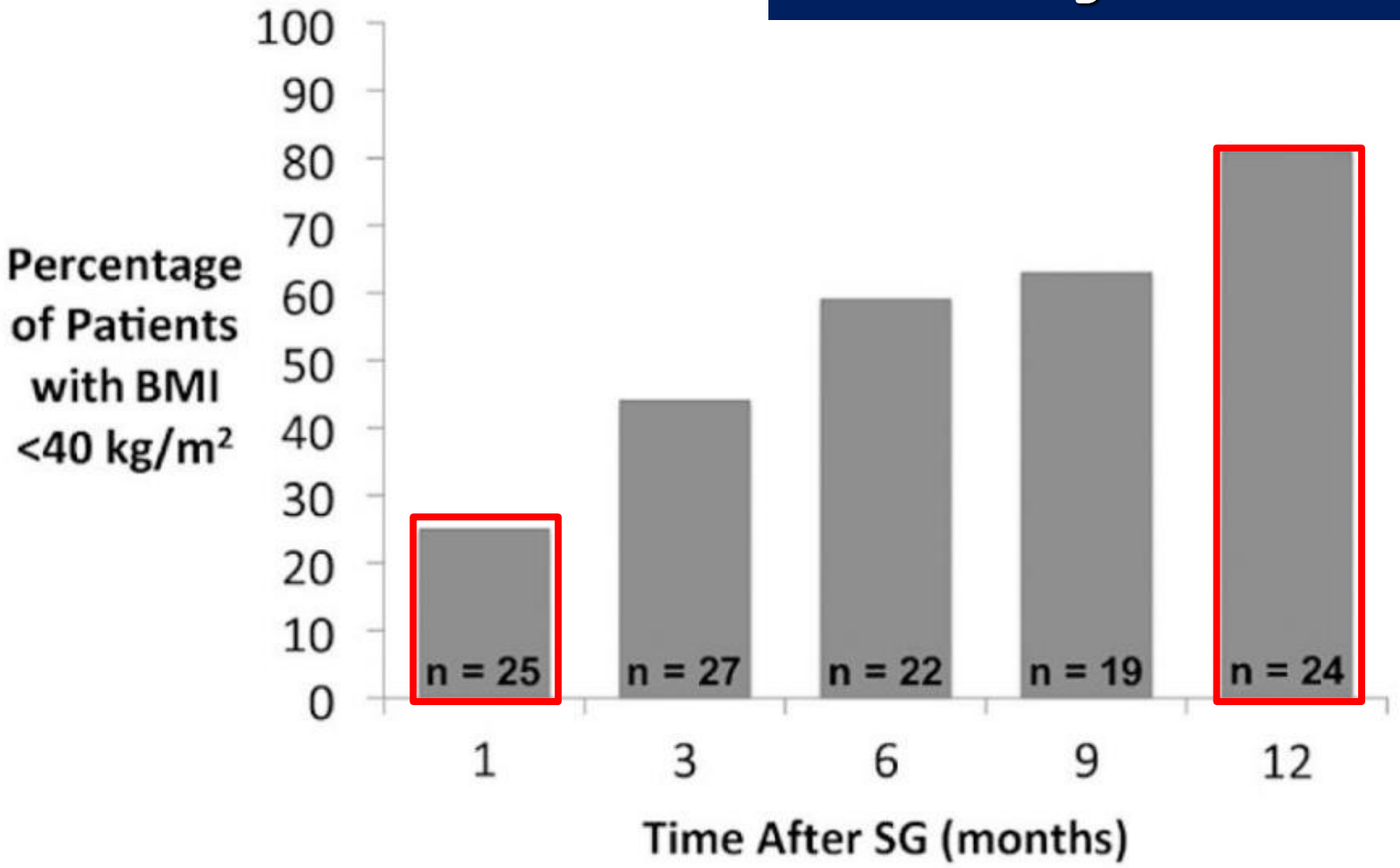


FIG. 3.
Percentage of patients who achieved a BMI <40 kg/m^2 at time points after SG.

Sharpton SR, et al. Liver Transpl 2019;25:538–44.

Sleeve gastrectomy

TABLE 3.

Weight Loss Outcomes After SG*

Time After SG	Absolute Weight Loss, kg	Percentage of Excess Body Weight Loss	Absolute BMI Reduction, kg/m^2
1 month (n = 25)	9.8 (7.2–12.6)	15.0 (10.2–19.2)	3.8 (2.6–4.4)
3 months (n = 27)	16.6 (11.8–21.7)	23.0 (16.8–29.5)	6.3 (3.8–7.3)
6 months (n = 22)	22.0 (18.9–26.8)	33.4 (27.9–45.5)	8.0 (7.3–9.7)
9 months (n = 19)	30.4 (26.3–46.4)	44.4 (34.8–62.5)	12.0 (8.8–16.6)
12 months (n = 24)	31.0 (23.6–50.3)	52.4 (36.9–63.3)	11.3 (9.2–18.5)

*All results are reported as median (IQR).

Sharpton SR, et al. Liver Transpl 2019;25:538–44.

Sleeve gastrectomy

TABLE 2.

Operative and Perioperative Outcomes With SG

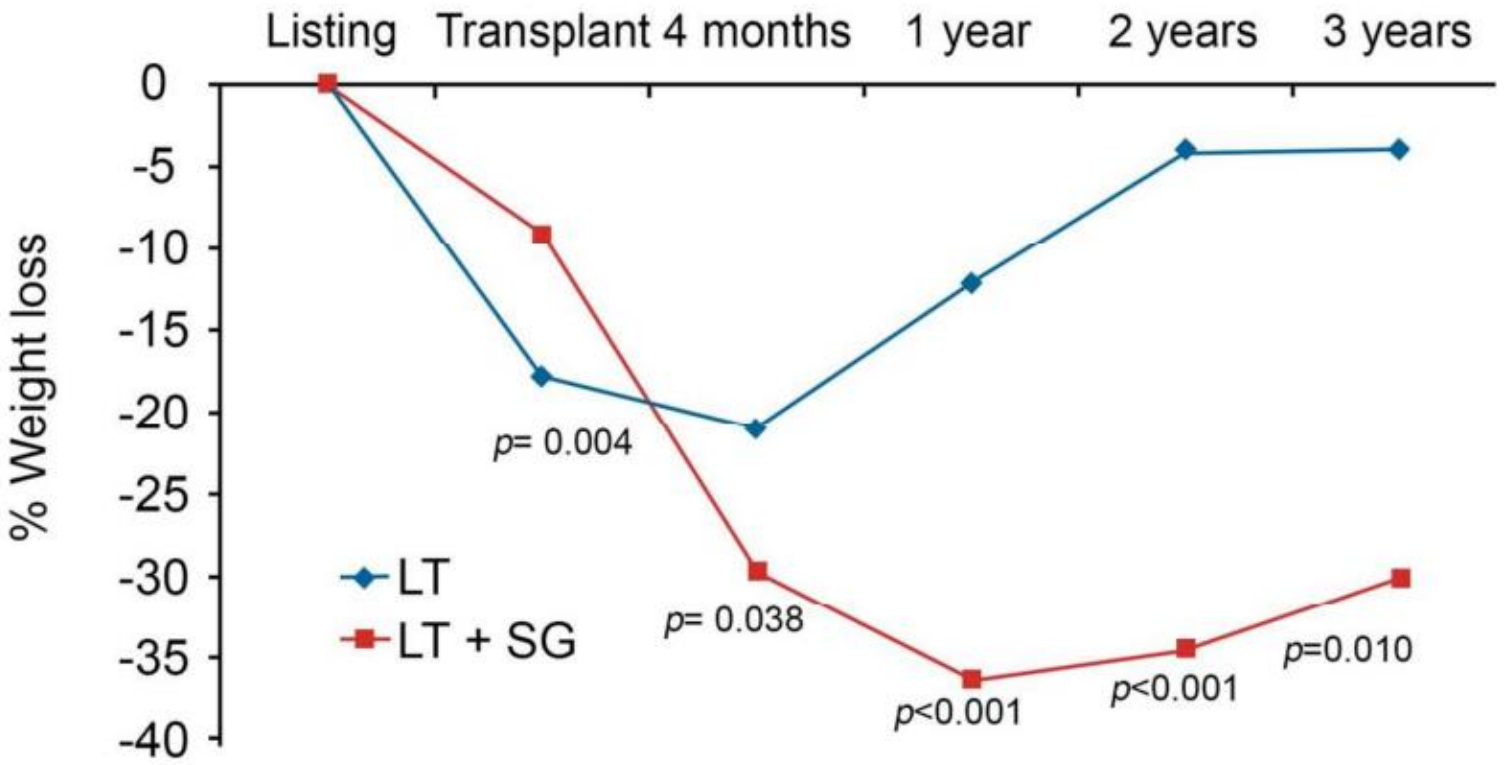
Characteristic	Value (n = 32)
Estimated blood loss, median (IQR), mL	50 (50–100)
Conversion to open procedure, n	0
Hospital length of stay, median (IQR), days	3 (2–3)
Reoperation, n	0
Perioperative morbidity, n	3
Major perioperative morbidity, n *	1
Liver-related morbidity, n	0
All-cause mortality, n	0

NOTE: Perioperative outcomes were defined as those occurring within 90 days after SG.

* Major morbidity was defined as Clavien-Dindo surgical complication grade of >2.

Sharpton SR, et al. Liver Transpl 2019;25:538–44.

Sleeve gastrectomy



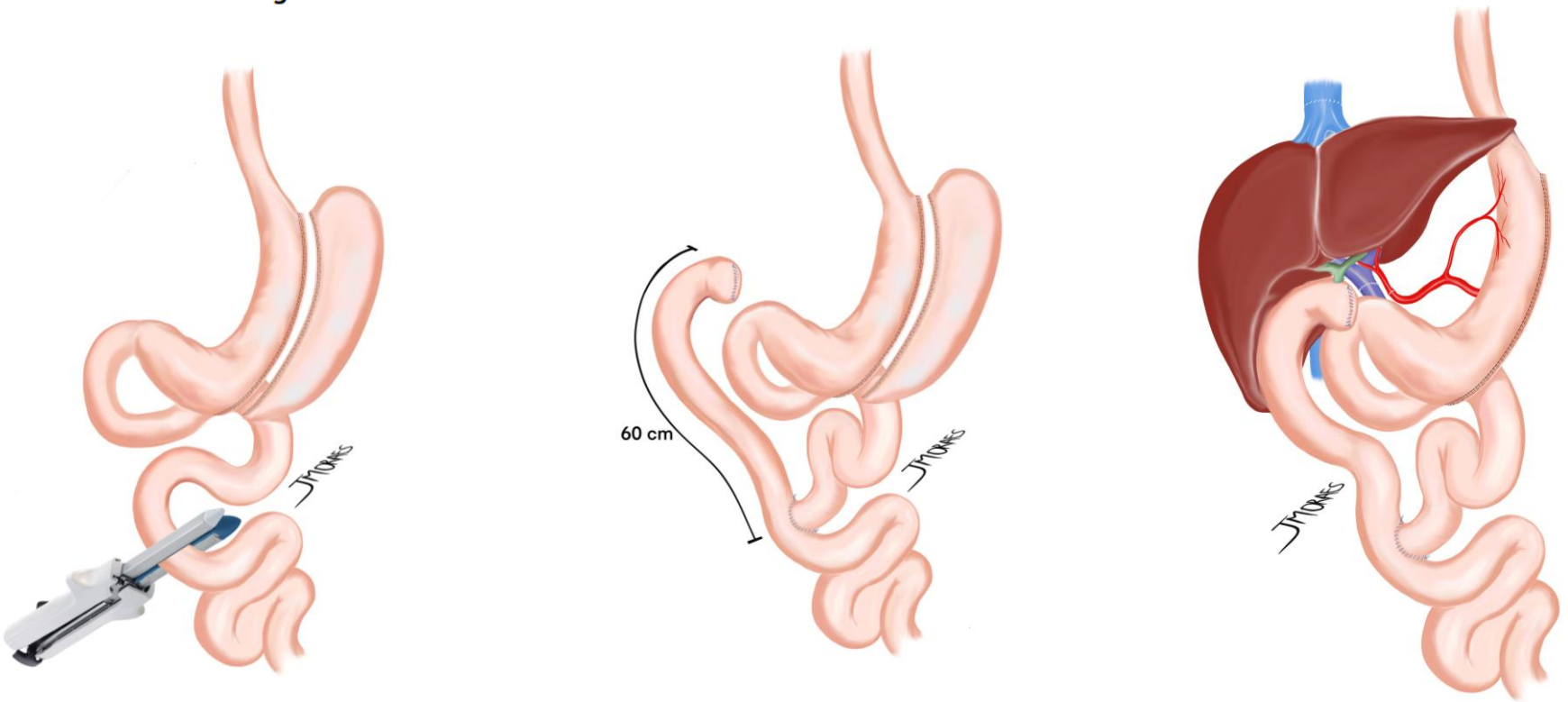
Zamora-Valdes D, et al. Hepatology 2018;68:485-95.

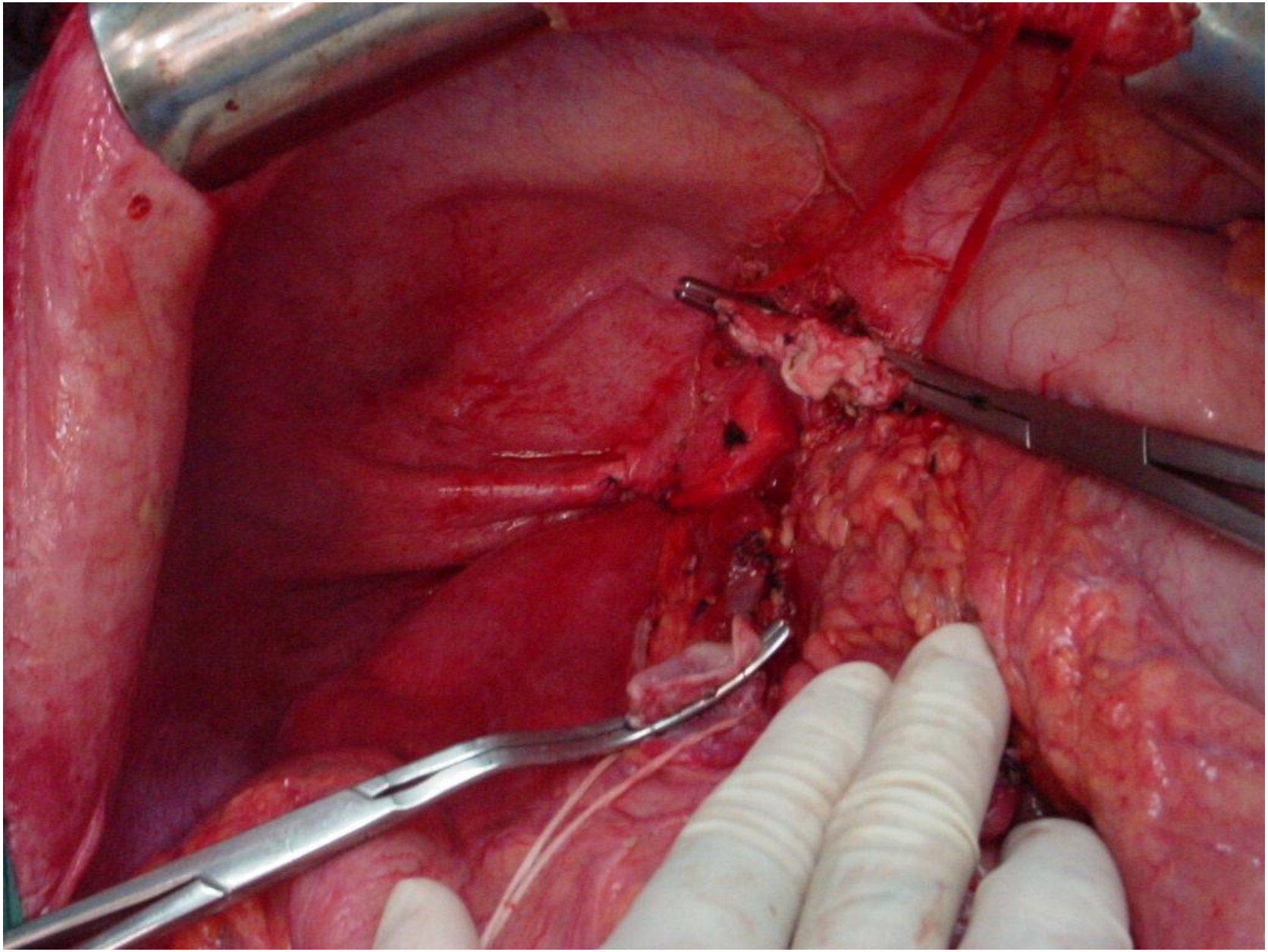
Updates in Surgery
https://doi.org/10.1007/s13304-021-01230-0

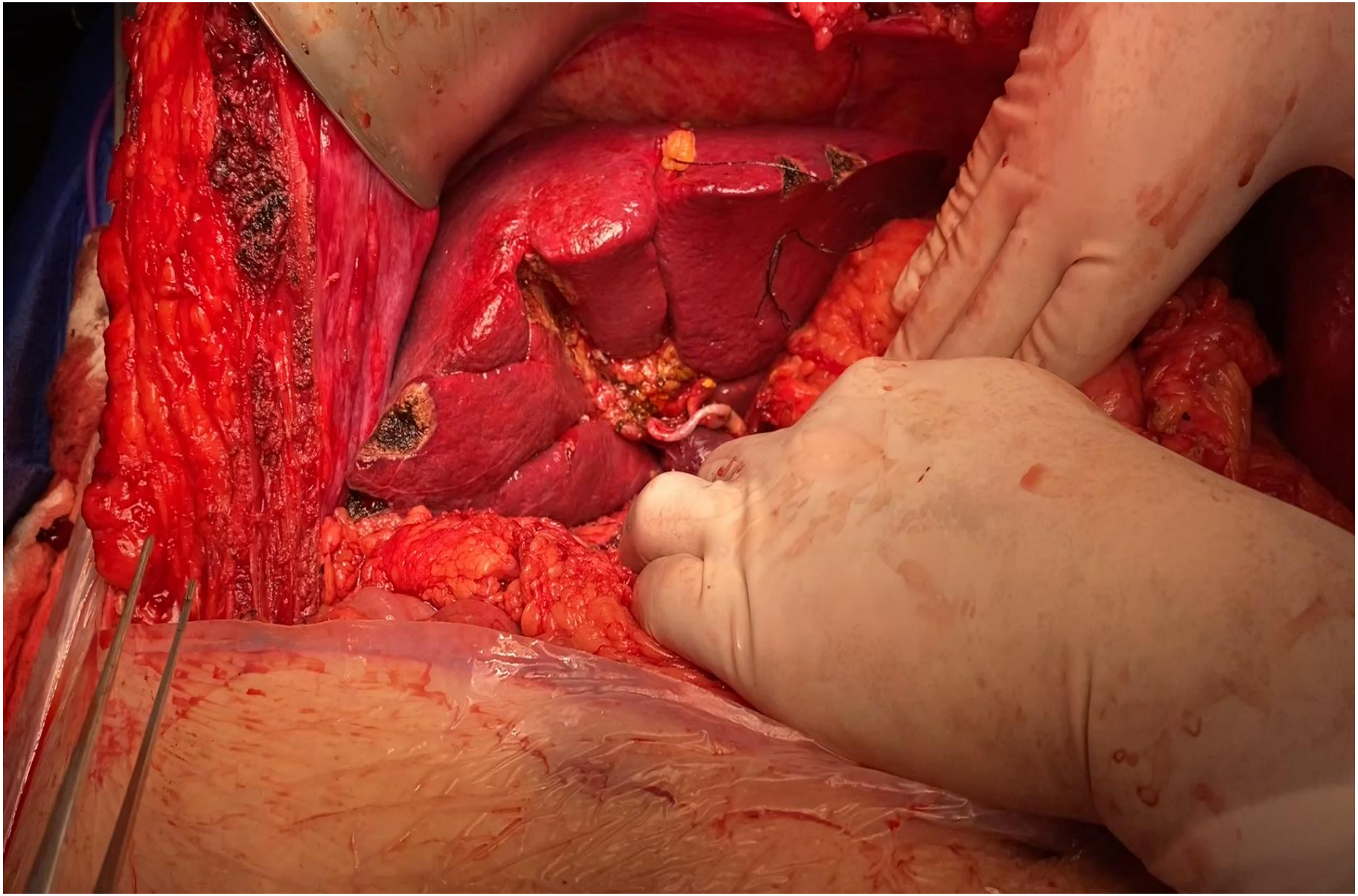
ORIGINAL ARTICLE

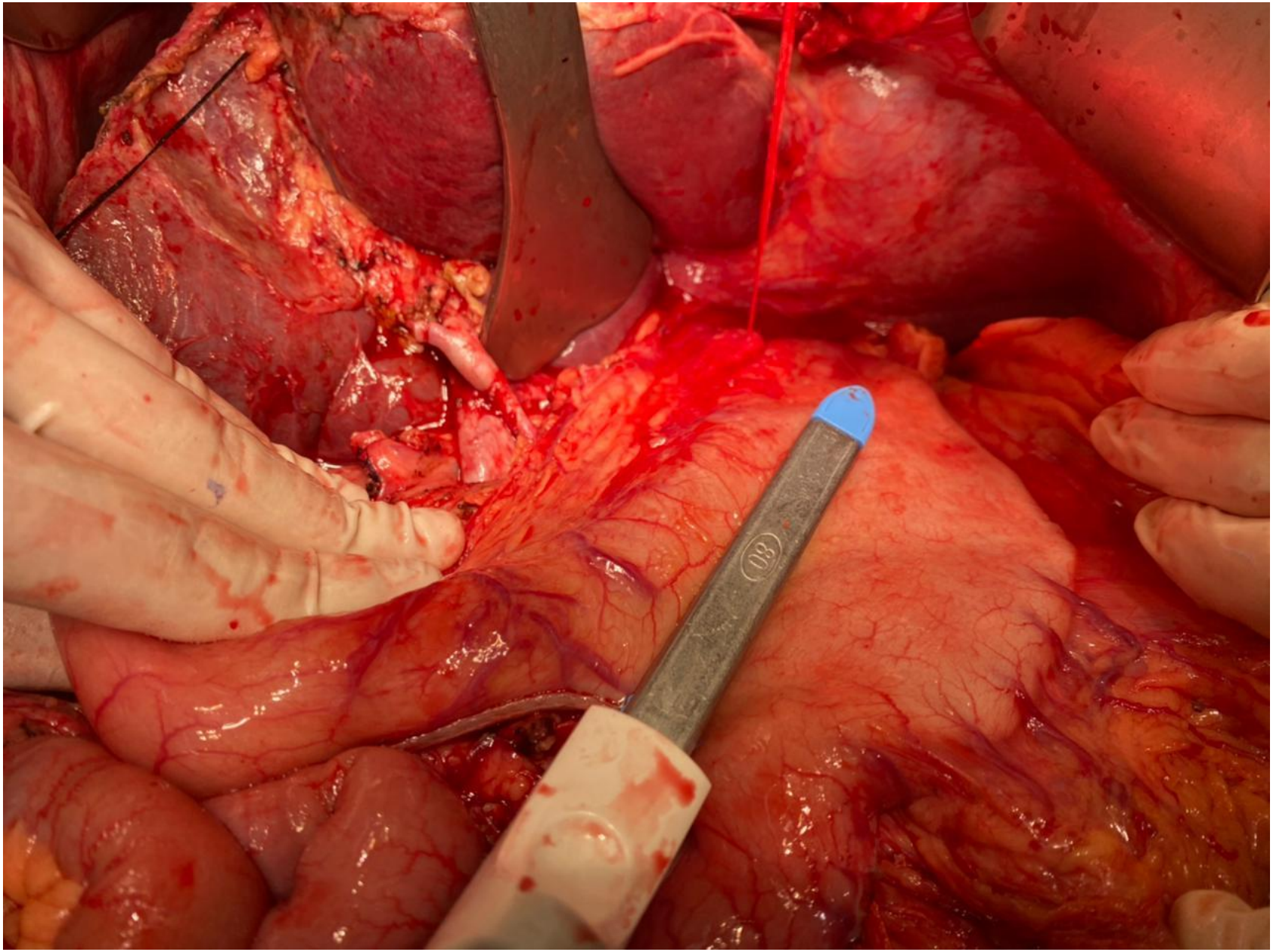
Combined liver transplantation with sleeve gastrectomy: a pioneer case series from Brazil

Eduardo de Souza M. Fernandes[1,2] · Felipe Pedreira Tavares de Mello[1,2] · Leandro Savattone Pimentel[1,2] · Ronaldo de Oliveira Andrade[1,2] · Camila Girão[1,2] · Camilla César[1,2] · Luciana Janene El-Kadre[1] · Fernando de Barros[1,2] · Henrique Sergio Moraes Coelho[3] · Anderson Brito[3] · Claudia Cristina Tavares de Sousa[3] · Orlando Jorge M. Torres[4,5]

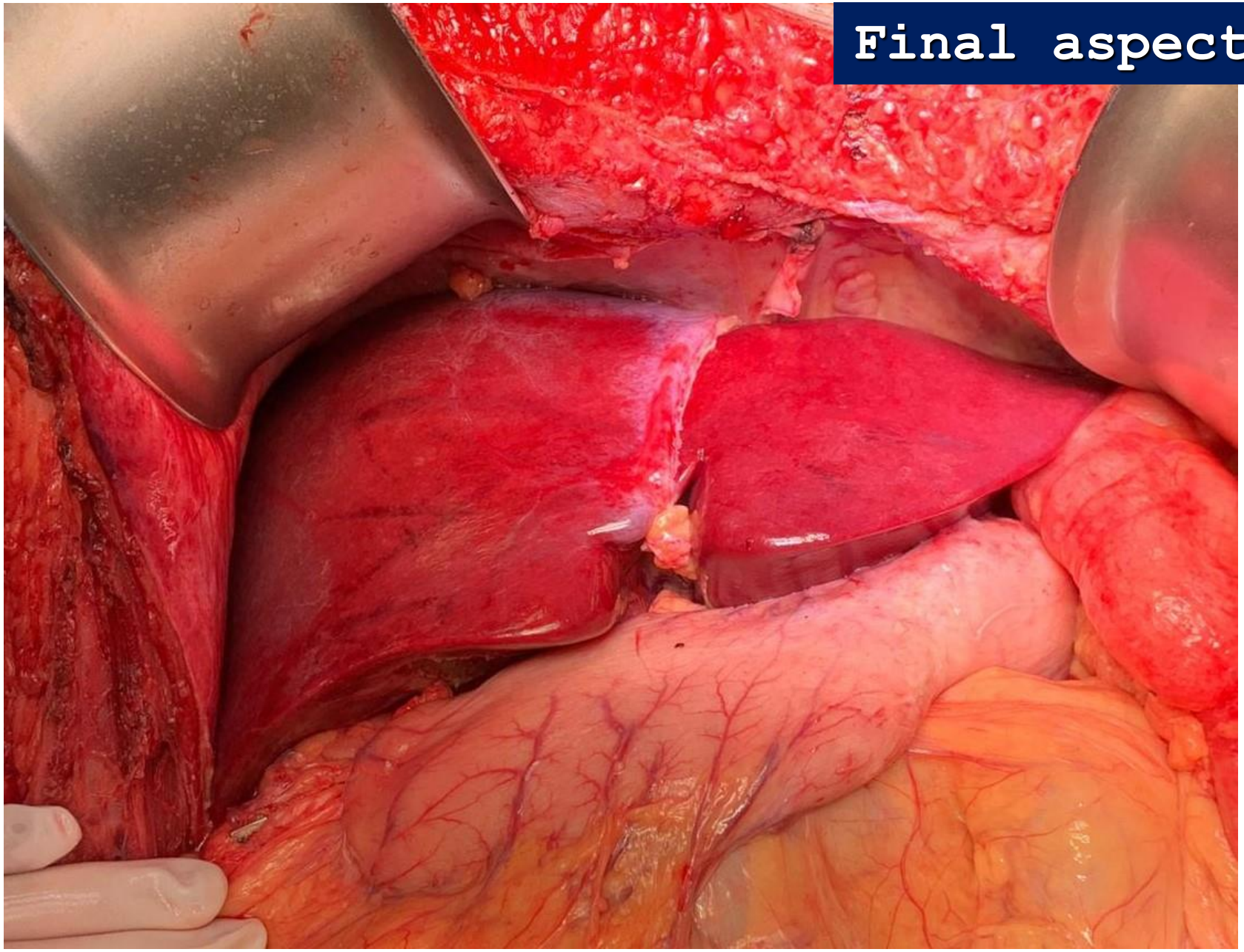








Final aspect



Specimen

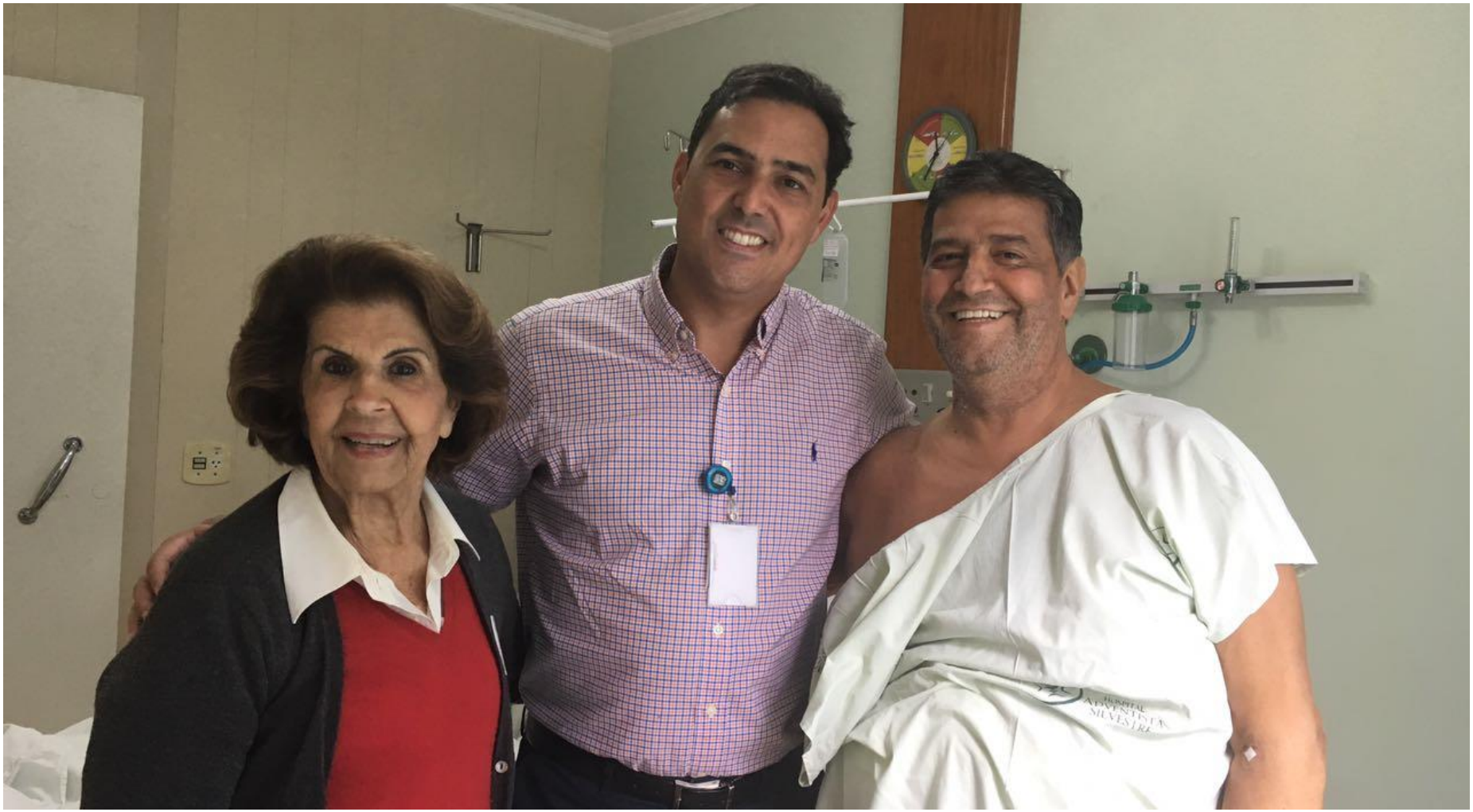


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Table 1 Characteristics of seven patients who underwent combined liver transplant with a Roux-en-Y biliary reconstruction plus sleeve gastrectomy

Gender	BMI at TX (kg/m^2)	Comorbidities	Age	MELD	TX indication	Donor age	Donor BMI (kg/m^2)	operative time	Hospital stay (days)	Surgical complication	BMI after surgery
Male	45.6	T2D, SAH, OBESITY	51	18	NASH	78	31	8:10	20	None	34 at 6 months
Male	41.9	OBESITY, SAH	61	24	NASH, HCC	34	25.9	5:25	63	Perforated diverticulitis	27.7 at 9 months
Female	37.3	SAH, OBESITY	61	29	NASH, HCC	63	39	5:10	8	None	26 at 7 months
Female	37.2	T2D, SAH, OBESITY	60	29	NASH,HCC	64	35	4:45	17	None	25 at 11 moths
Male	35	T2D, CKD, SAH, OBESITY	61	29	HCC, VIRUS C	54	31	4:55	9	None	25 at 12 months
Male	33.4	T2D, SAH, CAD, OBESITY	74	29	ALD, HCC	55	23.4	5:15	17	Sleeve leak Colonic perforation Death	
Female	37	OBESITY	56	20	NASH, HCC	49	24	6:00	10	None	29 at 3 months

BMI body mass index, *T2D* type 2 diabetes, *SAH* systemic arterial hypertension, *CKD* chronic kidney disease, *CAD* coronary artery disease, *NASH* Nonalcoholic Steatohepatitis, *HCC* Hepatocellular Carcinoma, *ALD* Alcoholic liver disease

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Conclusion

Simultaneous LTSG was an attractive and effective strategy to treat patients with end-stage liver disease associated with morbid obesity. However, other studies with more patients and longer follow-up are needed to achieve evidence-based data. The Roux-en-Y biliary reconstruction is a remarkably interesting alternative during the combined procedure.

Fernandes ESM, et al. Updates Surg 2022

Lençóis Maranhenses

Thanks!

www.drorlandotorres.com.br