Bariatric Surgery in a Cardiac Transplant Program – how, when and why

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A partnership between

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Mr. LW 29/04/1981

- First referred 2021, aged 40 during COVID pandemic for consideration of advanced heart heart therapies
- Height 183cm, weight 155.5kg -> BMI = 46.4
- Severe non-ischaemic cardiomyopathy diagnosed 2016
  - Ejection fraction (EF) nadir 30%, improved to 39% with good medical therapy
- Atrial fibrillation, hypertension, diabetes
- Frequent admissions with heart failure and malignant ventricular arrhythmia
  - Biventricular pacemaker, implantable cardioverter defibrillator in situ with recurrent shocks
  - Admission to ICU 17/11/22 requiring inotrope support – ceiling of care given BMI
- Not a candidate for intra-cardiac ablation for ventricular nor atrial arrhythmia due to anesthetic risk
- DSP – wife is a nurse, 3 children

Mr. LW 29/04/1981

- Gets through and after a period of engagement on ward and in OP clinic is felt to to be suitable candidate for advanced therapies however weight is currently a major contraindication
- Our usual multidisciplinary process:
  - HF team deem patient appropriate for advanced therapies
  - Patient meets bariatric team and agrees to pre and post op commitments
  - Right heart catheter
  - MDM
  - Gastroscopy used as “test”
  - MDM – include ICU
- Laparoscopic Sleeve Gastrectomy 27/2/2024 - uncomplicated
- Last weight measured in clinic 2/8/24 126.4 -> BMI 37.7

DW: Height 183cm, weight 159kg -> BMI = 47.5

Haemodynamics

Condition	W	Time	NIBP Sys	NIBP Dias	HR	RA m	RV Sys	RV Dias	RV EDP	PA Sys	PA Dias	PA m	PAW a	PAW v	PAW m
Rest		0:00	133	87	65	2	30	0	7	31	18	24	15	16	13

		PVR	CO	CI	TPG	RASa	ArtSat	PASat	W sat	Fick CO	RA/LA	RVSWI
Rest	0:00	2.3	4.7	1.7	11		100	66		6.46	0.15	575

Summary and Recommendations

Mildly elevated pulmonary pressures with mPA 24mmHg.
Normal RA 2mmHg and PCWP 13mmHg.
Reduced cardiac index CI 1.7L/min/m2 and RVSWI 575.

Haemodynamics

Condition	W	Time	NIBP Sys	NIBP Dias	HR	RA m	RV Sys	RV Dias	RV EDP	PA Sys	PA Dias	PA m	PAW a	PAW v	PAW m
Rest		0:00	92	65	60	10	66		17	65	25	41	22	37	26

		PVR	CO	CI	TPG	RASa	ArtSat	PASat	W sat	Fick CO	RA/LA	RVSWI
Rest	0:00	4.5	3.3	1.3	15		99				0.38	672

AB: Height 179cm, weight 150kg -> BMI = 46.8

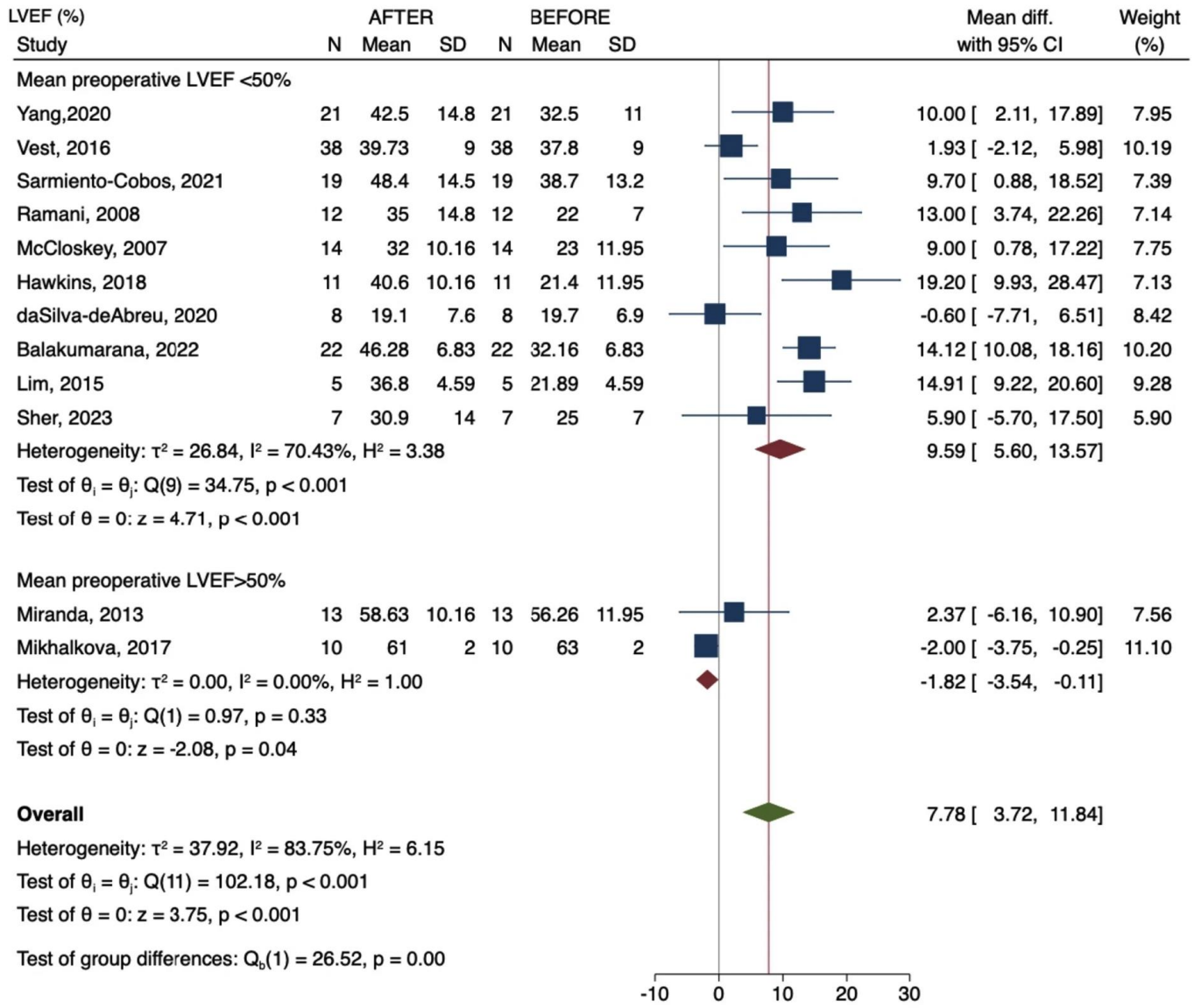
Summary and Recommendations

RHC via right brachial vein. Features of moderately elevated right atrial pressure, with moderate-severe pulmonary hypertension driven in part by elevated left-sided pressures. PVR is moderately elevated at 4.5 Wood Units. Severe reduction in cardiac index.

The Effect of Bariatric Surgery on Patients with Heart Failure: a Systematic Review and Meta-analysis. Obesity Surgery 2023.

- Meta-analysis of 14 articles with 217 patients showed that bariatric surgery can significantly improve LVEF: **mean difference of 7.78%**
- and NYHA class: **mean difference of − 0.40** in patients with obesity and HF.
  - other left ventricle echocardiographic findings including LV mass, LV mass index were significantly decreased post op
- Unfortunately these changes will not be clinically meaningful in a patient such as LW

From: The Effect of Bariatric Surgery on Patients with Heart Failure: a Systematic Review and Meta-analysis



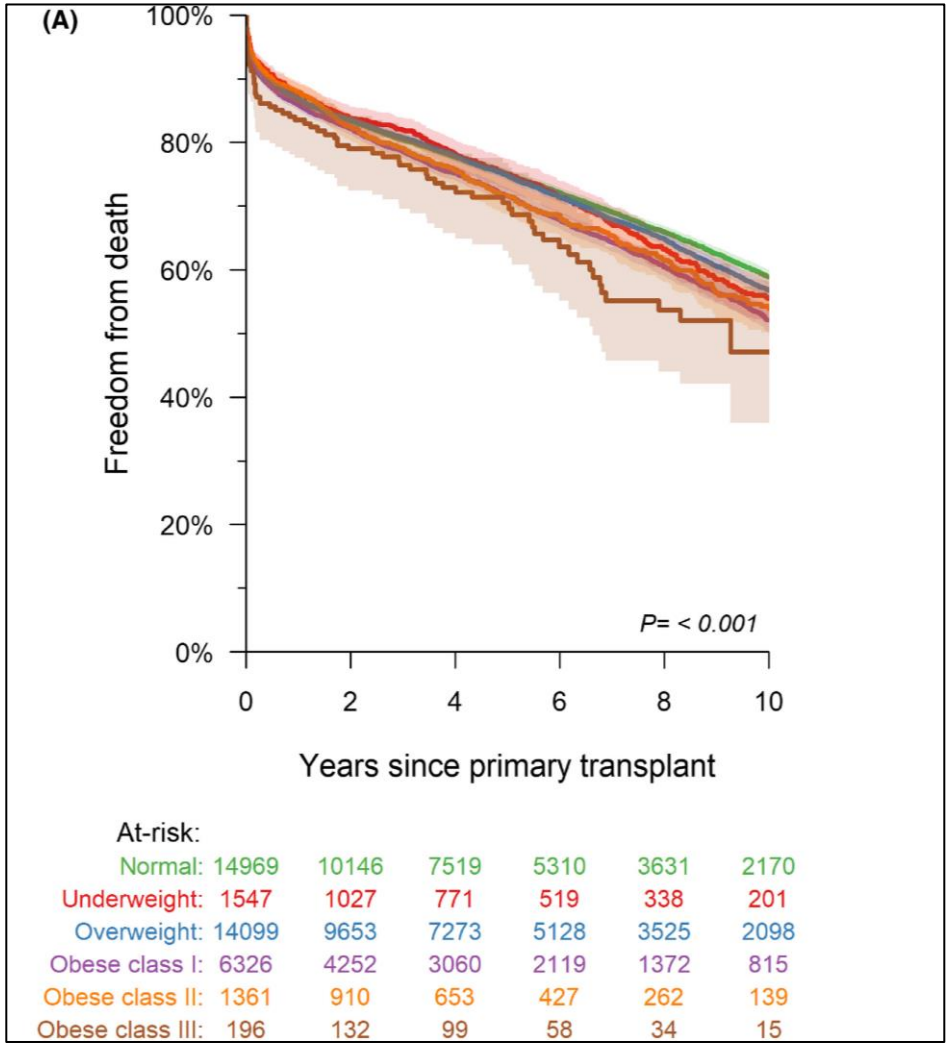
Effect of bariatric surgery on LVEF in patients with HF and subgroup analysis of the effect of bariatric surgery on LVEF in patients with HF based on the preoperative LVEF

BMI ≥35 kg/m2 is considered a relative contraindication to HT

Class II-III obesity is associated with post-operative complications as well as poor long-term survival

Kaplan Meir: Effect of pre–heart transplant BMI on posttransplant outcomes (ISHLT) Registry

- 38498 heart transplant recipients aged ≥18 years from the ISHLT Registry who underwent primary heart transplant between 2000 and 2014
  - 4.0% of patients were underweight (<18.5 kg/m2)
  - 38.9% normal weight (18.5-24.99 kg/m2)
  - 36.6% overweight (25-29.99 kg/m2)
  - 16.4% obese class I (30-34.99 kg/m2)
  - 3.5% class II (35-39.99 kg/m2)
  - 0.5% class III (≥40 kg/m2)
- 19.2% increased mortality risk in obesity class I (HR 1.192, 95% CI 1.129-1.258),
- 19.5% in class II (HR 1.195, 95% CI 1.080-1.323)
- 45.2% in class III (HR 1.452, 95% CI 1.150-1.833) vs normal weight patients
- Adjusted for the pretransplant clinical characteristics, obesity was associated with increased risk of death:
  - secondary to MI (P < 0.001)
  - chronic rejection (P < 0.001)
  - infection (P < 0.001)
  - renal dysfunction (P < 0.001)



Clinical Transplantation, Volume: 33, Issue: 7, First published: 01 June 2019, DOI: (10.1111/ctr.13621)

The 2016 International Society for Heart Lung Transplantation listing criteria for heart transplantation: A 10-year update

2006

Overall, pre-transplant BMI $>$ 30 kg/m^2 or percent ideal body weight (PIBW) $>$ 140% are associated with poor outcome after cardiac transplantation. For obese patients, it is reasonable to recommend weight loss to achieve a BMI of $<$ 30 kg/m^2 or percent BMI of $<$ 140% of target before listing for cardiac transplantation (**Class IIa, Level of Evidence: C**).

2016

Pre-transplant body mass index **(BMI)** $>$ **35 kg/m^2** is associated with a worse outcome after cardiac transplantation. For such obese patients, it is reasonable to recommend weight loss to achieve a BMI of $\leq$ 35 kg/m^2 before listing for cardiac transplantation (**Class IIa, Level of Evidence: C**).

Efficacy of bariatric intervention as a bridge to cardiac transplant (eligibility)

Surgery for Obesity and Related Diseases. 2023.

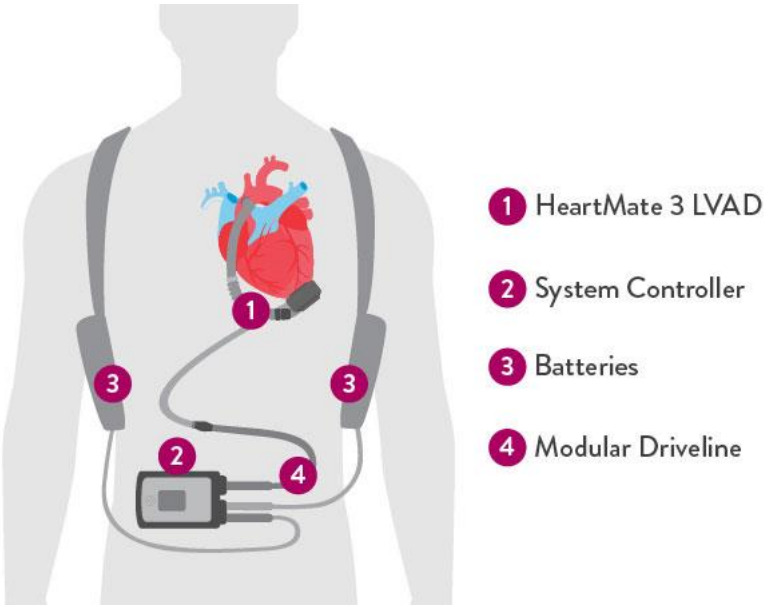
Table 3. Post–bariatric intervention cardiac transplantation status among the patient cohort

Patients	Postintervention transplant status				
	Ineligible	Waitlisted	Pretransplant	Transplanted	Transplant no longer necessary
Total patients (n = 18)	50.0% (n = 9)	16.7% (n = 3)	16.7% (n = 3)	5.6% (n = 1)	11.1% (n = 2)
Surgical patients (n = 7)	42.9% (n = 3)	14.3% (n = 1)	14.3% (n = 1)	0% (n = 0)	28.6% (n = 2)
Nonsurgical patients (n = 11)	54.5% (n = 6)	18.2% (n = 2)	18.2% (n = 2)	9.1% (n = 1)	0% (n = 0)

- 5 (71.4%) of 7 patients who underwent bariatric surgery obtained a BMI of <35 kg/m2
  - only 2 (18.2%) of 11 patients who received nonsurgical bariatric management met this BMI goal
- 2 of the patients with a BMI reduction to <35 kg/m2 had an increase in LVEF to almost within normal limits (46% and 48%)
  - no longer being considered for transplantation at this time
- Caution: Case report data suggesting post MBS surgery who go on to transplant spend more time out of target immunosuppression range however this has not translated to increase rates of rejection but warrants further study

Bariatric Surgery in Patients with Left Ventricular Assist Devices (LVADs)

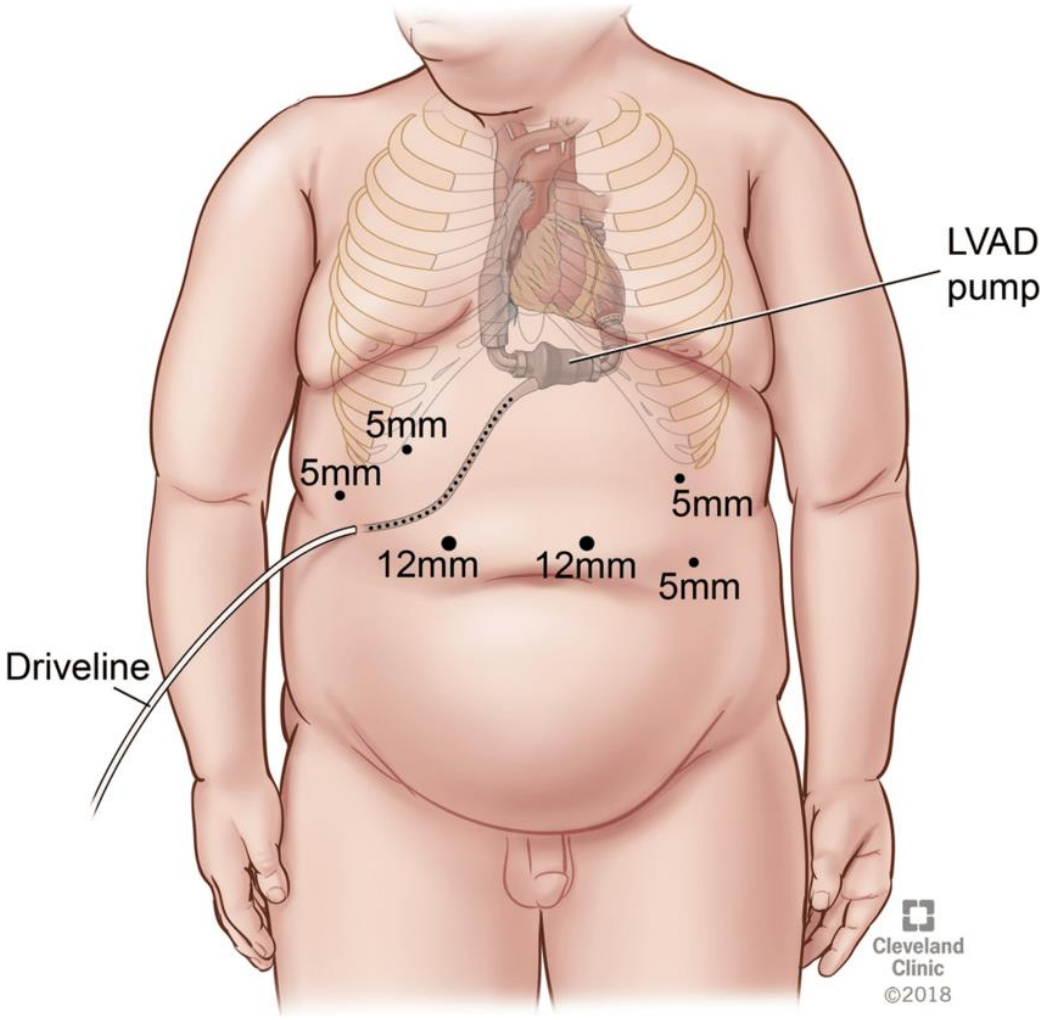
- Electromechanical circulatory support device for end-stage heart failure used as a bridge to heart transplantation
- Mechanical pump implanted in the patient's left ventricle (LV) to improve cardiac output
- Receives blood from the LV and delivers it to the aorta
- Consists of an implanted pump, driveline that connects the pump to the controller and an energy supply
- The driveline exits the lower chest and passes subcutaneously across the abdomen exiting on the right/left side
- IMACS (International Registry for Mechanically Assisted Circulatory Support) registry (USA):
  - 29.4% of LVAD recipients had class I-II obesity (BMI: 30 to 39.9 kg/m2) at device implantation
  - 4.7% had class III obesity (BMI: ≥40 kg/m2)
- Patients more prone to cardiac arrhythmias and less tolerant of exercise



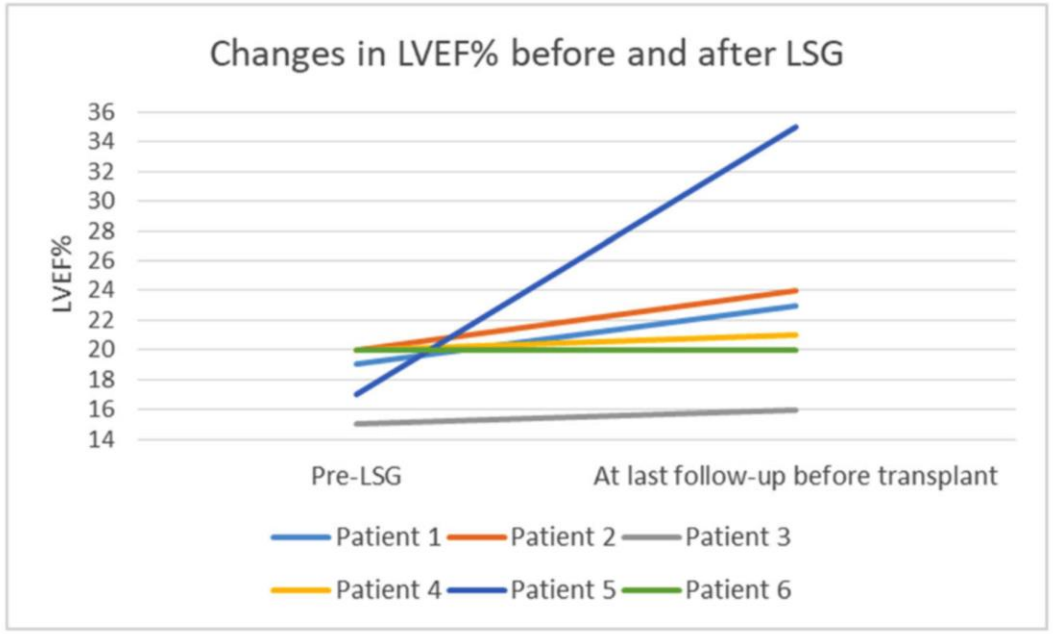
Laparoscopic Sleeve Gastrectomy in Heart Failure Patients with Left Ventricular Assist Device

Obesity Surgery 2019

- Seven patients with end stage heart failure and LVAD in situ who underwent laparoscopic sleeve gastrectomy (LSG) as a bridge to make them acceptable candidates for heart transplantation
- 6-port technique used
  - Avoid injury to the driveline and the pump
  - Before the operation, the sub-cutaneous driveline is marked with an absorbable skin marker
  - Veres needle placed below the left costal margin away from the driveline and pump
  - All the incisions for the ports are made 1–2 cm away from the driveline
  - Port sites as shown
  - The pump itself sometimes extends slightly below the left costal margin
  - The left subcostal port sometimes needs to be placed slightly more caudal to avoid injury to the driveline



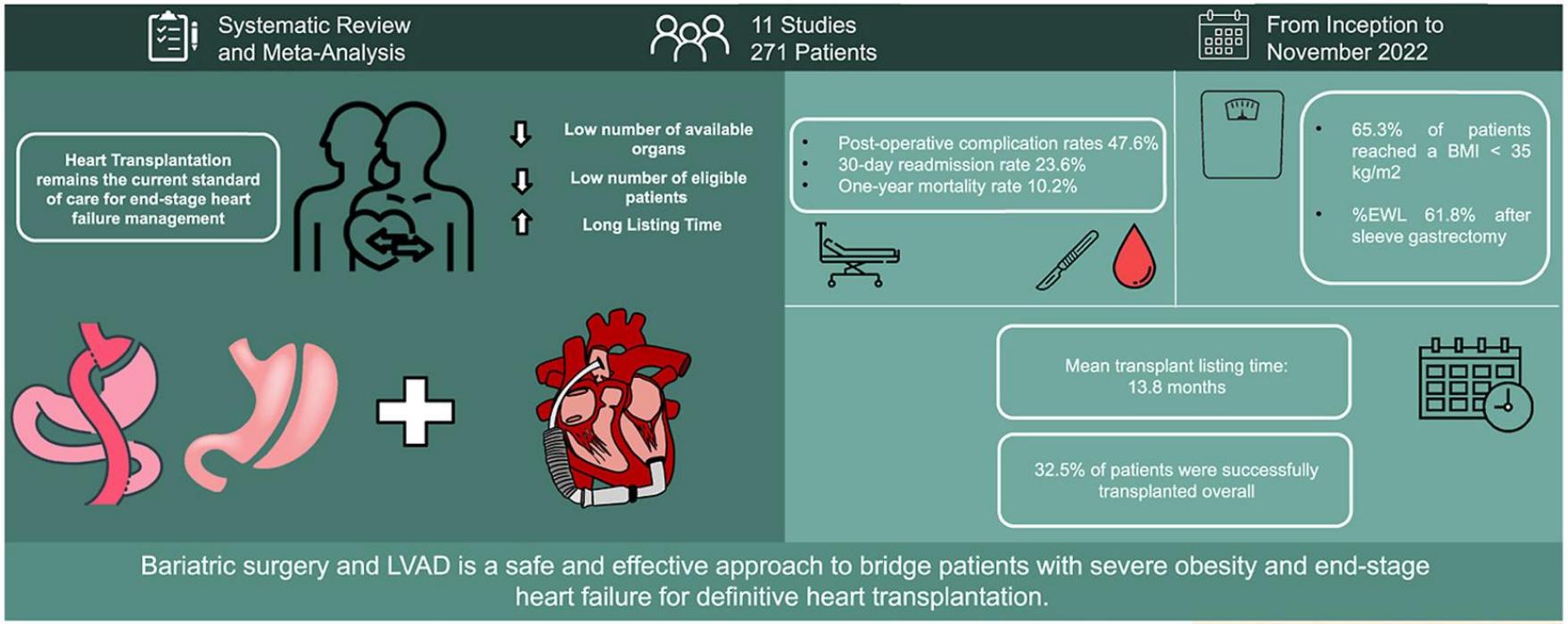
Results



- LSG safe and feasible in this high-risk group
- The median length of hospital stay was 9 days (range 6–23)
- Four patients had a planned 1-day intensive care unit (ICU) admission after surgery
- There were five 30-day complications, including two major and three minor complications and no perioperative deaths
  - One patient experienced gastrointestinal bleeding on postoperative day 2 secondary to anticoagulation which was managed with vitamin K
  - Another patient developed acute cholecystitis with septic shock requiring intubation and percutaneous cholecystostomy tube drainage
- There was no 30-day or 1-year mortality.
- Effective weight loss outcome - the median BMI decreased from 43.6 to 37.2 kg/m2 at a median follow up of 24 months
- Improvement in the cardiac function

Bariatric surgery and left ventricular assist device in patients with heart failure: A systematic review and meta-analysis

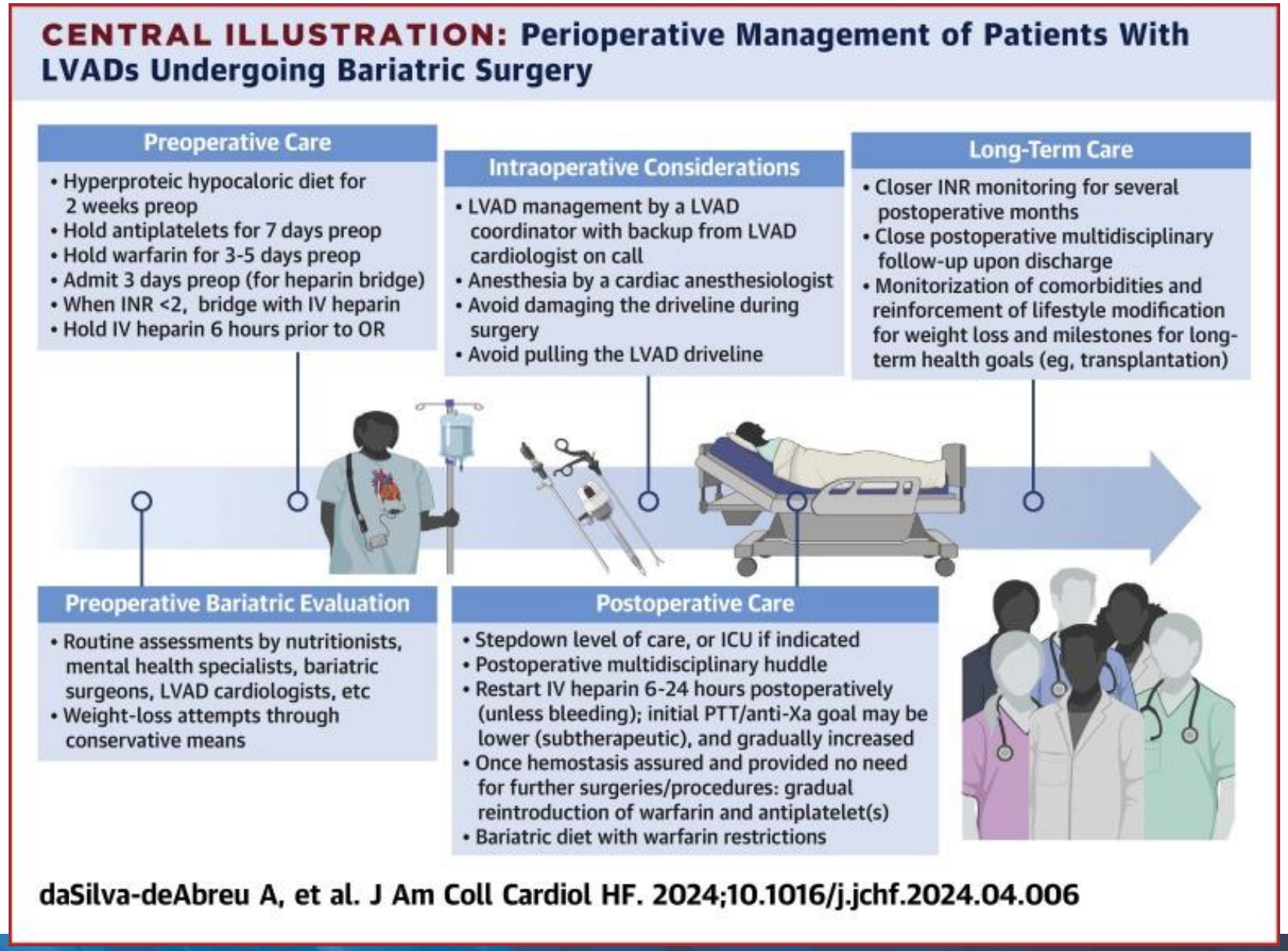
Am J Surg 2023



- 271 patients who underwent MBS during or after the LVAD implantation from eleven separate studies
- 67.4% of patients were listed on the heart transplant waitlist
- 32.5% underwent a successful transplant
- Mean listing time of 13.8 months
- The pooled postoperative complication rate, 30-day readmission rate, and one-year mortality rate were 47.6%, 23.6% and 10.2% respectively.
- Conclusions: MBS and LVAD is a safe and effective approach to bridge patients with severe obesity and end-stage heart failure for definitive heart transplantation.

Cautions

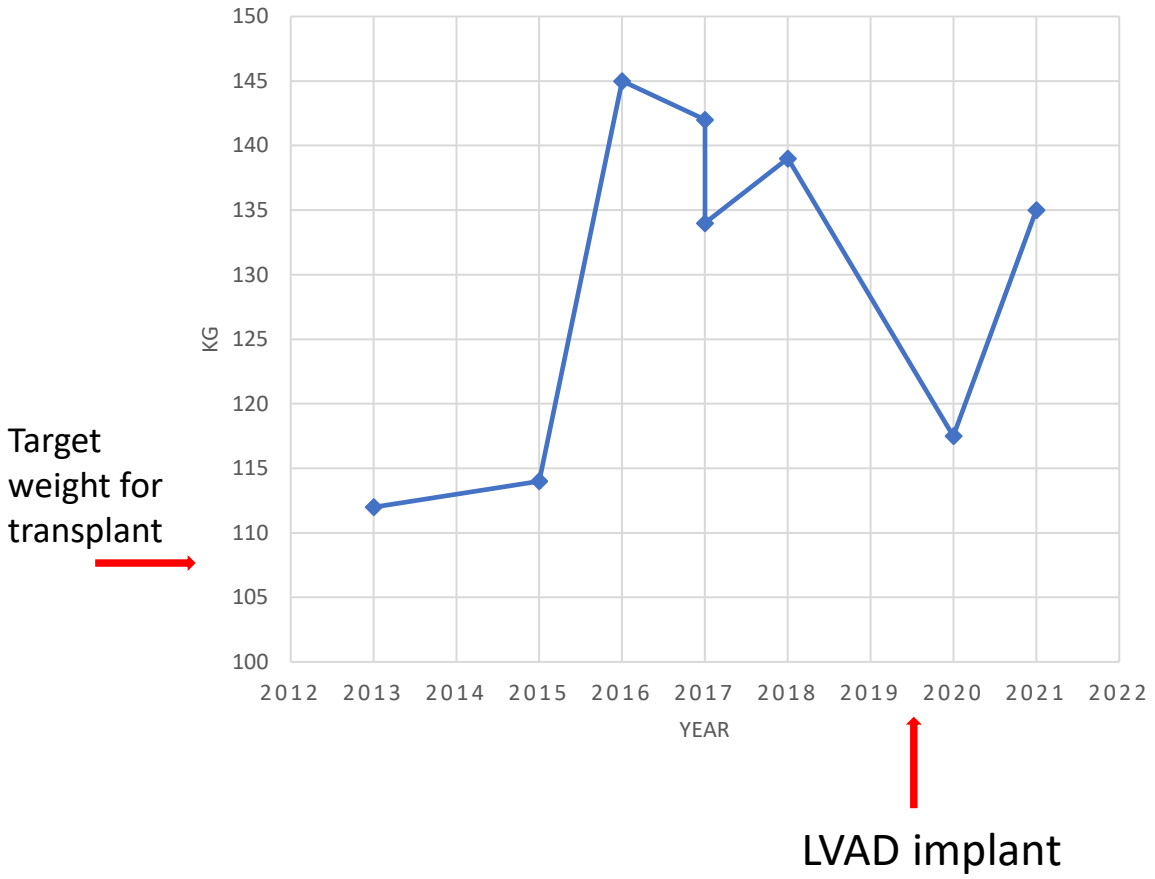
- Multidisciplinary team involvement for appropriate case selection and perioperative management including:
  - Advanced heart failure cardiologists
  - Mechanical support coordinators
  - Bariatric surgeons
  - Cardiac anesthetists
  - Intensive care
- Anticoagulation management
- LVAD driveline - ?cardiothoracic surgeon involvement



Mr. DW 09/05/1990

- 1st presented to The Alfred 2013 as a 23 year old man with new diagnosis of dilated cardiomyopathy in cardiogenic shock
- Ejection fraction (EF) = 15-20%
- Treated with IV frusemide, dobutamine and levosimendan
- Obesity: Height 181cm, weight 112kg, BMI 34.2
- OAHP: Bicuspid aortic valve, depression, OSA

Mr. DW 09/05/1990



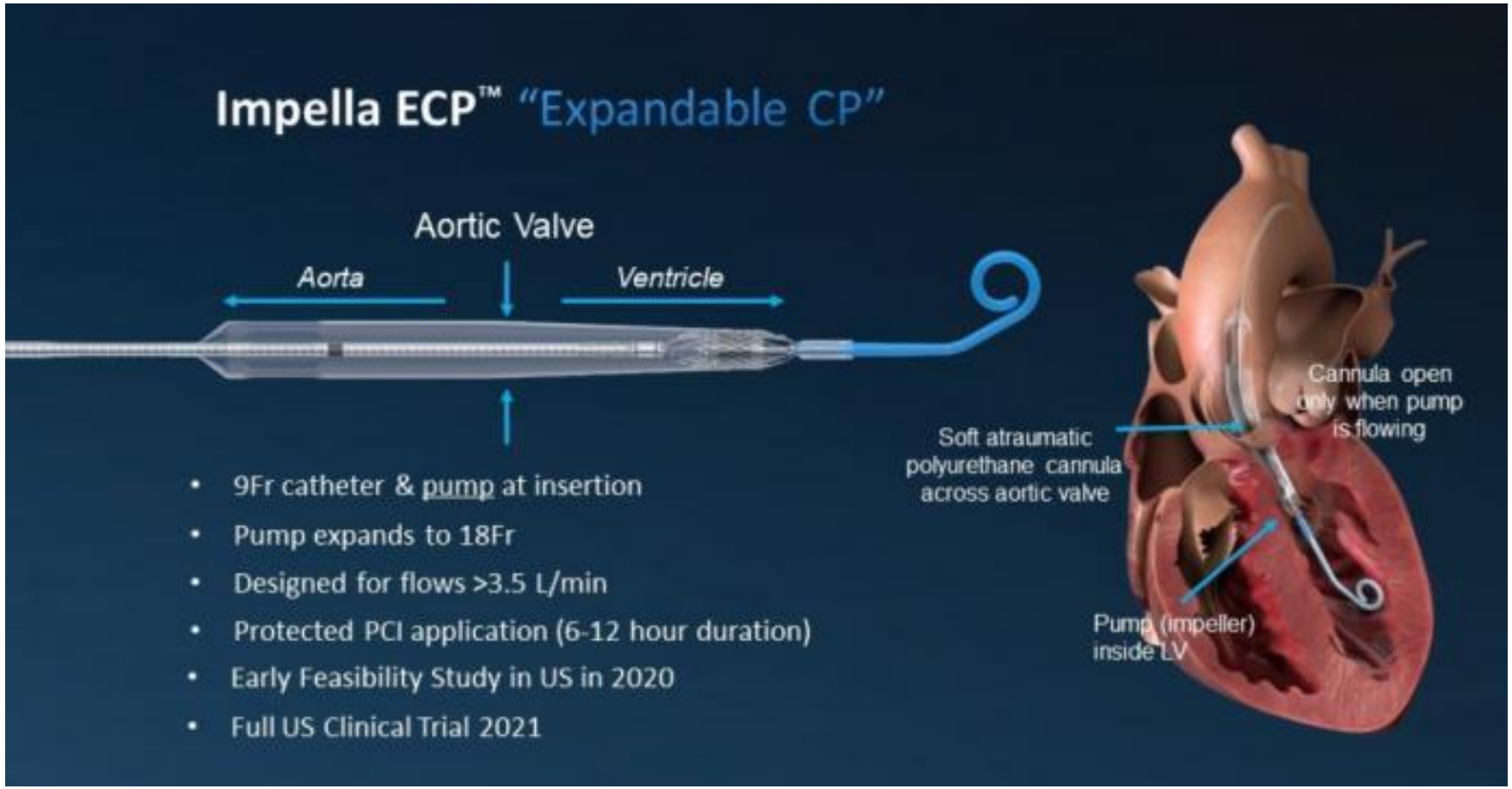
- 2013-2017: Stable in the Alfred heart failure clinic
- 2017: Admitted with decompensated heart failure *"obesity significant contraindication to heart transplant"*
- 2020 develops worsening heart failure and kidney injury, referred to bariatric clinic
- Presents in cardiogenic shock and worked up for urgent LVAD
- LVAD inserted 27/4/2020
- Well supported for 6 months
- October 2020: Undergoes heart transplant workup: *"Whilst D is suitable for heart transplantation, he would still need to lose a significant amount of weight prior to being listed…he will need to hit a target weight of under 107kg to achieve a BMI of <32mg/k2. He will continue to work with the dietician to this end".*

Mr. DW 09/05/1990

- Jan 2021 referred for consideration of bariatric surgery
- Laparoscopic Sleeve Gastrectomy 28/2/2023
  - Off warfarin
- Pre-op weight: 151kg, BMI 44.8
- June 2023 weight 116, BMI under 35, listed for heart transplant
- November 2023 underwent heart transplantation
  - Complicated by primary graft dysfunction, rejection
- Now 9 months post transplant, well, normal graft function, 105kg

Future Directions

Impella supported bariatric surgery



THANK YOU.

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