

ASMBS guidelines/statements

Scientific evidence for the updated guidelines on indications for metabolic and bariatric surgery (IFSO/ASMBS)

Maurizio De Luca, M.D.^{a,*}, Scott Shikora, M.D.^b, Dan Eisenberg, M.D.^c,
Luigi Angrisani, M.D.^d, Chetan Parmar, M.S., D.N.B., F.R.C.S.^e,
Aayed Alqahtani, M.D., F.R.C.S.C., F.A.C.S.^f, Ali Aminian, M.D.^g, Edo Aarts^h,
Wendy A. Brown, Ph.D., M.B.B.S., F.R.A.C.S., F.A.C.S.ⁱ, Ricardo V. Cohen, M.D., Ph.D.^j,
Nicola Di Lorenzo, M.D.^k, Silvia L. Faria, Ph.D.^l, Kasey P. S. Goodpaster, Ph.D.^m,
Ashraf Haddad, M.D.ⁿ, Miguel F. Herrera, M.D., Ph.D.^o, Raul Rosenthal, M.D.^p,
Jacques Himpens, M.D.^q, Angelo Iossa, M.D.^r, Mohammad Kermansaravi, M.D.^s,
Lilian Kow, B.M.B.S., Ph.D.^t, Marina Kurian, M.D.^u, Sonja Chiappetta, M.D., Ph.D.^v,
Teresa LaMasters, M.D.^w, Kamal Mahawar, M.B.B.S., M.Sc.^x, Giovanni Merola, M.D.^y,
Abdelrahman Nimeri, M.D., M.B.B.Ch.^b, Mary O’Kane, M.Sc., R.D.^z,
Pavlos K. Papasavas, M.D.^{aa}, Giacomo Piatto, M.D.^{ab}, Jaime Ponce, M.D.^{ac},
Gerhard Prager, M.D.^{ad}, Janey S. A. Pratt, M.D.^{ae}, Ann M. Rogers, M.D.^{af},
Paulina Salminen, M.D., Ph.D., F.A.C.S.^{ag}, Kimberley E. Steele, M.D., Ph.D.^{ah},
Michel Suter, M.D.^{ai}, Salvatore Tolone, M.D., Ph.D.^{aj}, Antonio Vitiello, M.D., Ph.D.^{ak},
Marco Zappa, M.D.^{al}, Shanu N. Kothari, M.D.^{am}

^aDepartment of General Surgery, Rovigo Hospital, Rovigo, Italy^bDepartment of Surgery, Center for Metabolic and Bariatric Surgery, Brigham and Women’s Hospital, and Harvard Medical School, Boston, Massachusetts^cDepartment of Surgery, Stanford School of Medicine, VA Palo Alto Health Care System, Palo Alto, California^dDepartment of Public Health, Federico II University of Naples, Naples, Italy^eDepartment of Surgery, Whittington Hospital, London, UK^fNew You Medical Center, King Saud University, Riyadh, Saudi Arabia^gDepartment of General Surgery, Bariatric and Metabolic Institute, Cleveland Clinic, Cleveland, Ohio^hDepartment of Surgery, Weight Works Clinics and Allurion Clinics, Amersfoort, The NetherlandsⁱDepartment of Surgery, Central Clinical School, Alfred Health, Monash University, Melbourne, Victoria, Australia^jCenter for the Treatment of Obesity and Diabetes, Hospital Alemão Oswaldo Cruz, Sao Paulo, Brazil^kDepartment of Surgical Sciences, University of Rome “Tor Vergata”, Rome, Italy^lGastrocirurgia de Brasília, University of Brasília, Brasília, Brazil^mBariatric and Metabolic Institute, Cleveland Clinic, Cleveland, OhioⁿGastrointestinal Bariatric and Metabolic Center (GBMC)-Jordan Hospital, Amman, Jordan^oEndocrine and Bariatric Surgery, UNAM at INCMNSZ, Mexico City, México^pCleveland Clinic Florida, The Bariatric Institute, Weston, Florida^qBariatric Surgery Unit, Delta Chirec Hospital, Brussels, Belgium^rDepartment of Medico Surgical Sciences and Biotechnologies Sapienza Polo Pontino, ICOT Hospital Latina, Latina, Italy

This paper was jointly developed by the American Society for Metabolic and Bariatric Surgery and International Federation for the Surgery of Obesity and Metabolic Disorders and jointly published in Surgery for Obesity and Related Diseases and Obesity Surgery. The articles are identical except for minor stylistic and spelling differences in keeping with each journal’s style. Either citation can be used when citing this article.

*Correspondence: Maurizio De Luca, General Surgery, Rovigo Hospital, Contrà San Pietro n 55, Vicenza 36100, Italy.

E-mail address: nnwdel@tin.it or maurizio.deluca@aulss5.veneto.it (M. De Luca).

<https://doi.org/10.1016/j.soard.2024.05.009>

1550-7289/ © 2024 The Author(s). Published by Elsevier Inc on behalf of American Society for Metabolic and Bariatric Surgery (ASMBS) and Springer Science+Business Media, LLC, part of Springer Nature on behalf of the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO). This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

[§]Division of Minimally Invasive and Bariatric Surgery, Department of Surgery, Minimally Invasive Surgery Research Center, Hazrat-e Fatemeh Hospital, Iran University of Medical Sciences, Tehran, Iran

[†]Adelaide Bariatric Centre, Flinders University of South Australia, Adelaide, Australia

[‡]Department of Surgery, New York University Grossman School of Medicine, New York, New York

[¶]Obesity and Metabolic Surgery Unit, Department of General and Laparoscopic Surgery, Ospedale Evangelico Betania, Naples, Italy

^{||}Department of Surgery, University of Iowa, Iowa City, Iowa

[×]Department of General Surgery, Sunderland Royal Hospital, Sunderland, United Kingdom

^γGeneral and Laparoscopic Surgery, San Giovanni di Dio Hospital - Frattamaggiore, Naples, Italy

^zDepartment of Nutrition and Dietetics, Leeds Teaching Hospitals NHS Trust, Leeds, UK

^{aa}Division of Metabolic and Bariatric Surgery, Hartford Hospital, Hartford, Connecticut

^{ab}UOC Chirurgia Generale e d'Urgenza, Ospedale di Montebelluna, Montebelluna, Italy

^{ac}Bariatric Surgery Program, CHI Memorial Hospital, Chattanooga, Tennessee

^{ad}Department of Surgery, Medical University of Vienna, Vienna, Austria

^{ae}Department of Surgery, Stanford School of Medicine, VA Palo Alto Health Care System, Palo Alto, California

^{af}Department of Surgery, Penn State Health Milton S. Hershey Medical Center, Hershey, Pennsylvania

^{ag}Division of Digestive Surgery and Urology, Department of Digestive Surgery, Turku University Hospital, Turku, Finland

^{ah}NIDDK Metabolic and Obesity Research Unit, National Institutes of Health, Bethesda, Maryland

^{ai}Department of Visceral Surgery, University Hospital, Lausanne, Switzerland

^{aj}Department of Surgery, Seconda Università di Napoli, Naples, Italy

^{ak}Department of Advanced Biomedical Sciences, Università Degli Studi Di Napoli "Federico II", Naples, Italy

^{al}General Surgery Unit, Asst Fatebenefratelli-Sacco Milan, Milan, Italy

^{am}Prisma Health, Department of Surgery, University of South Carolina School of Medicine, Greenville, South Carolina

Received 14 May 2024; accepted 14 May 2024

Abstract

The 2022 American Society for Metabolic and Bariatric Surgery (ASMBS) and International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) updated the indications for metabolic and bariatric surgery (MBS), replacing the previous guidelines established by the National Institutes of Health (NIH) over 30 years ago. The evidence supporting these updated guidelines has been strengthened to assist metabolic and bariatric surgeons, nutritionists, and other members of multidisciplinary teams (MDTs), as well as patients. This study aims to assess the level of evidence and the strength of recommendations compared to the previously published criteria. (Surg Obes Relat Dis 2024;20:991–1025.) © 2024 The Author(s). Published by Elsevier Inc on behalf of American Society for Metabolic and Bariatric Surgery (ASMBS) and Springer Science+Business Media, LLC, part of Springer Nature on behalf of the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO). This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords:

Obesity; Metabolic and bariatric surgery; IFSO; ASMBS; Guidelines indications

Since its inception in the mid-1950s, gastrointestinal (GI) surgery to treat excess adiposity and associated medical conditions has significantly changed [1]. Weight loss surgery, in its early history, lacked regulation, was associated with a high risk of adverse events, and had a high rate of recurrent weight gain (RWG). There were no uniform guidelines for patient selection, preoperative work-up, procedure selection, and long-term follow-up. These deficiencies contributed to the high rates of suboptimal outcomes.

To create uniform criteria for bariatric surgery, in 1991, the National Institutes of Health (NIH) in the United States held a consensus conference on GI surgery for the treatment of severe obesity [2]. A multidisciplinary panel of “experts” reviewed the available peer-reviewed literature and patient experience and created the first criteria for the practice of metabolic bariatric surgery (MBS). However, since 1991, there have been dramatic changes in the field of MBS, including fellowship training, accreditation of MBS centers of excellence, development of MBS registries, the introduction of minimally invasive surgery, and new procedures such

as sleeve gastrectomy (SG), and dramatic improvements in perioperative and long-term patient care and safety. Despite these improvements in surgical techniques and perioperative care for patients undergoing MBS, the reliance on the 1991 NIH criteria for determining patient candidacy for surgery remained unchanged, and surprisingly, it is still in wide use more than 33 years later.

In 2022, a group of metabolic bariatric surgeons and other clinicians caring for people with obesity recognized that the 33-year-old guidelines based on expert opinion in the era of open surgery did not reflect the current published literature or state of the field. There was a growing interest in revisiting the 1991 NIH criteria and revising it to reflect MBS's current practice.

The two largest MBS organizations in the world, the American Society for Metabolic and Bariatric Surgery (ASMBS) and the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO), agreed to partner to create new guidelines that would be evidence-based and rely on the most up to date high quality published literature along with current expert global practice. The group searched the

literature for high-level evidence using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [3]. Without supportive literature, a Delphi survey of experts in the field was performed [4]. Systematic reviews were performed on 13 topics highlighted in the recently published MBS guidelines. This study aimed to determine the level of evidence and the grade of the recommendations of these 13 previously published criteria [5,6].

Methods

In order to methodologically support the previously published ASMBS/IFSO guidelines, 2 international teams of writers were created.

One team of seven researchers (M.D.L., G.M., A.I., G.P., S.T., S.C. and A.V.) performed a systematic search of high-level evidence for different items, according to the PRISMA (see *PRISMA Prospect*). Two independent researchers analyzed each article, first by title and abstract and subsequently by the full text, and extracted the relevant data. In case of disagreement, a third researcher (M.D.L.) was consulted.

Eventually, 12 different systematic reviews from the 13 PRISMA were carried out. PRISMA on item 2 (body mass index [BMI] 35–40 kg/m² without obesity-associated medical problems) produced no studies.

The level of evidence and grade of recommendation are categorized in Table 1.

The second team (M.D.L., M.K., and S.T.) was tasked to resolve any issues not answered by the systematic reviews. For these situations, a Delphi survey was constructed and consisted of two consecutive rounds. Forty-nine recognized MBS experts from 18 countries participated in this Delphi survey to address nine statements that did not have strong backing from the literature search (Tables 2 and 3). Consensus was reached when the agreement/disagreement rate was equal to or greater than 70%. An online platform (Survey Monkey on <https://www.surveymonkey.com/r/MBS-Criteria>) was used. Seven statements reached consensus in the first round, and 2 reached consensus in the second round of voting (Tables 2 and 6.2). Statements 1–5 referred to item 2 (BMI 35–40 kg/m² without

co-morbidities), and statements 6–9 referred to item 6 (joint arthroplasty).

Results

BMI criteria for MBS

1. MBS for BMI 30–34.9 kg/m² [7–35]

PRISMA Appendix 1 [PubMed, Cochrane, Embase]
Systematic review Table 4

Forty-three articles were included in the present review, 29 (69%) were conducted on non-Asian patients [7–35] and 13 (31%) on Asian patients.

Nine retrospective (31%) and 20 (69%) prospective studies reported MBS results. All articles had a good/fair quality. Two articles investigated the effects of surgery on patients with BMI <30 kg/m², 4 papers compared outcomes in low BMI with results in patients with severe obesity, and 3 other studies made a comparison with lifestyle intervention.

Seventeen articles reported results after Roux-en-Y gastric bypass (RYGB), 11 after SG, 1 after one anastomosis gastric bypass (OAGB), 2 after biliopancreatic diversion (BPD), 7 after adjustable gastric banding (AGB), and 2 after revisional surgery from AGB to RYGB with an overall medium follow-up of 29.3 (12–120) months.

Operative time and length of stay (LOS) appeared comparable to available data in the literature for MBS in BMI ≥35 kg/m². All articles reported satisfactory weight loss with no mortality. Clavien-Dindo complications grades 3–4 ranged from 0% to 40% (40% in a paper on BPD complications). A higher complication rate was reported after revisional surgery. Remission from type 2 diabetes mellitus (T2DM) and hypertension (HTN) ranged from 33% to 100% and from 28% to 100%, respectively.

Recommendation

- MBS is recommended for patients with T2DM and a BMI of 30–34.9 kg/m².

Table 1
Grade of recommendation and level of evidence

Grade of recommendation	Level of evidence	Type of study
A	1a	Systematic review of [homogeneous] randomized controlled trials
A	1b	Individual randomized controlled trials [with narrow confidence intervals]
B	2a	Systematic review of [homogeneous] cohort studies of “exposed” and “unexposed” subjects
B	2b	Individual cohort study/low-quality randomized control studies
B	3a	Systematic review of [homogeneous] case-control studies
B	3b	Individual case-control studies
C	4	Case series, low-quality cohort, or case-control studies
D	5	Expert opinions based on nonsystematic reviews of results or mechanistic studies

Table 2
IFSO/ASMBS Delphi results of MBS indications individuals with class II obesity with no associated medical problems

Statement	Round 1	Round 2	Final result
1. Metabolic and bariatric surgery (MBS) is indicated in 18–65-yr-old individuals with class II obesity with no associated medical problems (body mass index of ≥ 35 kg/m ²).	95.7% agree	-	CONSENSUS (AGREE)
2. MBS is indicated in under 18-yr-old individuals with class II obesity with no associated medical problems (body mass index of ≥ 35 kg/m ²).	76.6% agree	-	CONSENSUS (AGREE)
3. MBS is indicated in over 65-yr-old individuals with class II obesity with no associated medical problems (body mass index of ≥ 35 kg/m ²).	85.1% agree	-	CONSENSUS (AGREE)
4. MBS is indicated for individuals with class II obesity and have no associated medical problems following comprehensive multidisciplinary team (MDT) assessment (body mass index of ≥ 35 kg/m ²).	54.1% agree	100% agree	CONSENSUS (AGREE)
5. MBS is cost-effective in individuals with class II obesity compare to nonsurgical therapy.	97.8% agree	-	CONSENSUS (AGREE)

- MBS is recommended for patients with a BMI of 30–34.9 kg/m² and one obesity-associated medical problem.
- MBS should be considered in patients with a BMI of 30–34.9 kg/m² who do not achieve substantial or durable weight loss or co-morbidity improvement using nonsurgical methods.

Level of evidence 2a

Grade of recommendation B

2. MBS for BMI 35–40 kg/m² without obesity-associated medical problems

PRISMA Appendix 2 [PubMed, Cochrane, Embase]
not enough studies

No systematic review.

Delphi Table 2

Although previous studies support the superiority of MBS compared to nonsurgical therapy in patients with BMI ≥ 35 kg/m² with no obesity-associated complications there is a lack of high-grade evidence to support this item. Considering the lack of data from the literature, the leaderships of IFSO and ASMBS have convened a Delphi survey. According to the survey results of 49 experts, MBS is indicated in patients with class II obesity, a BMI of 35–40 kg/m², with no associated medical problems in all groups of ages following a

Table 3
IFSO/ASMBS Delphi Results on MBS in Individuals Need Joint Arthroplasty

MBS can be considered as a bridge to joint arthroplasty in patients with Body Mass Index of ≥ 30 kg/m ²	84.7% Agree	-	CONSENSUS (AGREE)
MBS can decrease the operating time, risk of readmission and short-term complications of subsequent joint arthroplasty in individuals with Body Mass Index of ≥ 30 kg/m ²	82.9% Agree	-	CONSENSUS (AGREE)
MBS can decrease the need for Joint arthroplasty in patients with Body Mass Index of ≥ 30 kg/m ² .	84.7% Agree	-	CONSENSUS (AGREE)
Joint arthroplasty in patients with a Body Mass Index of ≥ 30 kg/m ² should be done 6 months to 1 year after MBS depending on the severity of their arthritis or if their weight loss stabilizes and they have sufficient muscle mass and good nutritional status.	50.0% Agree	88.3% Agree	CONSENSUS (AGREE)

Table 4
MBS indications for individuals with BMI 30-34.9

First author year	Study design	Quality assessment (NOS)	Asian/non-Asian	Number of surgical patients	BMI	Comparison to nonsurgical treatment	Number of nonsurgical patients	Intervention	Operative time (min)	Length of stay (d)	Weight loss	Complication Clavien-Dindo 1–2	Complications Clavien-Dindo 3–4	Complications Clavien-Dindo 5 (surgical related mortality)	Nutritional complications
Billeter et al. (2022) [7]	Prospective	Good quality	Non-Asian	20	25 < BMI < 35	NO	N/A	RYGB	Not reported	Not reported	8.3 Δ BMI	5%	5%	0%	Not reported
Chaturvedi et al. (2022) [8]	Retrospective/simulation	N/A	Non-Asian	347	30 < BMI < 35	NO	N/A	RYGB, SG	Not reported	Not reported	Not reported	Not reported	Not reported	Not Reported	Not reported
Altieri et al. (2022) [9]	Retrospective	Fair quality	Non-Asian	1296	30 < BMI < 35	NO	N/A	RYGB, SG	Not reported	Not reported	30% BMI loss	Not reported	Not reported	Not Reported	Not reported
Singh et al. (2022) [10]	Retrospective	Fair quality	Non-Asian	20	30 < BMI < 35	NO	N/A	SG	Not reported	Not reported	18% TWL; 70.3% % EWL	Not reported	0%	0%	0%
Baldwin et al. (2021) [11]	Retrospective	Fair quality	Non-Asian	30	BMI < 35	NO	N/A	RYGB, SG	Not reported	Not reported	20%–21% TWL; 83%–94% %EWL	Not reported	Not reported	Not Reported	Not reported
Gupta et al. (2020) [12]	Retrospective	Fair quality	Non-Asian	132	30 < BMI < 35	NO	N/A	LAGB to RYGB	Not reported	Not reported	44% EWL	7.8%	23.4% <30 d; 50% >30 d	0%	Not reported
Varban et al. (2020) [13]	Retrospective	Fair quality	Non-Asian	1073	BMI <35	NO	N/A	SG	Not reported	3	22% TWL; 71% % EWL	.7%	3.4%	0%	Not reported
Navarette Aulestia et al. (2020) [14]	Prospective	Fair quality	Non-Asian	16	30 < BMI < 35	NO	N/A	OAGB	70	2	87.6% EWL	0%	0%	Not Reported	Not reported
Gamme et al. (2019) [15]	Retrospective	Good quality	Non-Asian	9094	30 < BMI < 35	Comparison to class II	9094	RYGB, SG	82	1.6	Not reported	.9%	3.9%	0%	Not reported
Feng et al. (2019) [16]	Retrospective	Good quality	Non-Asian	8628	30 < BMI < 35	NO	N/A	RYGB, SG	80	1.6	Not reported	.6%	.7%	0%	Not reported
Vitiello et al. (2019) [17]	Retrospective	Fair quality	Non-Asian	56	30 < BMI < 35	YES	20	LAGB, RYGB, SG	Not reported	Not reported	69% BMI loss	0%	7%	7%	Not reported
Noun et al. (2016) [18]	Prospective	Fair quality	Non-Asian	541	30 < BMI < 35	NO	N/A	SG	74	1.7	24% TWL	1.8%	0%	0%	0%
Maiz et al. (2015) [19]	Retrospective	Fair quality	Non-Asian	1119	BMI <35	NO	N/A	RYGB, SG	70	3	107% EWL	3.8%	.7%	0%	Not reported
Kaska et al. (2014) [20]	Retrospective	Poor quality	Non-Asian	30	30 < BMI < 35	Comparison to class II	82	RYGB	Not reported	Not reported	5 Δ BMI	20%	3%	0%	3.6%
Walker et al. (2014) [21]	Prospective	Fair quality	Non-Asian	52	30 < BMI < 35	NO	N/A	LAGB to RYGB	105	3	3 Δ BMI	5%	20%	0%	Not reported
Boza et al. (2014) [22]	Prospective	Fair quality	Non-Asian	100	BMI <35	NO	N/A	RYGB	110	3	93% EWL	5%	9%	0%	Not reported

(continued on next page)

Table 4 (continued)

First author year	Study design	Quality assessment (NOS)	Asian/non-Asian	Number of surgical patients	BMI	Comparison to nonsurgical treatment	Number of nonsurgical patients	Intervention	Operative time (min)	Length of stay (d)	Weight loss	Complication Clavien-Dindo 1–2	Complications Clavien-Dindo 3–4	Complications Clavien-Dindo 5 (surgical related mortality)	Nutritional complications
Scopinaro et al. (2014) [23]	Retrospective	Fair quality	Non-Asian	10	30 < BMI < 35	NO	N/A	BPD	Not reported	Not reported	6 Δ BMI	40%	40%	0%	Not reported
Serrot et al. (2011) [24]	Retrospective	Fair quality	Non-Asian	17	30 < BMI < 35	YES	17	RYGB	Not reported	Not reported	70% EWL	11.7%	11.7%	0%	0%
Gianos et al. (2011) [25]	Retrospective	Fair quality	Non-Asian	42	30 < BMI < 35	YES	17	LAGB, RYGB, SG	Not reported	Not reported	7–8 Δ BMI	Not reported	Not reported	Not reported	Not reported
Choi et al. (2010) [26]	Retrospective	Fair quality	Non-Asian	66	30 < BMI < 35	Comparison to class II	438	AGB	Not reported	Not reported	40% EWL	4.5%	1.5%	0%	Not reported
Varela et al. (2011) [27]	Retrospective	Fair quality	Non-Asian	10	30 < BMI < 35	Comparison to class II	20	AGB	118	1.3	20% TWL	0%	0%	0%	Not reported
Scopinaro et al. (2011) [28]	Retrospective	Fair quality	Non-Asian	40	25 < BMI < 35	NO	N/A	BPD	Not reported	Not reported	5 Δ BMI	0%	2.5%	0%	2.5%
De Maria et al. (2010) [29]	Retrospective	Fair quality	Non-Asian	235	BMI < 35	NO	N/A	AGB, RYGB	Not reported	Not reported	4 Δ BMI	10%	1.3%	0%	Not reported
Parikh et al. (2010) [30]	Prospective	Fair quality	Non-Asian	93	30 < BMI < 35	NO	N/A	AGB	Not reported	Not reported	54% EWL	1%	3.2%	0%	Not reported
Sultan et al. (2009) [31]	Prospective	Fair quality	Non-Asian	53	30 < BMI < 35	NO	N/A	AGB	Not reported	Not reported	69.7% EWL	7.6%	1.9%	0%	Not reported
Cohen et al. (2006) [32]	Retrospective	Fair quality	Non-Asian	33	30 < BMI < 35	NO	N/A	RYGB	56	3	81%	0%	0%	0%	0%
Angrisani et al. (2004) [33]	Retrospective	Fair quality	Non-Asian	225	BMI < 35	NO	N/A	AGB	Not reported	Not reported	5.2%	2.8%	0%	0%	Not reported
Cevallos (2021) [34]	Prospective	Fair quality	Non-Asian (Latinos)	51	30 < BMI < 35	NO	N/A	RYGB	Not reported	Not reported	25% TWL; 74% % EWL	0%	1.9% < 30 d; 7.8% > 30 d	0%	0%
Espinosa (2018) [35]	Prospective	Fair quality	Non-Asian (Latinos)	23	30 < BMI < 35	NO	N/A	RYGB	168	3.2	24% TWL	13%	0%	0%	Not reported
				23,452											

Bold indicates total number of surgical patients. BMI = body mass index; RYGB = Roux-en-Y gastric bypass; SG = sleeve gastrectomy; OAGB = one anastomosis gastric bypass; AGB = adjustable gastric banding; BPD = biliopancreatic diversion.

comprehensive multidisciplinary team (MDT) assessment. The consensus also supported the fact that MBS is cost-effective in patients with class II obesity when compared to nonsurgical therapy.

Recommendation

- *MBS is recommended for patients with a BMI ≥ 35 kg/m² regardless of the presence, absence, or severity of obesity-related complications.*

Level of evidence 5

Grade of recommendation D

3. BMI thresholds in the Asian population [36–54]

PRISMA Appendix 3

Systematic review Table 5

Seven retrospective (54%, 2 multicenter) and 6 (46%) prospective studies reported the results of MBS on the Asian population. All articles have a good/fair quality. The articles investigated the effects of surgery on patients with BMI < 30 kg/m².

Eight articles reported results after RYGB, 5 after SG, 2 after OAGB, and 1 study after single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S) with an overall medium follow-up of 33.4 (12–84) months. Operative time and LOS appeared comparable to data already published in the literature for MBS in patients with a BMI > 35 kg/m².

All articles reported satisfactory weight loss with no mortality. Clavien-Dindo complications grades 3–4 ranged from 0% to 7.3%. Higher long-term nutritional complications were recorded after hypoabsorptive procedures. Remission from T2DM and HTN ranged from 38% to 100% and 30% to 83%, respectively.

Recommendations

- *Clinical obesity in the Asian population is recognized in patients with BMI ≥ 25 kg/m². Access to MBS should not be denied solely based on the traditional BMI criteria.*

Level of evidence 2a

Grade of recommendation B

Extreme of age

4. MBS in the older population [55–72]

PRISMA Appendix 4 [PubMed, Cochrane, Embase]

Systematic review Supplementary Table 1

Eighteen papers have been retrieved [55–72] for qualitative analysis. One randomized controlled trial

(RCT) [56] and 1 prospective multicenter paper [62] have been found. Papers were categorized as comparative [55,56,62–65,68,69,72] and noncomparative [57–61,66,67,70,71]. In the comparative group, 2 subgroups have been identified: older [age ≥ 65 yr old] versus younger age [55,65,68,69,72]. SG, RYGB, and AGB were more representative surgical operations in these studies [56,62–64]. The other studies were not comparative.

Five studies compared the intra and postoperative complications of MBS between the elderly and nonelderly populations [55,65,68,69,72]. Despite the high-risk populations evaluated, the studies found no differences in postoperative complications, weight loss, and co-morbidities resolutions.

Five studies evaluated the efficacy of AGB [57,60,61,65,71]. Despite its low perioperative complication rates, all studies concluded that other procedures, such as SG or the RYGB, have better postoperative outcomes regarding weight loss and co-morbidity resolution or improvement.

According to Gondal et al. [73], rather than age alone, frailty is independently associated with higher rates of postoperative complications following MBS. Furthermore, when considering MBS in older patients, the risk of surgery should be evaluated against the morbidity risk of obesity-related problems. Thus, there is no evidence to support an age limit on patients seeking MBS, but a careful selection that includes an assessment of frailty is recommended.

Two systematic reviews that included studies with elderly groups aged more than 60 years were found in the literature [74,75]. Both supported MBS in the elderly with a careful selection of patients.

According to the literature, although there was only one RCT, we could state that MBS is a safe and effective treatment of the elderly in carefully selected cases. In this patient population, attention must be paid to patient selection and procedure selection, considering the chance of co-morbidity resolution and postoperative follow-up compliance.

Recommendation

- *MBS has been performed successfully in increasingly older patients, including patients ≥ 70 years of age. In septuagenarians, compared with a younger population, MBS is associated with slightly higher rates of postoperative complications but still provides substantial benefits of weight loss and co-morbid disease remission.*
- *Frailty, cognitive capacity, smoking status, and end-organ function have an important role in the indications for MBS.*
- *There is no evidence to support an age limit for older patients seeking MBS, but a careful patient selection that includes a frailty assessment is recommended.*

Level of evidence 2a

Grade of recommendation B

Table 5
BMI thresholds in the Asian population for MBS

Author, yr [ref]	Study design	Quality assessment	Number of patient (intervention)	Mean follow-up (mo)	BMI basal (kg/m ²)	BMI follow-up (kg/m ²)	EWL/ TWL	Co-morbidities resolution	Intraoperative complications	Perioperative complications	Postoperative complications	Long term complications	Bridge to surgery	Outcomes of secondary surgery
Mazidi, 2017 [36]	Prospective	5	152 type II diabetic obese; all RYGB	3 yr	30.31 +- 5.38	24.45 +- 3.79	NA	65% remission of diabetes	NA	NA	NA	NA		Good rate of T2DM, improvement of insulin sensitivity and glucose homeostasis in a cohort BMI 27.5–32.5
Osman, 2019 [37]	Prospective	5	17 type II diabetic obese, all SAGB	18 mm	25.1-29.7	26.7	NA	76 & complete remission	None	None	None	NA		Serum fasting C-peptide was predictive of remission. Good results in patients without obesity
Ma, 2022 [38]	Retrospective	5	49 T2DM, all SG	2 yr	25-32.5	22.5	127.5	49% remission	None	NA	NA	NA		SG was effective in obtaining T2DM remission
Park, 2021 [39]	Prospective nonrandomized controlled	5	17 T2DM BMI 30–35 versus 115 medical therapy; 7 RYGB, 10 SG	10 mm	30–35	Assessed cumulative with group BMI >35	NA	47% cumulative remission	NA	NA	NA	NA		Better results of BS than MT in remission and co-morbidities control regardless of BMI
Luo, 2020 [40]	Retrospective	5	87 patients with T2DM, 25 SG, 62 RYGB	2 yr	31 +-6	NA	NA	41% remission in BMI <27.5, 55.5% in BMI 27.5–32	NA	NA	NA	NA		Good rate if remission even in BMI <27.5
Nautiyal, 2019 [41]	Retrospective	5	113 T2DM	2 yr	33	NA	NA	72% remission	NA	NA	NA	NA		Duration of diabetes was correlated to relapse, even in lower BMI
Huang, 2020 [42]	Retrospective multicenter db	5	1199 patients BMI >25	5 yr	38.7	NA	NA	NA	NA	NA	NA	NA		Not possible to subanalyze BMI >25 <30. Cumulative results were positive.
Malapan, 2014 [43]	Prospective	5	29 T2DM RYGB	1 yr	24.4	20.3	NA	38% remission, 65% improvement	NA	NA	5 marginal ulcers	NA		Significant clinical and biochemical improvements in Asian patients without obesity.
Zuo, 2020 [44]	Retrospective	5	17 RYGB, 3 SG,	3 yr	NA	NA	NA	NA	NA	NA	NA	NA	THA	BS were more likely to have reoperation and periprosthetic joint infection than lean control; 90 d complications were lower in BS than BMI >40.
Zhao, 2018 [45]	Retrospective	5	78 T2DM, RYGB	2 yr	28.2 +- 5.8	25	NA	44% total remission T2DM	NA	NA	NA	NA		BS effective in low BMI also for remission of T2DM, preoperative fasting C-peptide seems to predict the remission

(continued on next page)

Table 5 (continued)

Author, yr [ref]	Study design	Quality assessment	Number of patient (intervention)	Mean follow-up (mo)	BMI basal (kg/m ²)	BMI follow-up (kg/m ²)	EWL/ TWL	Co-morbidities resolution	Intraoperative complications	Perioperative complications	Postoperative complications	Long term complications	Bridge to surgery	Outcomes of secondary surgery
Fan, 2014 [46]	Retrospective	5	19 BMI<35 lap band	5 yr	NA	NA	NA	Improvement of all NAFLD, T2DM and hypertension	NA	NA	NA	NA		Better results in lap band in BMI <35 for metabolic parameters than those with BMI >35
Kim, 2014 [47]	Retrospective	5	107 BMI <30, SAGB	1 yr	25.3 ± 3.2	22.4	NA	Remission of T2DM	NA	5 minor complications	NA	22 marginal ulcers		Optimal results of MS for weight loss and T2DM control
Zhang, 2017 [48]	Retrospective	5	25 T2DM BMI<30 and 28 T2DM BMI <28	3 yr	31 and 27	22.9 and 22.1	NA	Improvement of HTN, DL, and remission of T2DM	NA	NA	NA	NA		The cohort achieved diabetes remission and metabolic disorder control and reduced their cardiovascular risk, but there is trend in weight regain and relapse for T2DM in long-term.
Kwon, 2017 [49]	Prospective nonrandomized	6	15 T2DM BMI 23–30 RYGB	2 yr	26.1	NA	NA	Remission of T2DM, then reduction of medication to .8	NA	NA	NA	NA		Optimal improvement of glycemic control in BMI <30
Du, 2018 [50]	Retrospective	5	58 T2DM BMI 27.5–32.5, RYGB	3 yr	30	31	NA	73.8% overall remission/ improvement	NA	NA	NA	NA		Higher remission of T2DM in class II/III but not statistically difference.
Liang, 2018 [51]	Retrospective	5	54 BMI <30 T2DM, RYGB	1 yr	27	22	NA	50% remission	NA	NA	NA	NA		Lower remission rate in low BMI but duration of T2DM was predictive of remission.
Widjaja, 2020 [52]	Retrospective	5	18 BMI 27.5–30, SG	1 yr	29.3	23.9	NA	72% remission, 100% improvement	None	55% vomit	None	None		SG was effective in obtaining T2DM remission and improvement in low BMI.
Yu, 2021 [53]	Retrospective	5	90 RYGB, 22 SG BMI <32.5 T2DM	2 yr	27.8	24.6	NA	33.9% remission, improvement of glycemic control and lipid profile	NA	NA	NA	NA		MS is effective especially in BMI >29 and in young T2DM, not insulin user.
Mazidi, 2017 [54]	Retrospective	5	209 RYGB	1 yr	29.9	25.3	NA	FBG, lipid profile, and liver function	NA	NA	NA	NA		BS can significantly improve adiposity and cardiometabolic factors.

RYGB = Roux-en-Y gastric bypass; BMI = body mass index; T2DM = type 2 diabetes mellitus; SG = sleeve gastrectomy; BMI = body mass index; NAFLD = nonalcoholic fatty liver disease; SAGB = single anastomosis gastric bypass; HT = HTN; DL = dyslipidemia; FBG = fasting blood glucose; BS = bariatric Surgery; MBS = metabolic bariatric Surgery; MT = medical treatment.

5. MBS for the pediatrics and adolescents [76–117]

PRISMA Appendix 5 [PubMed, Cochrane, Embase]

Systematic review Supplementary Table 2

Forty-two papers have been retrieved for qualitative analysis [76–117]. One RCT [76] and 14 comparative papers [83,88,90,93,94,96–98,101,104–107,115] were found.

Seven studies about MBS versus lifestyle modifications [76,88,90,94,97,105,115] were evaluated. The surgical approach was more effective and durable than lifestyle modification regarding excess weight loss (%EWL), total weight loss (%TWL), and co-morbidity resolutions.

Ten papers used the teen longitudinal assessment of bariatric surgery database [92–101], comparing different laparoscopic MBS procedures (AGB, RYGB, SG) to assess many aspects of MBS in pediatric and adolescent patients. All papers demonstrated an acceptable lasting % EWL with a good resolution of obesity-related complications.

Sixteen papers evaluated the efficacy of RYGB in adolescent patients [78,85,92,95,97–99,101,103,105,107,108,113,115–117], only 6 of them were comparative [97,98,101,105,107,115]. All studies concluded that RYGB achieved good weight loss, improvement, and/or resolution of co-morbidities in the pediatric and adolescent population with an acceptable complication rate.

A matched-control study evaluated the outcomes of MBS in Prader-Willi syndrome (PWS) compared with a non-PWS group of patients and concluded that the SG is a well-tolerated, effective treatment option for patients with PWS with obesity. In both groups, the weight loss and the resolution of the co-morbidities were similar [96].

Alqathani et al. [118], in a retrospective study with 10 years of follow-up, suggested that MBS would not negatively impact pubertal development or linear growth, and therefore, a specific Tanner stage and bone age should not be considered a requirement for surgery.

According to a literature review, the AGB seems to be a safer procedure. However, it achieved a lower weight loss, which was less durable than the RYGB or the SG.

Recommendation

- MBS does not negatively impact pubertal development or linear growth.
- MBS is safe in the population younger than 18 years and produces durable weight loss and improvement in co-morbid conditions.

Level of evidence 1b

Grade of recommendation A

Bridge to other treatments

6. MBS prior to joint arthroplasty [119–140]

PRISMA Appendix 6 [PubMed, Cochrane, Embase]

Systematic review Table 6 (some studies not in favor)

Delphi Table 6.2

Twenty-two articles were chosen to be included in the present review.

Several studies have shown that patients with severe obesity (BMI ≥ 40 kg/m²) were at increased risk of major and minor complications after joint surgery. The American Association for Hip and Knee Surgeons (AAHKS) provided a consensus opinion recommending delaying elective surgery when the BMI exceeds 40 kg/m² and in 2023, adherence to these recommendations was evaluated [141]. Preoperative health optimization programs, including weight loss with MBS before joint surgery, have been implemented to reduce postoperative complications.

However, the current literature is unclear whether persons undergoing MBS have a lower risk of postoperative complications and need for revisions after joint surgery when compared to people with obesity who have not had MBS. This systematic review (Table 6) demonstrated that only one RCT was available. Additional results were obtained from cohort studies. Some studies have demonstrated the benefits of preoperative MBS, while others have highlighted the risks of prior MBS. Additionally, it seems that MBS should be performed within 2 years before joint arthroplasty to decrease the negative impact of metabolic bone disease. Furthermore, given the setting of these studies, there is the possibility of bias due to the selection of patients.

In an RCT on 82 patients with obesity and osteoarthritis, 39 were randomized to AGB 12 months prior to total knee arthroplasty (TKA), and 41 patients were randomized to receive the usual nonoperative weight management prior to TKA. In a median follow-up of 2 years after TKA, 14.6% of patients in the MBS group incurred the primary outcome of composite complications, compared with 36.6% in the control group (difference 22.0%, $P = .02$). The incident TKA decreased by 29.3% in the MBS group because of symptom improvement following weight loss, compared with only 4.9% in the control group [132].

MBS can be performed safely before joint arthroplasty. However, further data are needed with specifically designed trials to clarify the causal role of MBS on the outcomes of subsequent joint arthroplasties.

Considering the conflicting data obtained from the literature, the IFSO and ASMBS decided to conduct a Delphi analysis on the topic of joint arthroplasty in patients with obesity (Table 6.2). This included the role of MBS as a bridge to joint arthroplasty and the proper time to arthroplasty after MBS.

Table 6
MBS prior to joint arthroplasty (as a bridge)

Author, year [ref]	Study design	Quality assessment	Number of patient (Intervention)	Mean follow-up (mo)	BMI basal	BMI follow-up	EWL/ TWL	Co-morbidities resolution	Intra-operative complications	Peri-operative complications	Post-operative complications	Long-term complications	Bridge to surgery	Outcomes of secondary surgery
Choi, 2020 [119]	Retrospective	5	1327 bariatric with hip repair versus 2127 only hip repair	10 yr	NA	NA	NA	NA	NA	NA	NA	NA	Hip fractur	Survival rates lower in bariatric (87.2% versus 91.8% $P = .048$), no differences for complications rates at 30 dd, greater readmission rates for bariatric patients (OR 1.46, 95%)
Inacio, 2014 [120]	Retrospective	5	69 patients with bariatric surgery >2 yr and 102 within 2 yr of total joint arthroplasty	1 yr	NA	NA	NA	NA	NA	NA	NA	NA	171 (hip 21%, knee 79%)	Similar postoperative complications than non operated obese
Werner, 2015 [121]	Retrospective	5	219 patients with previous bariatric surgery versus 11294 obese	2 yr	NA	NA	NA	NA	NA	NA	NA	NA	219 total knee arthroplasty	Lower 90-d complication rate than non operated obese, but increased than lean control
Nickel, 2016 [122]	Retrospective	5	5918 bariatric versus 26616 nonoperated obese BMI >40 versus 6480 lean	2 yr	NA	NA	NA	NA	NA	NA	NA	NA	5918 total knee arthroplasty	Higher 30-d complication rates for bariatric patients vs non operated obese vs lean

(continued on next page)

Table 6 (continued)

Author, year [ref]	Study design	Quality assessment	Number of patient (Intervention)	Mean follow-up (mo)	BMI basal	BMI follow-up	EWL/ TWL	Co-morbidities resolution	Intra-operative compli-cations	Peri-operative compli-cations	Post-operative compli-cations	Long-term compli-cations	Bridge to surgery	Outcomes of secondary surgery
McLawhorn, 2018 [123]	Propensity score matched analysis	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2636 bariatric versus 2636 non operated TKA; 792 bariatric versus 792 nonoperated obese THA	Lower in-hospital complications rate in bariatric patients; similar rates of revision
Lee, 2018 [124]	Retrospective	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	35 bariatric THA, 70 bariatric TKA	Prior to THA, bariatric surgery patients were at increased risk for postoperative infections; prior to TKA were at increased risk of revision but lower risk for infections
Wang, 2019 [125]	Propensity score matched analysis	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2540 bariatric versus 2540 nonoperated THA; 9803 bariatric versus 9803 nonoperated TKA	Prior to THA, bariatric surgery patients were at increased risk for blood transfusion and anemia; prior to TKA were at increased risk of for blood transfusion and anemia but lower risk for pulmonary embolism

(continued on next page)

Table 6 (continued)

Author, year [ref]	Study design	Quality assess- ment	Number of patient (Intervention)	Mean follow- up (mo)	BMI basal	BMI follow- up	EWL/ TWL	Co-morbidities resolution	Intra- operative compli- cations	Peri- operative compli- cations	Post- operative compli- cations	Long- term compli- cations	Bridge to surgery	Outcomes of secondary surgery
Sax, 2022 [126]	Retrospective	5	NA	6–12 mo	NA	NA	NA	NA	NA	NA	NA	NA	1901 BS 6 mo before TKA; 14022 BS 1 yr before TKA; versus 121934 lean and 87449 BMI >40	Lower complications than BMI >40; similar rates BS at 6 mo versus BS at 1 yr
Ryan, 2022 [127]	Retrospective	5	64 RYGB, 9 LAGB, 8 SG, 7 NA bypass	NA	NA	NA	NA	NA	NA	NA	NA	NA	THA	BS were more likely to have reoperation and periprosthetic joint infection than lean control; 90 d complications were lower in BS than BMI >40
Martin, 2015 [128]	Retrospective	5	NA	5 yr	51.1	36.5	NA	NA	NA	NA	NA	NA	91 TKA after BS versus 91 TKA high BMI and 182 low BMI	Increased risk of reoperation in BS group vs high BMI group and versus lean
Watts, 2016 [129]	Retrospective	5	47	10 yr	49.7	35.3	NA	NA	NA	NA	NA	NA	47THA after BS versus 94 THA in nonoperated obese	Lower rate of reoperation and revision after BS
Liu, 2021 [130]	Retrospective	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1894 BS before TKA/THA versus 1000 obese TKA/ THA	After 6 mo from the primary surgery, BS patients had less complications than THA/TKA alone

(continued on next page)

Table 6 (continued)

Author, year [ref]	Study design	Quality assessment	Number of patient (Intervention)	Mean follow-up (mo)	BMI basal	BMI follow-up	EWL/ TWL	Co-morbidities resolution	Intra-operative complications	Peri-operative complications	Post-operative complications	Long-term complications	Bridge to surgery	Outcomes of secondary surgery
Nickel, 2018 [131]	Retrospective	5	NA	NA	NA	36.5	NA	NA	NA	NA	NA	NA	1545 BS before THA versus 6918 BMI >40 versus 3697 lean	Dislocation and revision rate increased after BS; lower rate at 90-d complications BS versus BMI >40
Dowsey, 2022 [132]	RCT	8	39 LAGB	12 mo	43.8	36.5	20%	NA	NA	NA	NA	NA	29 BS before TKA versus 39 obese TKA	Perioperative complications were lower in BS group
Ighani Arani, 2021 [133]	Retrospective	5	SG and RYGB	12 mo	43	31	NA	NA	NA	NA	NA	NA	441 BS before TKA versus 95948 TKA same age and same BMI	SIMILAR risk for revision and infection
Nearing II, 2016 [134]	Retrospective	5	92 RYGB and 10 SG	4.9	NA	37.6	NA	4 T2DM, 8 OSAS	NA	NA	NA	NA	49 TKA and 17 THA after BS versus 23 TKA and 13 THA before BS	Lower operative time and lenght of stay, similar rate of 30-d complications and reinterventions over long-term FU
Liu, 2020 [135]	Retrospective	5	NA	2 yr	NA	NA	NA	NA	NA	NA	NA	NA	1478 BS before TJA, 60259 obese before TJA, 281973 lean before TJA	BS before TJA had increased complications, especially bllood transfusion, but lower pnuemonia than obese before TJA

(continued on next page)

Table 6 (continued)

Author, year [ref]	Study design	Quality assess- ment	Number of patient (Intervention)	Mean follow- up (mo)	BMI basal	BMI follow- up	EWL/ TWL	Co-morbidities resolution	Intra- operative compli- cations	Peri- operative compli- cations	Post- operative compli- cations	Long- term compli- cations	Bridge to surgery	Outcomes of secondary surgery
Meller, 2019 [136]	Retrospective	5	2044 LAGB, 1671 RYGB, 1025 SG, 21112 nonspecified BS		NA	NA	NA	NA	NA	NA	NA	NA	25852 BS before TKA versus 2675575 no previous BS TKA	Readmission in 90-d post TKA was increased in BS, a low increased trend for 90 d complications was observed in BS than in nonoperated.
Purcell, 2022 [137]	Retrospective	5	355 SG	5 yr	51.4	41.3	66.3 lb	6 resolution of knee pain	NA	NA	NA	NA	27 SG before TKA versus 24 TKA/ arthroscopy before SG	BS can reduce knee symptoms and the necessity to undergo knee surgery. After BS complications were lower than those who underwent first to TKA
Schwarzkopf, 2018 [138]	Retrospective	5	1347	NA	NA	NA	NA	NA	NA	NA	NA	NA	330 BS before THA and 1017 BS before TKA	No association between the time of BS and arthroplasty and 90- d complication, whereas those who underwent BS less than 6 mo are at increased risk for readmission
Ighani Arani, 2022 [139]	Retrospective	5	NA	1.1 yr		30.6	33.6% TWL	NA	NA	NA	NA	NA	44 BS before TKA versus 3524 No BS TKA	No clinically differences in 1 yr postoperative score and function score (continued on next page)

Table 6 (continued)

Author, year [ref]	Study design	Quality assessment	Number of patient (Intervention)	Mean follow-up (mo)	BMI basal	BMI follow-up	EWL/ TWL	Co-morbidities resolution	Intra-operative complications	Peri-operative complications	Post-operative complications	Long-term complications	Bridge to surgery	Outcomes of secondary surgery
Severson, 2012 [140]	Retrospective	5	NA	NA	NA	37.9	NA	NA	NA	NA	NA	NA	61 BS >2 yr before TKA, versus 25 BS within 2 yr TKA versus 39 TKA before BS	Reduced postoperative time, similar 90 d complication

RCT = randomized controlled trial; RYGB = Roux-en-Y gastric bypass; LAGB = laparoscopic adjustable gastric banding; SG = sleeve gastrectomy; TWL = total weight loss; TKA = total knee arthroplasty; T2DM = type 2 diabetes mellitus; BMI = body mass index; BS = bariatric surgery; MBS = metabolic bariatric surgery; THA = total hip arthroplasty; OSAS = obstructive sleep apnea syndrome; TJA = total joint arthroplasty; OR = odds ratio.

During the two rounds of the Delphi analysis, the 49 experts reached a consensus on 5 statements concluding that MBS is indicated in patients with class II and III obesity (BMI of ≥ 35 kg/m²) even with no other medical conditions and in all age groups following a comprehensive MDT assessment. In this survey, consensus was reached in 4 statements. First, MBS can be considered a bridge to joint arthroplasty in patients with a BMI ≥ 30 kg/m². Second, MBS can decrease the operating time, risk of readmission, and short-term complications of subsequent joint arthroplasty in patients with a BMI ≥ 30 kg/m². Third, MBS can decrease the need for joint arthroplasty in patients with BMI ≥ 30 kg/m². Fourth, the experts also reached a consensus that joint arthroplasty in patients with a BMI ≥ 30 kg/m² should be done 6 months–1 year after MBS, depending on the severity of the joint disease, if there is weight loss stabilization and if the patient has good muscle mass and nutritional status.

Recommendation

- Obesity is associated with poor outcomes after total joint arthroplasty. Orthopedic surgical societies discourage hip and knee replacement in patients with BMI ≥ 40 kg/m², mainly due to the increased risk of readmission and surgical complications, such as wound infection and deep vein thrombosis.
- Before total knee and hip arthroplasty, MBS has decreased operative time, hospital LOS, and early postoperative complications.
- According to experts, MBS can be considered a bridge to joint arthroplasty in patients with BMI ≥ 30 kg/m².

Level of evidence 2b
Grade of recommendation B

7. MBS and abdominal wall hernia repair [142–164]
PRISMA Appendix [PubMed, Cochrane, Embase]
Systematic review Supplementary Table 3

Twenty-three studies were included [142–164]. Five studies were extracted from national registers, including the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) [143,150], the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) [158], and the French hospital discharge summaries database system [153]. The other 18 studies were single-cohort retrospective studies. The studies were heterogeneous regarding timing and technique. Timing is mainly divided into ventral hernia repair (VHR) before MBS [symptomatic, low-or high-grade intestinal obstruction], concomitant VHR, and VHR after MBS. Some authors presented treatment algorithms regarding timing in their studies [146,157,160]. Of the 23 studies,

18 studies included a concomitant VHR, and 5 studies a staged procedure [142,146,154,161,162]. Ventral hernias included epigastric, incisional, umbilical, paraumbilical, and Spigelian hernias, and 1 study reported the multistep approach in complex hernias with loss of domain [161]. Studies included primary and recurrent incisional hernia repair. VHR included open and laparoscopic techniques, with and without mesh. MBS included AGB, SG, and open and laparoscopic RYGB.

The studies analyzed postoperative morbidity and mortality, long-term complications, and recurrence rates. Abdominal wall hematoma, seroma, and surgical site infections were the most reported complications associated with all types of VHR. Small bowel obstructions (SBO) and mesh dehiscence were reported in some studies, with the highest incidence of SBO at 37.5% in 1 study with deferred treatment [152].

Early mortality was reported in four register studies that analyzed concomitant VHR and was reported to be .3% [143], <1% [150], .2% [156], and .1% [158].

The literature presents a large amount of heterogeneous data regarding VHR in patients with obesity, and only 5 studies evaluated a staged approach. Due to the higher risk of reoperation for recurrence, VHR would be avoided in bariatric patients before MBS.

Recommendation

- *Obesity is a risk factor for the development of ventral hernias.*
- *In persons with obesity and an abdominal wall hernia, MBS-induced weight loss is suggested before VHR in order to reduce the rate of postoperative complications.*

Level of evidence 2b

Grade of recommendation B

8. MBS prior to organ transplantation [165–188]

PRISMA Appendix 8 [PubMed, Cochrane, Embase]
Systematic review Supplementary Table 4

Generally, extremely high or low BMI is considered a contraindication to solid organ transplantation (SOT) due to poor outcomes. Class III obesity may prevent access to transplantation since it is considered a relative contraindication and poses specific technical challenges during surgery [189,190]. MBS, despite worldwide recognition as the most effective treatment for obesity, may be overlooked as an option in patients with severe end-stage organ disease. Nonetheless, MBS has been described in patients with end-stage organ disease to improve their candidacy for transplantation.

A systematic review of 2241 papers identified 24 thoroughly analyzed studies. The studies included different SOT summarized as heart/lung, kidney, and liver.

The literature search considered several variables, such as surgical procedures, disease status, patient age, and follow-up time. In many studies, specific data points such as weight loss, operative time, and complication rates were missing. In addition, there were differences between patients and studies, including different transplant timing and surgical techniques.

Recommendation

- *Obesity is associated with end-stage organ disease and may limit access to transplantation. Obesity is also a relative contraindication for SOT and poses unique technical challenges during surgery.*
- *Published data supports considering patients with end-stage renal disease and obesity grade 3 being able to be listed for kidney transplant after MBS.*
- *MBS is shown to be safe and effective as a bridge to liver transplantation in selected patients who would otherwise be ineligible.*
- *MBS can also improve heart transplants outcomes.*
- *Limited data suggest that MBS could improve eligibility for lung transplantation.*
- *MBS can be performed post-SOT or concomitantly to reduce complication rates and mortality.*

Level of evidence 2b

Grade of recommendation B

MBS in the high-risk patients

9. MBS for BMI ≥ 60 kg/m² [191–214], [215–237]

PRISMA Appendix 9 [PubMed, Cochrane, Embase]
Systematic review Supplementary Table 5

Forty-seven papers have been retrieved for qualitative analysis [191–214], [215–237].

Twelve studies were focused on the safety and feasibility of MBS among patients with severe obesity at 30 days follow-up after surgery with no reported data on weight loss or obesity-related co-morbidities. Thirty-five studies analyzed MBS's safety, feasibility, and medium to long-term results in patients with obesity and BMI ≥ 60 kg/m².

Concerning weight loss, the mean initial BMI was ≥ 66.64 kg/m² (standard deviation [SD] ± 3.05). After a mean follow-up of 28 months, the mean excess of body mass index loss (%EBMIL) was 51.5 (SD ± 16) with a mean Δ BMI was 21.64 kg/m² (SD ± 7.16). Improvement

or resolution of the obesity-related complications was reported in 17 studies, including patients with BMI ≥ 60 kg/m². The mean percentage of improvement/resolution of T2DM was 67.35% (SD $\pm$ 24.79). The mean percentage of improvement/resolution of HTN was 54.01% (SD $\pm$.93). The mean percentage of improvement/resolution of obstructive sleep apnea (OSA) was 63.61% (SD $\pm$ 21.51), while the mean percentage of improvement/resolution of dyslipidemia was 70.95% (SD $\pm$ 10.31).

Early complications (within 30 d from surgery) were reported in 45 studies.

The overall mean percentage of early complications was 7.57% (SD $\pm$ 6.28), and the mean percentage of early complications requiring reoperation was 4.9% (SD $\pm$ 3.48). The overall mean mortality was 1.61% (SD $\pm$ 2.29).

Long-term complications were reported in 13 studies. The mean percentage of long-term complications was 13.56% (SD $\pm$ 10.93).

Recommendation

- *MBS is safe and effective in patients with BMI ≥ 60 kg/m².*
- *Evidence suggests a higher rate of perioperative complications after MBS in patients with BMI ≥ 60 kg/m².*
- *According to the literature, MBS appears safe in patients with initial BMI ≥ 70 kg/m².*

Level of Evidence 2a

Grade of recommendation B

10. MBS in patients with liver cirrhosis [238–252]

PRISMA Appendix 10 [PubMed, Cochrane, Embase]
Systematic review Supplementary Table 6

Fifteen studies were included in this systematic review. Some studies differed between compensated and decompensated liver cirrhosis.

The early mortality was reported as .6% and .8% in the metabolic dysfunction-associated liver disease (MAFLD) or compensated liver cirrhosis, 19.4% and 22.1% in decompensated liver cirrhosis. Mumatz et al. and Are et al. [244,245] underlined the higher mortality of patients in low-volume centers (<50/yr). Miller et al. analyzed 3032 patients undergoing SG (n = 1168) and RYGB (n = 1864) with compensated liver cirrhosis and reported early mortality in 21 (1.1%) of patients after RYGB and 10 patients after SG (<1%). Late mortality occurred in 42 patients after RYGB (2.2%) and under 10 patients after SG (<.8%) [246].

Based on the current systematic review, patients with MAFLD or compensated liver cirrhosis have acceptable perioperative morbidity and mortality. However, patients with obesity and decompensated liver cirrhosis are at much higher risk for perioperative complications and perioperative mortality following MBS. Those patients should

only be considered for surgery on a selective basis after a comprehensive risk assessment and only in high-volume centers. The risk of postoperative liver decompensation is low but should not be underestimated. Weight loss and remission of co-morbidities are similar to the general bariatric surgical population. Careful patient selection and consideration of the choice of surgical procedure are important to ensure the best outcomes.

Recommendation

- *Obesity is a significant risk factor for MAFLD and liver cirrhosis.*
- *MBS has been associated with histologic improvement of MAFLD and regression of liver fibrosis.*
- *MBS is associated with a risk reduction of progression of MAFLD to liver cirrhosis.*
- *MBS in patients with ‘decompensated’ cirrhosis is associated with high perioperative mortality.*
- *Careful patient selection and consideration of the choice of surgical procedure are important to ensure the best outcomes.*

Level of evidence 2b

Grade of recommendation B

11. MBS in patients with heart failure (HF) [253–270]

PRISMA Appendix 11 [PubMed, Cochrane, Embase]
Systematic review Supplementary Table 7

Thirty-one full-text articles were assessed for eligibility. Eighteen studies are included in the qualitative synthesis [253–270].

MBS is associated with a lower risk of major adverse cardiovascular events (MACE), including myocardial infarction, ischemic heart disease, or HF in patients with severe obesity [254–256].

The overall risk for early (less than 30 d) and late (30 d or more) complications was similar for patients with cardiovascular disease and the matched group that did not have cardiovascular disease [257–261]. Some studies reported an increased risk for early cardiovascular complications as well as a higher 90-day mortality rate (still within an acceptable range) for patients with heart disease, such as HF [262–265].

Current data suggest that MBS can be a useful adjunct to treatment in patients with obesity and HF before heart transplantation or placement of a left ventricular assist device (LVAD) [265–267]. Patients who underwent MBS were observed to have improvement in cardiac function [268,269]. This had several beneficial effects, such as a reduction in rehospitalization for HF and improvement in their left ventricular ejection fraction (LVEF). MBS could increase the patient’s likelihood of receiving a heart

transplant. On the other hand, some patients had enough improvement in their cardiac function to no longer require a heart transplant [268,269].

Recommendation

- *MBS in patients with obesity and HF is associated with improvement of LVEF, improvement of functional capacity, and higher chances for receiving heart transplantation.*
- *In patients with obesity and HF, MBS has low morbidity and mortality and can be a useful adjunct before heart transplantation or placement of LVAD.*

Level of evidence 2b

Grade of recommendation B

Patient evaluation

12. Multidisciplinary care [271–283]

PRISMA Appendix 12 [PubMed, Cochrane, Embase]
Systematic review Table 7

The search screened 95 papers, but only 6 were thoroughly analyzed. There were guidelines or consensus statements, including those from the European Association for the Study of Obesity (EASO) and the European Association for Endoscopic Surgery (EAES) [271,278]. Standardized preoperative multidisciplinary evaluations have been reported to reduce major complications and reoperation rates.

The studies of this systematic review support the protective role of the MDT to ensure patient safety.

Registered experts in nutrition in MBS can assist in the management of postoperative patients who may experience issues such as food intolerances, malabsorption, micronutrient deficiencies, dumping syndrome, hypoglycemia, and RWG. Licensed mental health providers with specialty knowledge and experience in MBS behavioral health are necessary to assess patients for psychopathology and determine the candidate's ability to cope with the adversity of surgery, the changing body image, and the lifestyle changes required after MBS.

Based on the EAES guidelines, scheduled multidisciplinary postoperative follow-up should be provided to every patient undergoing MBS [278].

Recommendation

- *MDT has an important role in MBS patients' pre- and post-operative management.*

Level of evidence 2c

Grade of recommendation B

Revisional surgery

13. Revisional MBS [284–309]

PRISMA Appendix 13 [PubMed, Cochrane, Embase]
Systematic review

Twenty-six studies were selected for this systematic review. All studies were retrospective with a good/fair quality.

Recent articles report conversion from AGB and SG and revision of RYGB and OAGB. Revisional MBS is currently performed laparoscopically and robotically, with a growing trend toward a robotic approach. Operative time and LOS of revisional surgery were reduced with time and experience, which could be comparable to those reported in the literature for primary surgery.

All revisional and conversional interventions lead to additional weight loss. Clavien-Dindo complications 3–4 ranged from .9% to 26%. Mortality was lower than 1% for conversions from restrictive procedures, and up to 11.9% was reported after revisional stapling procedures. Revisional surgery appeared to induce further remission from T2DM and HTN.

Recommendation

- *Indication for revisional surgery after MBS varies among patients but may include insufficient weight loss, weight regain, insufficient remission of co-morbidities, and management of complications [e.g., gastroesophageal reflux].*
- *Due to its complexity, revisional MBS may be associated with higher rates of perioperative complications. However, revisional MBS induces satisfactory metabolic outcomes with acceptable complications and mortality rates.*

Level of evidence 2b

Grade of recommendation B

Discussion

The indications for MBS have not changed since the NIH proposed them in 1991 (see criteria Table 8). In other words, the indications have not kept up with the evolution of surgical technique from open laparotomy to minimally invasive, the changing procedure types, the improved safety of MBS, and the emerging evidence on numerous health benefits of weight loss.

IFSO and ASMBS joined forces to tackle this major problem, and the new MBS guidelines were published in October 2022. Updated guidelines based on current literature and data are vital as access to this life-saving surgery is still very low despite the available evidence—in most countries, access to MBS is less than 2% of eligible candidates.

Table 7
Multidisciplinary care

Practical Recommendations of the Obesity Management Task Force of the European Association for the Study of Obesity for the Post-Bariatric Surgery Medical Management [271]	Busetto L, Dicker D, Azran C, Batterham RL, Farpour-Lambert N, Fried M, Hjelmæsæth J, Kinzl J, Leitner DR, Makaronidis JM, Schindler K, Toplak H, Yumuk V.	Obes Facts	Metabolic/obesity surgery is today the most effective long-term therapy for the management of patients with severe obesity, and its use is recommended by the relevant guidelines of the management of obesity in adults. Bariatric surgery is in general safe and effective, but it can cause new clinical problems and is associated with specific diagnostic, preventive, and therapeutic needs. For clinicians, the acquisition of special knowledge and skills is required in order to deliver appropriate and effective care to the postbariatric patient. In the present recommendations, the basic notions needed to provide first-level adequate medical care to postbariatric patients are summarized. Basic information about nutrition, management of co-morbidities, pregnancy, psychological issues as well as weight regain prevention and management is derived from current evidences and existing guidelines. A short list of clinical practical recommendations is included for each item. It remains clear that referral to a bariatric multidisciplinary center, preferably the one performing the original procedure, should be considered in case of more complex clinical situations.	eng	2017	MEDLINE
Optimizing Bariatric Surgery Multidisciplinary Follow-up: a Focus on Patient-Centered Care [272]	Aarts MA, Sivapalan N, Nikzad SE, Serodio K, Sockalingam S, Conn LG.	Obes Surg	Background: Failure to follow-up postbariatric surgery has been associated with higher postoperative complications, lower percentage weight loss, and poorer nutrition. Objective: This study aimed to understand the patient follow-up experience in order to optimize follow-up care within a comprehensive bariatric surgery program. Methods: Qualitative telephone interviews were conducted in patients who underwent surgery through a publically funded multidisciplinary bariatric surgery program in 2011, in Ontario, Canada. Inductive thematic analysis was used. Results: Of the 46 patients interviewed, 76.1% were female, mean age was 50, and 10 were lost to follow-up within 1 yr postsurgery. Therapeutic continuity was the most important element of follow-up care identified by patients and was most frequently established with the dietician, as this team member was highly sought and accessible. Patients who attended regularly (1) appreciated the specialized care, (2) favored ongoing monitoring and support, (3) were committed to the program and (4) felt their family doctor had insufficient experience/knowledge to manage their follow-up care. Of the 36 people who attended the clinic regularly, 8 were not planning to return after 2 yr due to (1) perceived diminishing usefulness, (2) system issues, (3) confidence that their family physician could continue their care, or (4) higher priority personal/health issues. Patients lost to follow-up stated similar barriers. Conclusion: Patients believe the follow-up postbariatric surgery is essential in providing the support required to maintain their diet and health. More personalized care focusing on continuity and relationships catering to individual patient needs balanced with local healthcare resources may redefine and reduce attrition rates.	eng	2017	MEDLINE

(continued on next page)

Table 7 (continued)

Panel report: best practices for the surgical treatment of obesity [273]	Gould J, Ellsmere J, Fanelli R, Hutter M, Jones S, Pratt J, Schauer P, Schirmer B, Schwaitzberg S, Jones DB	Transplantation	The multidisciplinary bariatric patient care team and the bariatric program accreditation process are key factors in best outcomes. The multidisciplinary WLS team should include trained surgeon(s), a WLS program coordinator, nutritionist, primary care physician, medical subspecialists, and the operating room team. Optimal perioperative care of the WLS patient involves the use of multiple medical disciplines and the multidisciplinary team. For this reason, WLS should be focused at centers where these resources are readily available. The multidisciplinary WLS team is an important component of any bariatric surgery program for a variety of reasons. First of all, bariatric surgery patients have needs that are very different from patients undergoing other types of surgery. Education and behavior modification are important for WLS to succeed. These complex needs, coupled with an extremely low tolerance for poor outcomes (public scrutiny), the essentially elective nature of these operations, and a lack of sympathy for and bias against obesity, create an environment where multidisciplinary programs and accreditation of these programs is essential. There are currently 2 systems of accreditation for WLS programs not run by individual insurance companies. The American College of Surgeons Bariatric Surgery Centers Network and the Surgical Review Corporation Bariatric Surgery Center of Excellence Program (Affiliated with the American Society of Metabolic and Bariatric Surgery) are similar in many ways [22,23]. Both programs require specific resources (facilities and specialized equipment), and evaluate key personnel, the bariatric surgeon(s), the patient selection process, and patient education as well as outcomes and follow-up. There are some minor differences in terms of the data collection process, fees, and the fact that the ACS only accredits centers where the Surgical Review Corporation accredits both surgeons and centers. As outcomes data from these accredited centers have accumulated over the year, it has become apparent that the morbidity and mortality rates for these centers are lower than expected based on published data [24]. Future steps in the accreditation process include developing a risk-adjusted system where outcomes can replace surgical volume as a surrogate for excellence. It is likely that the future of bariatric surgery accreditation and reimbursement will take into account these outcomes.	eng	2011	MEDLINE
--	---	-----------------	--	-----	------	---------

(continued on next page)

Table 7 (continued)

The application of laparoscopic bariatric surgery for treatment of severe obesity in adolescents using a multidisciplinary adolescent bariatric program [274]	Warman JL	Crit Care Nurs Q	The evolution of laparoscopic surgery has made bariatric surgery acceptable for weight loss; however, much controversy exists about its appropriateness for adolescents. Despite the controversial issues, the growing epidemic in adolescent obesity has resulted in rising numbers of applications for bariatric surgery. There are few bariatric surgical programs designed for adolescents. Pediatric settings face high start-up costs and poor reimbursement and lack established bariatric surgeons. Even so, bariatric surgery is increasingly being performed on adolescents in alarming numbers. To avoid adverse physical and psychosocial outcomes, the application of the principles of growth and development is essential. The program should be established as a multidisciplinary approach to management of adolescents and should be in institutions capable of meeting the guidelines for surgical treatment outlined by the American Society of Bariatric Surgery. To prevent postoperative complication, a multidisciplinary team of experienced medical and surgical specialists is needed for optimal preoperative decision making and postoperative management and long-term follow-up. Laparoscopic Roux-en-Y gastric bypass is a safe procedure and an effective means to treat obesity-related morbidity in the adolescent. Results have been excellent and justify a clinical trial to confirm the safety and efficacy of bariatric surgery in the adolescent population	eng	2013	MEDLINE
Collazo-Clavell ML, Clark MM, McAlpine DE, et al. Assessment and preparation of patients for bariatric surgery. Mayo Clin Proc.2006;81:S11–7.39. 2012report2/downloads/BS_fullreport.pdf [275]	Collazo-Clavell ML, Clark MM, McAlpine DE, et al.			eng		
				eng		

(continued on next page)

Table 7 (continued)

Proposal for a multidisciplinary approach to the patient with morbid obesity: the St. Francis Hospital morbid obesity program [276]	Elte JW, Castro Cabezas M, Vrijland WW, Ruseler CH, Groen M, Mannaerts GH	Eur J Intern Med	Morbid obesity is a serious disease as it is accompanied by substantial co-morbidity and mortality. The prevalence is increasing to an alarming extent, in Europe as well as in the United States. In the past few decades, bariatric surgery has developed and gained importance. It currently represents the only long-lasting therapy for this group of patients, resulting in an efficient reduction in body weight and obesity-related medical conditions, mostly cardiovascular in nature. The importance of a standardized protocol, the use of selection criteria, and a multidisciplinary approach have been stressed but not yet described in detail. Therefore, in this article, the multidisciplinary approach and the treatment protocol that have been applied in our hospital for more than 20 yr are set out in a detailed manner. The application of a strict protocol may help to select and follow-up motivated patients and to organize multidisciplinary research activities.	eng	2008		
Apovian CM, Cummings S, Anderson W, et al. Best practice updates for multidisciplinary care in weight loss surgery. Obesity. 2009;17:871–89. https://doi.org/10.1038/oby.2008.58 [277]	Apovian CM, Cummings S, Anderson W, Borud L, Boyer K, Day K, Hatchigian E, Hodges B, Patti ME, Pettus M, Perna F, Rooks D, Saltzman E, Skoropowski J, Tantillo MB, Thomason P	Obesity (Silver Spring)	The objective of this study is to update evidence-based best practice guidelines for multidisciplinary care of weight loss surgery (WLS) patients. We performed systematic search of English-language literature on WLS, patient selection, and medical, multidisciplinary, and nutritional care published between April 2004 and May 2007 in MEDLINE and the Cochrane Library. Key words were used to narrow the search for a selective review of abstracts, retrieval of full articles, and grading of evidence according to systems used in established evidence-based models. A total of 150 papers were retrieved from the literature search and 112 were reviewed in detail. We made evidence-based best practice recommendations from the most recent literature on multidisciplinary care of WLS patients. New recommendations were developed in the areas of patient selection, medical evaluation, and treatment. Regular updates of evidence-based recommendations for best practices in multidisciplinary care are required to address changes in patient demographics and levels of obesity. Key factors in patient safety include comprehensive preoperative medical evaluation, patient education, appropriate perioperative care, and long-term follow-up	eng	2009	MEDLINE	Santry HP, Chin MH, Cagney KA, Alverdy JC, Lauderdale DS. The use of multidisciplinary teams to evaluate bariatric surgery patients: results from a national survey in the USA. <i>Obes Surg</i> 2006;16:59–66. [PubMed: 16417760] 8. Giusti V, De Lucia A, Di Vetta V, et al. Impact of preoperative teaching on surgical option of patients qualifying for bariatric surgery. <i>Obes Surg</i> 2004;14:1241–1246. [PubMed: 15527642] 9. Cunningham E. What is the registered dietitian's role in the preoperative assessment of a client contemplating bariatric surgery? <i>J Am Diet Assoc</i> 2006;106:163. [PubMed: 16390679]

(continued on next page)

Table 7 (continued)

Clinical practice guidelines of the European Association for Endoscopic Surgery (EAES) on bariatric surgery: update 2020 endorsed by IFSO-EC, EASO and ESPCOP [278]	Di Lorenzo N, Antoniou SA, Batterham RL, Busetto L, Godoroja D, Iossa A, Carrano FM, Agresta F, Alarçon I, Azran C, Bouvy N, Balaguè Ponz C, Buza M, Copaescu C, De Luca M, Dicker D, Di Vincenzo A, Felsenreich DM, Francis NK, Fried M, Gonzalo Prats B, Goitein D, Halford JCG, Herlesova J, Kalogridaki M, Ket H, Morales-Conde S, Piatto G, Prager G, Pruijssers S, Pucci A, Rayman S, Romano E, Sanchez-Cordero S, Vilallonga R, Silecchia G.	Surg Endoscop	Preoperative dietitian consultation should be considered for patients undergoing bariatric surgery Strong recommendation Justification A meta-analysis reporting 3 RCTs was found on this topic [40]. Analyses were reperformed due to error in the primary meta-analysis (calculation of WMD instead of standardized MD, SMD). The overall quality of evidence was very low for weight loss and low for postoperative complications due to risk of bias across RCTs, inconsistency (conceptual and statistical heterogeneity due to variety of preoperative interventions for weight loss, and heterogeneity in the duration of follow-up) and indirectness (follow-up duration for weight loss insufficient for generalizability of findings). Postoperative weight loss was more pronounced in the preoperative diet consultation group (SMD .4, 95% CI .03–.78 higher). No difference in the odds of postoperative complications was found (risk ratio [RR], .80, 95% CI .22–2.86), although interval estimates were wide. Confidence in the evidence was generally low; however, the panel favored a strong recommendation after consulting with the patient representative who expressed a strong preference for a holistic approach of the bariatric patient with continuous preoperative and postoperative consultation. The panel considered this practice feasible, requiring moderate human and financial resources, and being acceptable to stakeholders. There was no evidence of any risk for the intervention according to the panel's judgment.	eng 2020	Paper for justification Antoniou SA, Anastasiadou A, Antoniou GA, Granderath F-A, Kafatos A (2017) Preoperative nutritional counseling versus standard care prior to bariatric surgery: Effects on postoperative weight loss. Eur Surg Acta Chir Aust. https://doi.org/10.1007/s10353-016-0459-4
van Hout GC, Vreeswijk CM, van Heck GL. Bariatric surgery and bariatric psychology: evolution of the Dutch approach. Obes Surg. 2008 Mar;18 (3):321-5. https://doi.org/10.1007/s11695-007-9271-3 . Epub 2008 Jan 17. PMID: 18202896. [279]				0	
It's Time for Multidisciplinary Obesity Management Centers Comment Obesity (Silver Spring). 2019 Apr;27 (4):534. https://doi.org/10.1002/oby.22450 . COMMENTARY [280]	Walter J Pories 1, Louis J Aronne 2		U.S. problems		

(continued on next page)

Table 7 (continued)

Predictors of attrition in a multidisciplinary adult weight management clinic. Gill RS, Karmali S, Hadi G, Al-Adra DP, Shi X, Birch DW *Can J Surg.* 2012 Aug;55 (4):239–43. <https://doi.org/10.1503/cjs.035710>. PMID: 22617538; PMCID: PMC3404143 [281]

Background: Worldwide, more than 1.7 billion individuals may be classified as overweight and are in need of appropriate medical and surgical treatments. The primary goal of a comprehensive weight management program is to produce sustainable weight loss. However, for such a program to be effective, the patient must complete it. We analyzed attrition rates and predictors of attrition within a publicly funded, multidisciplinary adult weight management program.

Methods: We retrospectively reviewed charts from an urban multidisciplinary adult weight management clinic program database. Patients received medical or surgical treatment with appropriate follow-up. We collected information on demographics and co-morbidities. Patients in the surgical clinics received either laparoscopic gastric band insertion or gastric bypass. We conducted univariate analysis and multivariate analyses on predictors of attrition.

Results: A total of 1205 patients were treated in the weight management program: 887 in the medical clinic and 318 with surgery and follow-up in a surgical clinic. Overall, 516 patients left the program or were lost to follow-up (attrition rate 42.8%). The attrition rate was 53.9% in the medical clinic and 11.9% in the surgical clinic. Multivariate analyses identified participation in the medical clinic, younger patient age and lower body mass index as predictors of attrition.

Conclusion: We found lower attrition rates among surgically than medically treated patients in a multidisciplinary weight management clinic. Further research is needed to understand those variables that lead to improved attrition rates.

Andalib A, Bouchard P, Bougie A, Loiseleur SE, Demyttenaere S, Court O. Variability in Bariatric Surgical Care Among Various Centers: a Survey of All Bariatric Surgeons in the Province of Quebec, Canada. *Obes Surg.* 2018 Aug;28 (8):2327–2332. <https://doi.org/10.1007/s11695-018-3157-4>. PMID: 29492752. [282]

Aboueid S, Jasinska M, Bourgeault I, Giroux I. Current Weight Management Approaches Used by Primary Care Providers in Six Multidisciplinary Healthcare Settings in Ontario. *Can J Nurs Res.* 2018 Dec;50 (4):169–178. <https://doi.org/10.1177/0844562118769229>. Epub 2018 Apr 17. PMID: 29665702. [283]

Canada situation

ACS = American College of Surgeons; RCT = randomized controlled trial; WMD = weighted mean difference; MD = mean difference; SMD = standardized mean difference; CI = confidence interval.

Table 8
Summary of recommendations with their grade and level of evidence

Criteria	PRISMA and Delphi	Appendix/ table	Level of evidence	Grade of recommendation	Recommendation	References
MBS for BMI 30–34.9 kg/m ²	PRISMA	1	2a	B	MBS is recommended for patients BMI 30–34.9 kg/m ² with T2DM and/or other obesity-associated medical problems.	[7–35]
MBS for BMI 35–40 kg/m ² without obesity-associated co-morbidities	PRISMA insufficient data Delphi	2	5	D	MBS is recommended regardless of the presence, absence, or severity of obesity-associated medical problems.	-
BMI thresholds in the Asian population	PRISMA	3	2a	B	Access to MBS should not be denied solely based on the BMI.	[36–54]
MBS in the older population	PRISMA	4	2a	B	There is no evidence to support an age limit.	[55–72]
MBS for pediatric and adolescents	PRISMA	5	1b	A	MBS is safe in the population younger than 18 yr, produces durable weight loss, and improvement obesity-associated medical problems.	[76–117]
MBS prior to joint arthroplasty	PRISMA Conflicting data Delphi	6	2b	B	MBS can be considered a bridge to joint arthroplasty in patients with BMI ≥30 kg/m ² .	[119–140]
MBS and abdominal wall hernia repair	PRISMA	7	2b	B	In patients with severe obesity and an abdominal wall hernia, MBS-induced weight loss is suggested before hernia repair.	[142–164]
MBS prior to organ transplantation	PRISMA	8	2b	B	Published data supports considering patients in need of SOT first to undergo MBS to improve their eligibility for transplantation.	[165–188]
MBS for BMI ≥60 kg/m ²	PRISMA	9	2a	B	MBS is safe and effective in patients BMI ≥60 kg/m ² .	[191–214], [215–237]
MBS in patients with liver cirrhosis	PRISMA	10	2b	B	MBS is associated with a reduction of progression of MAFDL to cirrhosis.	[238–252]
MBS in patients with heart failure	PRISMA	11	2b	B	MBS can be a useful treatment adjunct in patients with obesity and heart failure.	[253–270]
Multidisciplinary care	PRISMA	12	2c	B	Despite the low evidence level, MDT is at present the unmodifiable core of pre- and postoperative obesity management.	[271–283]
Revisional surgery	PRISMA	13	2b	B	Revisional MBS induces satisfactory metabolic outcomes with acceptable rates of complications and mortality.	[284–309]

MBS = metabolic and bariatric surgery; BMI = body mass index; PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses; T2DM = type 2 diabetes mellitus; SOT = solid organ transplantation; MAFDL = metabolic dysfunction-associated liver disease; MDT = multidisciplinary team.

This study systematically reviewed the best literature available for the outcomes of MBS for various populations with differing demographics and obesity-related complications. Eleven of the 13 criteria were supported by the literature. Where there was a lack of evidence, a Delphi process was employed to achieve expert consensus. *PRISMA Prospect* summarized the findings.

From these data, MBS impacted positively a range of populations and settings. The majority of examined populations had grade B recommendations for the indications of surgery. Expert opinion (grade D) was only relied upon to strengthen the evidence for the role of MBS in a few unique circumstances. This includes patients with a BMI of 35–40 kg/m² who have no co-morbidities, patients with a concurrent need for arthroplasty, and the role of the MDT. Particularly in the pediatric and adolescent populations, the

strength of the available data supported a grade A recommendation. Improved access to surgery in adolescents was one of the two major new emphases of the new IFSO/ASMBS guidelines.

This systematic review highlights the need for well-designed RCTs or large prospective cohort studies to enable better-informed decision-making for clinicians and patients. Clinicians working in the field innately understand the benefit of multidisciplinary teamwork. However, it has yet to be proven in high-quality studies.

Just as the NIH indications from 1991 became outdated as surgical techniques, with a better understanding of the pathophysiology of obesity and improved perioperative safety, these current guidelines should be regularly revisited when new evidence emerges to inform treatment decisions.

List of Delphi consensus Experts

First Name	Last Name	Country
Edo	Aaarts	Netherland
Ahmad	Aly	Australia
Ali	Aminian	USA
Luigi	Angrisani	Italy
Ahmad Abdallah	Bashir	Jordan
Estuardo	Behrens	Guatemala
Helmuth Thorlakur	Billy	USA
Sonja	Chiappetta	Italy
Jean-Marc	Chevallier	France
Ricardo Vitor	Cohen	Brazil
Maurizio	De Luca	Italy
Pierre Y	Garneau	Canada
Khaled Aly	Gawdat	Egypt
Ashraf	Haddad	Jordan
Jacques M	Himpens	Belgium
Farah Anwari	Husain	USA
Angelo	Iossa	Italy
Mohammad	Kermansaravi	Iran
Shanu Nikhil	Kothari	USA
Lilian	Kow	Australia
Marina	Kurian	USA
Teresa LeAnn	LaMasters	USA
Silvia	Leite Faria	Brazil
Ken Wing King	Loi	Australia
Kamal K	Mahawar	UK
Corrigan Lee	McBride	USA
Giovanni	Merola	Italy
Monali	Misra	USA
Abdelrahman Ali	Nimeri	USA
Joe	Northup	USA
Mary	O'Kane	UK
Pavlos	Papasavas	USA
Richard M	Peterson	USA
Giacomo	Piatto	Italy
Luis	Poggi	Peru
Jaime	Ponce	USA
Gerhard	Prager	Austria
Janey Sue Andrews	Pratt	USA
Almino Cardoso	Ramos	Brazil
Ann M	Rogers	USA
Paulina	Salminen	Finland
Nathaniel James	Sann	USA
John David	Scott	USA
Scott Alan	Shikora	USA
Michel	Suter	Switzerland
Salvatore	Tolone	Italy
Antonio	Vitiello	Italy
Cunchuan	Wang	China

Disclosures

None.

Supplementary data

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.soard.2024.05.009>.

References

- [1] Mun EC, Blackburn GL, Matthews JB. Current status of medical and surgical therapy for obesity. *Gastroenterology* 2001;120(3):669–81.
- [2] Gastrointestinal surgery for severe obesity. Consensus Statement 1991;9(1):1–20.
- [3] Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71.
- [4] Nasa P, Jain R, Juneja D. Delphi methodology in healthcare research: how to decide its appropriateness. *World J Methodol* 2021;11(4):116–29.
- [5] Eisenberg D, Shikora SA, Aarts E, et al. 2022 American Society of Metabolic and Bariatric Surgery (ASMBS) and International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) indications for metabolic and bariatric surgery. *Obes Surg* 2023;33(1):3–14.
- [6] Eisenberg D, Shikora SA, Aarts E, et al. 2022 American Society for Metabolic and Bariatric Surgery (ASMBS) and International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO): indications for metabolic and bariatric surgery. *Surg Obes Relat Dis* 2022;18(12):1345–56.
- [7] Billeter AT, Scheurlen KM, Israel B, et al. Gastric bypass resolves metabolic dysfunction-associated fatty liver disease (MAFLD) in low-BMI patients: a prospective cohort study. *Ann Surg* 2022;276(5):814–21.
- [8] Chaturvedi R, Gracner T, Tysinger B, Narain K, Goldman D, Sturm R. The long-term value of bariatric surgery interventions for American adults with type 2 diabetes mellitus. *Ann Surg* 2023;277(5):789–97.
- [9] Altieri MS, DeMaria E, Lensing C, et al. Real-world retrospective analysis of outcomes in patients undergoing bariatric surgery with class 1 obesity. *Surg Obes Relat Dis* 2022;18(5):569–76.
- [10] Singh D, Baksi A, Ramana P, Singla V, Aggarwal S. Five-year outcomes of sleeve gastrectomy in patients with class I obesity and type 2 diabetes mellitus. *Obes Surg* 2022;32(1):96–102.
- [11] Baldwin D, Sanchez-Johnsen L, Bustos R, Mangano A, Masrur M. Metabolic surgery outcomes in U.S. patients with class I obesity. *Bariatric Surg Pract Patient Care* 2021;16(2):85–91.
- [12] Gupta S, Beitner M, Skinner C, Hopkins G. Medium-term outcomes of converting laparoscopic adjustable gastric band to Roux-en-Y gastric bypass in patients with body mass index <35 kg/m(2): a uniquely Australian perspective. *Surg Obes Relat Dis* 2020;16(4):485–91.
- [13] Varban OA, Bonham AJ, Finks JF, Telem DA, Obeid NR, Ghaferi AA. Is it worth it? Determining the health benefits of sleeve gastrectomy in patients with a body mass index <35 kg/m(2). *Surg Obes Relat Dis* 2020;16(2):248–53.
- [14] Navarrete Aulestia S, Leyba JL, Navarrete Llopis S, Pulgar V. One anastomosis gastric bypass/minigastric bypass in patients with BMI < 35 kg/m(2) and type 2 diabetes mellitus: preliminary report. *Obes Surg* 2019;29(12):3987–91.
- [15] Gamme G, Dang JT, Switzer N, Gill R, Birch DW, Karmali S. Evaluating the safety of bariatric surgery for weight loss in class I obesity: a propensity-matched analysis of North American data. *Surg Obes Relat Dis* 2019;15(4):629–35.
- [16] Feng X, Andalib A, Brethauer SA, Schauer PR, Aminian A. How safe is bariatric surgery in patients with class I obesity (body mass index 30–35 kg/m(2))? *Surg Obes Relat Dis* 2019;15(2):253–60.
- [17] Vitiello A, Angrisani L, Santonicola A, Iovino P, Pilone V, Forestieri P. Bariatric surgery versus lifestyle intervention in class I obesity: 7–10-year results of a retrospective study. *World J Surg* 2019;43(3):758–62.

- [18] Noun R, Slim R, Nasr M, et al. Results of laparoscopic sleeve gastrectomy in 541 consecutive patients with low baseline body mass index (30–35 kg/m²). *Obes Surg* 2016;26(12):2824–8.
- [19] Maiz C, Alvarado J, Quezada N, Salinas J, Funke R, Boza C. Bariatric surgery in 1119 patients with preoperative body mass index <35 (kg/m²): results at 1 year. *Surg Obes Relat Dis* 2015;11(5):1127–32.
- [20] Kaska L, Proczko M, Kobiela J, Stefaniak TJ, Sledzinski Z. Dynamics of type 2 diabetes mellitus laboratory remission after Roux-en-Y gastric bypass in patients with body mass index lower than 35 kg/m² and higher than 35 kg/m² in a 3-year observation period. *Wideochir Inne Tech Maloinwazyjne* 2014;9(4):523–30.
- [21] Walker DM, Hii MW, Skinner CE, Hopkins GH. Roux-en-Y gastric bypass after successful weight loss with a laparoscopic adjustable gastric band: rationales and early outcomes in patients of body mass index <35 kg/m². *Surg Obes Relat Dis* 2014;10(6):1104–8.
- [22] Boza C, Valderas P, Daroch DA, et al. Metabolic surgery: Roux-en-Y gastric bypass and variables associated with diabetes remission in patients with BMI <35. *Obes Surg* 2014;24(8):1391–7.
- [23] Scopinaro N, Adami GF, Papadia FS, et al. Effects of gastric bypass on type 2 diabetes in patients with BMI 30 to 35. *Obes Surg* 2014;24(7):1036–43.
- [24] Serrot FJ, Dorman RB, Miller CJ, et al. Comparative effectiveness of bariatric surgery and nonsurgical therapy in adults with type 2 diabetes mellitus and body mass index <35 kg/m². *Surgery* 2011;150(4):684–91.
- [25] Gianos M, Abdemur A, Fendrich I, Gari V, Szomstein S, Rosenthal RJ. Outcomes of bariatric surgery in patients with body mass index <35 kg/m². *Surg Obes Relat Dis* 2012;8(1):25–30.
- [26] Choi J, Digiorgi M, Milone L, et al. Outcomes of laparoscopic adjustable gastric banding in patients with low body mass index. *Surg Obes Relat Dis* 2010;6(4):367–71.
- [27] Varela JE. Bariatric surgery: a cure for diabetes? *Curr Opin Clin Nutr Metab Care* 2011;14(4):396–401.
- [28] Scopinaro N, Adami GF, Papadia FS, et al. The effects of biliopancreatic diversion on type 2 diabetes mellitus in patients with mild obesity (BMI 30–35 kg/m²) and simple overweight (BMI 25–30 kg/m²): a prospective controlled study. *Obes Surg* 2011;21(7):880–8.
- [29] DeMaria EJ, Pate V, Warthen M, Winegar DA. Baseline data from American Society for Metabolic and Bariatric Surgery-designated bariatric surgery centers of excellence using the bariatric outcomes longitudinal database. *Surg Obes Relat Dis* 2010;6(4):347–55.
- [30] Parikh M, Duncombe J, Fielding GA. Laparoscopic adjustable gastric banding for patients with body mass index of <or=35 kg/m². *Surg Obes Relat Dis* 2006;2(5):518–22.
- [31] Sultan S, Parikh M, Youn H, Kurian M, Fielding G, Ren C. Early U.S. outcomes after laparoscopic adjustable gastric banding in patients with a body mass index less than 35 kg/m². *Surg Endosc* 2009;23(7):1569–73.
- [32] Cohen RV, Pereira TV, Aboud CM, et al. Microvascular Outcomes after Metabolic Surgery (MOMS) in patients with type 2 diabetes mellitus and class I obesity: rationale and design for a randomised controlled trial. *BMJ Open* 2017;7(1):e013574.
- [33] Angrisani L, Favretti F, Furbetta F, et al. Italian Group for Lap-Band System: results of multicenter study on patients with BMI < or =35 kg/m². *Obes Surg* 2004;14(3):415–8.
- [34] Cevallos L, Rodriguez FM, Herrera A, et al. Metabolic surgery and class I obesity (< 35 kg/m²): a prospective study with short-, mid-, and long-term results among Latinos. *Obes Surg* 2021;31(6):2401–9.
- [35] Espinosa O, Pineda O, Maydon HG, et al. Type 2 diabetes mellitus outcomes after laparoscopic gastric bypass in patients with BMI <35 kg/m² using strict remission criteria: early outcomes of a prospective study among Mexicans. *Surg Endosc* 2018;32(3):1353–9.
- [36] Mazidi M, Gao HK, Li L, Hui H, Zhang Y. Effects of Roux-en-Y gastric bypass on insulin secretion and sensitivity, glucose homeostasis, and diabetic control: a prospective cohort study in Chinese patients. *Surgery* 2017;161(5):1423–9.
- [37] Osman Abouzeid TA, Ain Shoka AA, Abd Elsamee Atia KS. From diabetes remedy to diabetes remission, could single-anastomosis gastric bypass be a safe bridge to reach target in non-obese patients? *Asian J Surg* 2019;42(1):307–13.
- [38] Ma S, Wang L, Chen J, Zhao Y, Jiang T. The effect of laparoscopic sleeve gastrectomy on type 2 diabetes remission outcomes in patients with body mass index between 25 kg/m² and 32.5 kg/m². *Asian J Surg* 2022;45(1):315–9.
- [39] Park DJ, An S, Park YS, et al. Bariatric surgery versus medical therapy in Korean obese patients: prospective multicenter, nonrandomized controlled trial (KOBESS trial). *Ann Surg Treat Res* 2021;101(4):197–205.
- [40] Luo Y, Guo Z, He H, Yang Y, Zhao S, Mo Z. Predictive model of type 2 diabetes remission after metabolic surgery in Chinese patients. *Int J Endocrinol* 2020;2020:2965175.
- [41] Nautiyal HK, Guan W, Lin S, Liang H. Preoperative predictors of early relapse/no-remission of type-2 diabetes after metabolic surgery in Chinese patients. *Clin Obes* 2020;10(2):e12350.
- [42] Huang YM, Lin YK, Lee WJ, et al. Long-term outcomes of metabolic surgery in overweight and obese patients with type 2 diabetes in Asia. *Diabetes Obes Metab* 2021;23(3):742–53.
- [43] Malapan K, Goel R, Tai CM, Kao YH, Chang PC, Huang CK. Laparoscopic Roux-en-Y gastric bypass for nonobese type II diabetes mellitus in Asian patients. *Surg Obes Relat Dis* 2014;10(5):834–40.
- [44] Zuo D, Xiao X, Yang S, Gao Y, Wang G, Ning G. Effects of bariatric surgery in Chinese with obesity and type 2 diabetes mellitus: a 3-year follow-up. *Medicine (Baltimore)* 2020;99(34):e21673.
- [45] Zhao L, Li W, Su Z, Liu Y, Zhu L, Zhu S. Preoperative fasting C-peptide predicts type 2 diabetes mellitus remission in low-BMI Chinese patients after Roux-en-Y gastric bypass. *J Gastrointest Surg* 2018;22(10):1672–8.
- [46] Fan J, Xu JH, Wang J, Wang GZ, Zhang YQ, Liu XZ. Effects of laparoscopic adjustable gastric banding on weight loss, metabolism, and obesity-related comorbidities: 5-year results in China. *Obes Surg* 2014;24(6):891–6.
- [47] Kim MJ, Hur KY. Short-term outcomes of laparoscopic single anastomosis gastric bypass (LSAGB) for the treatment of type 2 diabetes in lower BMI (<30 kg/m²) patients. *Obes Surg* 2014;24(7):1044–51.
- [48] Zhang H, Han X, Yu H, Di J, Zhang P, Jia W. Effect of Roux-en-Y gastric bypass on remission of T2D: medium-term follow-up in Chinese patients with different BMI obesity class. *Obes Surg* 2017;27(1):134–42.
- [49] Kwon O, Lee YJ, Yu JH, Kim MS, Heo Y. The recovery of beta-cell function is critical for antidiabetic outcomes of gastric bypass in Asian subjects with type 2 diabetes and a body mass index below 30. *Obes Surg* 2017;27(2):541–4.
- [50] Du X, Fu XH, Shi L, Hu JK, Zhou ZG, Cheng Z. Effects of laparoscopic Roux-en-Y gastric bypass on Chinese type 2 diabetes mellitus patients with different levels of obesity: outcomes after 3 years' follow-up. *Obes Surg* 2018;28(3):702–11.
- [51] Liang H, Cao Q, Liu H, Guan W, Wong C, Tong D. The predictive factors for diabetic remission in Chinese patients with BMI > 30 kg/m² and BMI < 30 kg/m² are different. *Obes Surg* 2018;28(7):1943–9.
- [52] Widjaja J, Pan H, Dolo PR, et al. Short-term diabetes remission outcomes in patients with BMI <= 30 kg/m² following sleeve gastrectomy. *Obes Surg* 2020;30(1):18–22.
- [53] Yu Z, Li W, Sun X, et al. Predictors of type 2 diabetes mellitus remission after metabolic surgery in Asian patients with a BMI < 32.5 kg/m². *Obes Surg* 2021;31(9):4125–33.
- [54] Mazidi M, Gao HK, Hui H, Li L, Ferns GA. Changes in adiposity and other cardiometabolic risk factors following Roux-en-Y gastric

- bypass: a 12-month prospective cohort study in Chinese patients. *Indian J Gastroenterol* 2017;36(4):258–62.
- [55] Athanasiadis DI, Hernandez E, Dirks RC, Stefanidis D, Banerjee A. Postoperative 4-year outcomes in septuagenarians following bariatric surgery. *Obes Surg* 2021;31(12):5127–31.
 - [56] Pajecski D, Dantas ACB, Tustumi F, Kanaji AL, de Cleve R, Santo MA. Sleeve gastrectomy versus Roux-en-Y gastric bypass in the elderly: 1-year preliminary outcomes in a randomized trial (BASE trial). *Obes Surg* 2021;31(6):2359–63.
 - [57] Nor Hanipah Z, Punchai S, Karas LA, et al. The outcome of bariatric surgery in patients aged 75 years and older. *Obes Surg* 2018;28(6):1498–503.
 - [58] Hammond JB, Webb CJ, Pulivarthi V, Pearson DG, Harold KL, Madura 2nd JA. Is there an upper age limit for bariatric surgery? Laparoscopic gastric bypass outcomes in septuagenarians. *Obes Surg* 2020;30(7):2482–6.
 - [59] Gholizadeh B, Makhsofi BR, Valizadeh R, Pazouki A, Kermansaravi M. Safety and efficacy of one anastomosis gastric bypass on patients with severe obesity aged 65 years and above. *Obes Surg* 2022;32(5):1610–6.
 - [60] Ramirez A, Roy M, Hidalgo JE, Szomstein S, Rosenthal RJ. Outcomes of bariatric surgery in patients >70 years old. *Surg Obes Relat Dis* 2012;8(4):458–62.
 - [61] Daigle CR, Andalib A, Corcelles R, Cetin D, Schauer PR, Brethauer SA. Bariatric and metabolic outcomes in the super-obese elderly. *Surg Obes Relat Dis* 2016;12(1):132–7.
 - [62] Casillas RA, Kim B, Fischer H, Zelada Getty JL, Um SS, Coleman KJ. Comparative effectiveness of sleeve gastrectomy versus Roux-en-Y gastric bypass for weight loss and safety outcomes in older adults. *Surg Obes Relat Dis* 2017;13(9):1476–83.
 - [63] Frieder JS, Montorfano L, Gomez CO, et al. Sleeve gastrectomy versus Roux-en-Y gastric bypass in patients aged ≥ 65 years: a comparison of short-term outcomes. *Surg Obes Relat Dis* 2021;17(8):1409–15.
 - [64] Quebbemann B, Engstrom D, Siegfried T, Garner K, Dallal R. Bariatric surgery in patients older than 65 years is safe and effective. *Surg Obes Relat Dis* 2005;1(4):389–93.
 - [65] Quirante FP, Montorfano L, Rammohan R, et al. Is bariatric surgery safe in the elderly population? *Surg Endosc* 2017;31(4):1538–43.
 - [66] Lainas P, Dammaro C, Gaillard M, Donatelli G, Tranchart H, Dagher I. Safety and short-term outcomes of laparoscopic sleeve gastrectomy for patients over 65 years old with severe obesity. *Surg Obes Relat Dis* 2018;14(7):952–9.
 - [67] Danan M, Nedelcu A, Noel P, Zulian V, Carandina S, Nedelcu M. Operative morbidity of laparoscopic sleeve gastrectomy in subjects older than age 65. *Surg Obes Relat Dis* 2019;15(1):8–11.
 - [68] van Rutte PW, Smulders JF, de Zoete JP, Nienhuijs SW. Sleeve gastrectomy in older obese patients. *Surg Endosc* 2013;27(6):2014–9.
 - [69] O’Keefe KL, Kemmeter PR, Kemmeter KD. Bariatric surgery outcomes in patients aged 65 years and older at an American Society for Metabolic and Bariatric Surgery Center of Excellence. *Obes Surg* 2010;20(9):1199–205.
 - [70] Garofalo F, Denis R, Pescarus R, Atlas H, Bacon SL, Garneau P. Long-term outcome after laparoscopic sleeve gastrectomy in patients over 65 years old: a retrospective analysis. *Surg Obes Relat Dis* 2017;13(1):1–6.
 - [71] Loy JJ, Youn HA, Schwack B, Kurian MS, Fielding GA, Ren-Fielding CJ. Safety and efficacy of laparoscopic adjustable gastric banding in patients aged seventy and older. *Surg Obes Relat Dis* 2014;10(2):284–9.
 - [72] Nevo N, Eldar SM, Lessing Y, Sabo E, Nachmany I, Hazzan D. Sleeve gastrectomy in the elderly. *Obes Facts* 2019;12(5):502–8.
 - [73] Gondal AB, Hsu CH, Zeeshan M, Hamidi M, Joseph B, Ghaderi I. A frailty index and the impact of frailty on postoperative outcomes in older patients after bariatric surgery. *Surg Obes Relat Dis* 2019;15(9):1582–8.
 - [74] Giordano S, Victorzon M. Bariatric surgery in elderly patients: a systematic review. *Clin Interv Aging* 2015;10:1627–35.
 - [75] Shenoy SS, Gilliam A, Mehanna A, et al. Laparoscopic sleeve gastrectomy versus laparoscopic Roux-en-Y gastric bypass in elderly bariatric patients: safety and efficacy—a systematic review and meta-analysis. *Obes Surg* 2020;30(11):4467–73.
 - [76] O’Brien PE, Sawyer SM, Laurie C, et al. Laparoscopic adjustable gastric banding in severely obese adolescents: a randomized trial. *JAMA* 2010;303(6):519–26.
 - [77] Carbajo MA, Gonzalez-Ramirez G, Jimenez JM, et al. A 5-year follow-up in children and adolescents undergoing one-anastomosis gastric bypass (OAGB) at a European IFSO Excellence Center (EAC-BS). *Obes Surg* 2019;29(9):2739–44.
 - [78] Dobritoiu D, Buza M, Catanescu E, Copescu C. Excellent short- and medium-term result of bariatric surgery in adolescence. A single center study. *Chirurgia (Bucur)* 2019;114(6):753–60.
 - [79] Elhag W, El Ansari W, Abdulrazzaq S, Abdullah A, Elsherif M, Elgenaied I. Evolution of 29 anthropometric, nutritional, and cardiometabolic parameters among morbidly obese adolescents 2 years post sleeve gastrectomy. *Obes Surg* 2018;28(2):474–82.
 - [80] Elhag W, El Ansari W. Durability of cardiometabolic outcomes among adolescents after sleeve gastrectomy: first study with 9-year follow-up. *Obes Surg* 2021;31(7):2869–77.
 - [81] Razieli A, Sakran N, Szold A, et al. Mid-term follow-up after laparoscopic sleeve gastrectomy in obese adolescents. *Isr Med Assoc J* 2014;16(1):37–41.
 - [82] Yitzhak A, Mizrahi S, Avinoach E. Laparoscopic gastric banding in adolescents. *Obes Surg* 2006;16(10):1318–22.
 - [83] Holterman AX, Holterman M, Browne A, Henriques S, Guzman G, Fantuzzi G. Patterns of surgical weight loss and resolution of metabolic abnormalities in superobese bariatric adolescents. *J Pediatr Surg* 2012;47(9):1633–9.
 - [84] Holterman AX, Browne A, Tussing L, et al. A prospective trial for laparoscopic adjustable gastric banding in morbidly obese adolescents: an interim report of weight loss, metabolic and quality of life outcomes. *J Pediatr Surg* 2010;45(1):74–8. discussion 8–9.
 - [85] Inge TH, Garcia V, Daniels S, et al. A multidisciplinary approach to the adolescent bariatric surgical patient. *J Pediatr Surg* 2004;39(3):442–7. discussion 6–7.
 - [86] Jaramillo JD, Snyder E, Farrales S, et al. A multidisciplinary approach to laparoscopic sleeve gastrectomy among multiethnic adolescents in the United States. *J Pediatr Surg* 2017;52(10):1606–9.
 - [87] Conroy R, Lee EJ, Jean A, et al. Effect of laparoscopic adjustable gastric banding on metabolic syndrome and its risk factors in morbidly obese adolescents. *J Obes* 2011;2011:906384.
 - [88] Riquin E, Schmitt F, Bouhours-Nouet N, et al. Laparoscopic adjustable gastric banding in adolescents with severe obesity: psychological aspects, decision makers of surgery, and 2-year outcomes. A case series. *Arch Pediatr* 2018;25(4):269–73.
 - [89] Loy JJ, Youn HA, Schwack B, Kurian M, Ren Fielding C, Fielding GA. Improvement in nonalcoholic fatty liver disease and metabolic syndrome in adolescents undergoing bariatric surgery. *Surg Obes Relat Dis* 2015;11(2):442–9.
 - [90] Manco M, Mosca A, De Peppo F, et al. The benefit of sleeve gastrectomy in obese adolescents on nonalcoholic steatohepatitis and hepatic fibrosis. *J Pediatr* 2017;180:31–37.e2.
 - [91] Nadler EP, Reddy S, Isenalmhe A, et al. Laparoscopic adjustable gastric banding for morbidly obese adolescents affects android fat loss, resolution of comorbidities, and improved metabolic status. *J Am Coll Surg* 2009;209(5):638–44.
 - [92] Zeller MH, Modi AC, Noll JG, Long JD, Inge TH. Psychosocial functioning improves following adolescent bariatric surgery. *Obesity (Silver Spring)* 2009;17(5):985–90.

- [93] Xiao N, Devarajan P, Inge TH, Jenkins TM, Bennett M, Mitsnefes MM. Subclinical kidney injury before and 1 year after bariatric surgery among adolescents with severe obesity. *Obesity* (Silver Spring) 2015;23(6):1234–8.
- [94] Sarwer DB, Dilks RJ, Spitzer JC, et al. Changes in dietary intake and eating behavior in adolescents after bariatric surgery: an ancillary study to the teen-LABS Consortium. *Obes Surg* 2017;27(12):3082–91.
- [95] Ryder JR, Edwards NM, Gupta R, et al. Changes in functional mobility and musculoskeletal pain after bariatric surgery in teens with severe obesity: teen-Longitudinal Assessment of Bariatric Surgery (LABS) study. *JAMA Pediatr* 2016;170(9):871–7.
- [96] Alqahtani AR, Elahmedi MO, Al Qahtani AR, Lee J, Butler MG. Laparoscopic sleeve gastrectomy in children and adolescents with Prader-Willi syndrome: a matched-control study. *Surg Obes Relat Dis* 2016;12(1):100–10.
- [97] Reiter-Purtill J, Ley S, Kidwell KM, et al. Change, predictors and correlates of weight- and health-related quality of life in adolescents 2-years following bariatric surgery. *Int J Obes* 2020;44(7):1467–78.
- [98] Xanthakos SA, Khouiry JC, Inge TH, et al. Nutritional risks in adolescents after bariatric surgery. *Clin Gastroenterol Hepatol* 2020;18(5):1070–1081.e5.
- [99] Nehus EJ, Khouiry JC, Inge TH, et al. Kidney outcomes three years after bariatric surgery in severely obese adolescents. *Kidney Int* 2017;91(2):451–8.
- [100] Kaar JL, Morelli N, Russell SP, et al. Obstructive sleep apnea and early weight loss among adolescents undergoing bariatric surgery. *Surg Obes Relat Dis* 2021;17(4):711–7.
- [101] Derderian SC, Patten L, Kaizer AM, et al. Influence of weight loss on obesity-associated complications after metabolic and bariatric surgery in adolescents. *Obesity* (Silver Spring) 2020;28(12):2397–404.
- [102] Nobili V, Carpino G, De Peppo F, et al. Laparoscopic sleeve gastrectomy improves nonalcoholic fatty liver disease-related liver damage in adolescents by reshaping cellular interactions and hepatic adipocytokine production. *J Pediatr* 2018;194:100–108.e3.
- [103] Kalra M, Inge T, Garcia V, et al. Obstructive sleep apnea in extremely overweight adolescents undergoing bariatric surgery. *Obes Res* 2005;13(7):1175–9.
- [104] Watanabe Y, Yamaguchi T, Tanaka S, et al. Characteristics of childhood onset and post-puberty onset obesity and weight regain after laparoscopic sleeve gastrectomy in Japanese subjects: a subgroup analysis of J-SMART. *Obes Facts* 2022;15(4):498–507.
- [105] Hjelmestaeth J, Hertel JK, Holt AH, et al. Laparoscopic gastric bypass versus lifestyle intervention for adolescents with morbid obesity. *Tidsskr Nor Laegeforen* 2020;140(16). English, Norwegian. <https://doi.org/10.4045/tidsskr.20.0526>.
- [106] Tashiro J, McKenna E, Alberto EC, Mackey ER, Nadler EP. The impact of parental bariatric surgery and patient age on laparoscopic sleeve gastrectomy outcomes in adolescents. *Surg Endosc* 2022;36(10):7392–8.
- [107] Lee DY, Guend H, Park K, et al. Outcomes of laparoscopic Roux-en-Y gastric bypass versus laparoscopic adjustable gastric banding in adolescents. *Obes Surg* 2012;22(12):1859–64.
- [108] Cozacov Y, Roy M, Moon S, et al. Mid-term results of laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass in adolescent patients. *Obes Surg* 2014;24(5):747–52.
- [109] Pena AS, Delko T, Couper R, et al. Laparoscopic adjustable gastric banding in Australian adolescents: should it be done? *Obes Surg* 2017;27(7):1667–73.
- [110] Dumont PN, Blanchet MC, Gignoux B, Matuissiere Y, Frering V. Medium- to long-term outcomes of gastric banding in adolescents: a single-center study of 97 consecutive patients. *Obes Surg* 2018;28(1):285–9.
- [111] Lainas P, De Filippo G, Di Giuro G, Mikhael R, Bougneres P, Dagher I. Laparoscopic sleeve gastrectomy for adolescents under 18 years old with severe obesity. *Obes Surg* 2020;30(1):267–73.
- [112] Mohammed MR, Mahdy T, Hashem A, et al. Impact of baseline BMI and adherence to follow-up on the outcome of sleeve gastrectomy in treatment of adolescent obesity. *Obes Surg* 2021;31(6):2567–75.
- [113] Teeple EA, Teich S, Schuster DP, Michalsky MP. Early metabolic improvement following bariatric surgery in morbidly obese adolescents. *Pediatr Blood Cancer* 2012;58(1):112–6.
- [114] Tuna T, Espinheira MDC, Vasconcelos C, Preto J, Campos JM. Laparoscopic sleeve gastrectomy in morbidly obese adolescents: initial experience of a pediatric multidisciplinary unit. *Arch Pediatr* 2020;27(6):310–4.
- [115] White B, Doyle J, Matschull K, et al. Outcomes of 50 patients entering an adolescent bariatric surgery programme. *Arch Dis Child* 2017;102(12):1152–6.
- [116] Messiah SE, Lopez-Mitnik G, Winegar D, et al. Effect of ethnicity on weight loss among adolescents 1 year after bariatric surgery. *World J Diabetes* 2013;4(5):202–9.
- [117] Kaulfers AM, Bean JA, Inge TH, Dolan LM, Kalkwarf HJ. Bone loss in adolescents after bariatric surgery. *Pediatrics* 2011;127(4):e956–61.
- [118] Alqahtani AR, Elahmedi M, Abdurabu HY, Alqahtani S. Ten-year outcomes of children and adolescents who underwent sleeve gastrectomy: weight loss, comorbidity resolution, adverse events, and growth velocity. *J Am Coll Surg* 2021;233(6):657–64.
- [119] Choi JT, Foster BD, Soraya Heidari K, Carney JJ, Hatch 3rd GF, Marecek GS. Effect of bariatric surgery on outcomes in the operative treatment of hip fractures. *Injury* 2020;51(3):688–93.
- [120] Inacio MC, Paxton EW, Fisher D, Li RA, Barber TC, Singh JA. Bariatric surgery prior to total joint arthroplasty may not provide dramatic improvements in post-arthroplasty surgical outcomes. *J Arthroplasty* 2014;29(7):1359–64.
- [121] Werner BC, Kurkis GM, Gwathmey FW, Browne JA. Bariatric surgery prior to total knee arthroplasty is associated with fewer postoperative complications. *J Arthroplasty* 2015;30(9 Suppl):81–5.
- [122] Nickel BT, Klement MR, Penrose CT, Green CL, Seyler TM, Bolognesi MP. Lingering risk: bariatric surgery before total knee arthroplasty. *J Arthroplasty* 2016;31(9 Suppl):207–11.
- [123] McLawhorn AS, Levack AE, Lee YY, Ge Y, Do H, Dodwell ER. Bariatric surgery improves outcomes after lower extremity arthroplasty in the morbidly obese: a propensity score-matched analysis of a New York statewide database. *J Arthroplasty* 2018;33(7):2062–2069.e4.
- [124] Lee GC, Ong K, Baykal D, Lau E, Malkani AL. Does prior bariatric surgery affect implant survivorship and complications following primary total hip arthroplasty/total knee arthroplasty? *J Arthroplasty* 2018;33(7):2070–2074.e1.
- [125] Wang Y, Deng Z, Meng J, Dai Q, Chen T, Bao N. Impact of bariatric surgery on inpatient complication, cost, and length of stay following total hip or knee arthroplasty. *J Arthroplasty* 2019;34(12):2884–9 e4.
- [126] Sax OC, Chen Z, Bains SS, et al. Timing and type of bariatric surgery preceding total knee arthroplasty leads to similar complications and outcomes. *J Arthroplasty* 2022;37(8S):S842–8.
- [127] Ryan SP, Couch CG, Duong SQ, et al. Frank Stinchfield award: does bariatric surgery prior to primary total hip arthroplasty really improve outcomes? *J Arthroplasty* 2022;37(7S):S386–90.
- [128] Martin JR, Watts CD, Taunton MJ. Bariatric surgery does not improve outcomes in patients undergoing primary total knee arthroplasty. *Bone Joint Lett J* 2015;97-B(11):1501–5.
- [129] Watts CD, Martin JR, Houdek MT, Abdel MP, Lewallen DG, Taunton MJ. Prior bariatric surgery may decrease the rate of re-operation and revision following total hip arthroplasty. *Bone Joint Lett J* 2016;98-B(9):1180–4.
- [130] Liu JX, Paoli AR, Mahure SA, Bosco 3rd J, Campbell KA. Preoperative bariatric surgery utilization is associated with increased 90-day

- postoperative complication rates after total joint arthroplasty. *J Am Acad Orthop Surg* 2020;28(5):e206–12.
- [131] Nickel BT, Klement MR, Penrose C, Green CL, Bolognesi MP, Seyler TM. Dislocation rate increases with bariatric surgery before total hip arthroplasty. *Hip Int* 2018;28(5):559–65.
- [132] Dowsey MM, Brown WA, Cochrane A, Burton PR, Liew D, Choong PF. Effect of bariatric surgery on risk of complications after total knee arthroplasty: a randomized clinical trial. *JAMA Netw Open* 2022;5(4):e226722.
- [133] Ighani Arani P, Wretenberg P, Ottosson J, Robertsson O, W-Dahl A. Bariatric surgery prior to total knee arthroplasty is not associated with lower risk of revision: a register-based study of 441 patients. *Acta Orthop* 2021;92(1):97–101.
- [134] Nearing 2nd EE, Santos TM, Topolski MS, Borgert AJ, Kallies KJ, Kothari SN. Benefits of bariatric surgery before elective total joint arthroplasty: is there a role for weight loss optimization? *Surg Obes Relat Dis* 2017;13(3):457–62.
- [135] Liu J, Zhong H, Poeran J, Sculco PK, Kim DH, Memtsoudis SG. Bariatric surgery and total knee/hip arthroplasty: an analysis of the impact of sequence and timing on outcomes. *Reg Anesth Pain Med* 2021;46(11):941–5.
- [136] Meller MM, Goodman S, Gonzalez MH, Lau E. Does bariatric surgery normalize risks after total knee arthroplasty? Administrative medicare data. *J Am Acad Orthop Surg Glob Res Rev* 2019;3(12):e19.00102.
- [137] Purcell S, Hossain I, Evans B, Porter G, Richardson G, Ellsmere J. Morbid obesity and severe knee osteoarthritis: which should be treated first? *J Gastrointest Surg* 2022;26(7):1388–93.
- [138] Schwarzkopf R, Lavery JA, Hooper J, Parikh M, Gold HT. Bariatric surgery and time to total joint arthroplasty: does it affect readmission and complication rates? *Obes Surg* 2018;28(5):1395–401.
- [139] Ighani Arani P, Wretenberg P, Ottosson J, W-Dahl A. Pain, function, and satisfaction after total knee arthroplasty, with or without bariatric surgery. *Obes Surg* 2022;32(4):1164–9.
- [140] Severson EP, Singh JA, Browne JA, Trousdale RT, Sarr MG, Lewallen DG. Total knee arthroplasty in morbidly obese patients treated with bariatric surgery: a comparative study. *J Arthroplasty* 2012;27(9):1696–700.
- [141] Adrados M, Samuel LT, Locklear TM, Moskal JT. Institutional adherence to the American Association of Hip and Knee Surgeons body mass index guidelines lowers perioperative emergency department visits in primary total knee arthroplasty. *J Arthroplasty* 2023;38(6S):S88–93.
- [142] Morrell DJ, Pauli EM, Lyn-Sue JR, Haluck RS, Rogers AM. Laparoscopic sleeve gastrectomy in patients with complex abdominal wall hernias. *Surg Endosc* 2021;35(7):3881–9.
- [143] Moolla M, Dang J, Modasi A, et al. Concurrent laparoscopic ventral hernia repair with bariatric surgery: a propensity-matched analysis. *J Gastrointest Surg* 2020;24(1):58–66.
- [144] Krivan MS, Giorga A, Barreca M, Jain VK, Al-Taani OS. Concomitant ventral hernia repair and bariatric surgery: a retrospective analysis from a UK-based bariatric center. *Surg Endosc* 2019;33(3):705–10.
- [145] Sharma G, Boules M, Punchai S, et al. Outcomes of concomitant ventral hernia repair performed during bariatric surgery. *Surg Endosc* 2017;31(4):1573–82.
- [146] Olmi S, Uccelli M, Cesana GC, et al. Laparoscopic ventral hernia repair in bariatric patients: the role of defect size and deferred repair. *Obes Surg* 2020;30(10):3905–11.
- [147] Raziel A, Sakran N, Szold A, Goitein D. Concomitant bariatric and ventral/incisional hernia surgery in morbidly obese patients. *Surg Endosc* 2014;28(4):1209–12.
- [148] Chandeze MM, Moszkowicz D, Beauchet A, Vychnevskaja K, Peschaud F, Bouillot JL. Ventral hernia surgery in morbidly obese patients, immediate or after bariatric surgery preparation: results of a case-matched study. *Surg Obes Relat Dis* 2019;15(1):83–8.
- [149] Praveen Raj P, Senthilnathan P, Kumaravel R, et al. Concomitant laparoscopic ventral hernia mesh repair and bariatric surgery: a retrospective study from a tertiary care center. *Obes Surg* 2012;22(5):685–9.
- [150] Clapp B, Lee I, Liggett E, et al. Are concomitant operations during bariatric surgery safe? An analysis of the MBSAQIP database. *Obes Surg* 2020;30(11):4474–81.
- [151] Chan DL, Talbot ML, Chen Z, Kwon SC. Simultaneous ventral hernia repair in bariatric surgery. *ANZ J Surg* 2014;84(7-8):581–3.
- [152] Eid GM, Mattar SG, Hamad G, et al. Repair of ventral hernias in morbidly obese patients undergoing laparoscopic gastric bypass should not be deferred. *Surg Endosc* 2004;18(2):207–10.
- [153] Moszkowicz D, Jacota M, Nkam L, Giovinazzo D, Grimaldi L, Lazzati A. Ventral hernia repair and obesity: results from a nationwide register study in France according to the timeframes of hernia repair and bariatric surgery. *Obes Surg* 2021;31(12):5251–9.
- [154] Newcomb WL, Polhill JL, Chen AY, et al. Staged hernia repair preceded by gastric bypass for the treatment of morbidly obese patients with complex ventral hernias. *Hernia* 2008;12(5):465–9.
- [155] Datta T, Eid G, Nahmias N, Dallal RM. Management of ventral hernias during laparoscopic gastric bypass. *Surg Obes Relat Dis* 2008;4(6):754–7.
- [156] Spaniolas K, Kasten KR, Mozer AB, et al. Synchronous ventral hernia repair in patients undergoing bariatric surgery. *Obes Surg* 2015;25(10):1864–8.
- [157] Eid GM, Wikel KJ, Entabi F, Saleem M. Ventral hernias in morbidly obese patients: a suggested algorithm for operative repair. *Obes Surg* 2013;23(5):703–9.
- [158] Khorgami Z, Haskins IN, Aminian A, et al. Concurrent ventral hernia repair in patients undergoing laparoscopic bariatric surgery: a case-matched study using the National Surgical Quality Improvement Program Database. *Surg Obes Relat Dis* 2017;13(6):997–1002.
- [159] Praveen Raj P, Bhattacharya S, Saravana Kumar S, Parthasarathi R, Kumar B, Palanivelu C. Morbid obesity with ventral hernia: is concomitant bariatric surgery with laparoscopic ventral hernia mesh repair the best approach? An experience of over 150 cases. *Surg Obes Relat Dis* 2019;15(7):1098–103.
- [160] Praveenraj P, Gomes RM, Kumar S, et al. Concomitant bariatric surgery with laparoscopic intra-peritoneal onlay mesh repair for recurrent ventral hernias in morbidly obese patients: an evolving standard of care. *Obes Surg* 2016;26(6):1191–4.
- [161] Borbely Y, Zerkowski J, Altmeier J, Eschenburg A, Kroll D, Nett P. Complex hernias with loss of domain in morbidly obese patients: role of laparoscopic sleeve gastrectomy in a multi-step approach. *Surg Obes Relat Dis* 2017;13(5):768–73.
- [162] Kaminski DL. The role of gastric restrictive procedures in treating ventral hernias in morbidly obese patients. *Int J Surg Investig* 2000;2(2):159–64.
- [163] Marzouk A, Ali HOE. Laparoscopic ventral hernia repair combined with sleeve gastrectomy in morbidly obese patients: early outcomes. *Surg J (N Y)* 2019;5(3):e87–91.
- [164] Vitiello A, Berardi G, Velotti N, Schiavone V, Musella M. Simultaneous small/medium umbilical hernia repair with laparoscopic sleeve gastrectomy (LSG): results of a retrospective case-matched study. *Surg Laparosc Endosc Percutan Tech* 2021;31(5):519–22.
- [165] Alexander JW, Goodman H. Gastric bypass in chronic renal failure and renal transplant. *Nutr Clin Pract* 2007;22(1):16–21.
- [166] Modanlou KA, Muthyala U, Xiao H, et al. Bariatric surgery among kidney transplant candidates and recipients: analysis of the United States renal data system and literature review. *Transplantation* 2009;87(8):1167–73.
- [167] Jamal MH, Corcelles R, Daigle CR, et al. Safety and effectiveness of bariatric surgery in dialysis patients and kidney transplantation candidates. *Surg Obes Relat Dis* 2015;11(2):419–23.

- [168] Mozer AB, Pender 4th JR, Chapman WH, Sippey ME, Pories WJ, Spaniolas K. Bariatric surgery in patients with dialysis-dependent renal failure. *Obes Surg* 2015;25(11):2088–92.
- [169] Freeman CM, Woodle ES, Shi J, et al. Addressing morbid obesity as a barrier to renal transplantation with laparoscopic sleeve gastrectomy. *Am J Transplant* 2015;15(5):1360–8.
- [170] Al-Bahri S, Fakhry TK, Gonzalvo JP, Murr MM. Bariatric surgery as a bridge to renal transplantation in patients with end-stage renal disease. *Obes Surg* 2017;27(11):2951–5.
- [171] Gheith O, Al-Otaibi T, Halim MA, et al. Bariatric surgery in renal transplant patients. *Exp Clin Transplant* 2017;15(Suppl 1):164–9.
- [172] Kim Y, Jung AD, Dhar VK, et al. Laparoscopic sleeve gastrectomy improves renal transplant candidacy and posttransplant outcomes in morbidly obese patients. *Am J Transplant* 2018;18(2):410–6.
- [173] Thomas IA, Gaynor JJ, Joseph T, et al. Roux-en-Y gastric bypass is an effective bridge to kidney transplantation: results from a single center. *Clin Transplant* 2018;32(5):e13232.
- [174] Cohen JB, Lim MA, Tewksbury CM, et al. Bariatric surgery before and after kidney transplantation: long-term weight loss and allograft outcomes. *Surg Obes Relat Dis* 2019;15(6):935–41.
- [175] Yemini R, Neshet E, Carmeli I, et al. Bariatric surgery is efficacious and improves access to transplantation for morbidly obese renal transplant candidates. *Obes Surg* 2019;29(8):2373–80.
- [176] Yemini R, Neshet E, Winkler J, et al. Bariatric surgery in solid organ transplant patients: long-term follow-up results of outcome, safety, and effect on immunosuppression. *Am J Transplant* 2018;18(11):2772–80.
- [177] Bouchard P, Tchervenkov J, Demyttenaere S, Court O, Andalib A. Safety and efficacy of the sleeve gastrectomy as a strategy towards kidney transplantation. *Surg Endosc* 2020;34(6):2657–64.
- [178] Cohen JB, Tewksbury CM, Torres Landa S, Williams NN, Dumon KR. National postoperative bariatric surgery outcomes in patients with chronic kidney disease and end-stage kidney disease. *Obes Surg* 2019;29(3):975–82.
- [179] Schindel H, Winkler J, Yemini R, Carmeli I, Neshet E, Keidar A. Survival benefit in bariatric surgery kidney recipients may be mediated through effects on kidney graft function and improvement of co-morbidities: a case-control study. *Surg Obes Relat Dis* 2019;15(4):621–7.
- [180] Kassam AF, Mirza A, Kim Y, et al. Long-term outcomes in patients with obesity and renal disease after sleeve gastrectomy. *Am J Transplant* 2020;20(2):422–9.
- [181] Sheetz KH, Woodside KJ, Shahinian VB, Dimick JB, Montgomery JR, Waits SA. Trends in bariatric surgery procedures among patients with ESKD in the United States. *Clin J Am Soc Nephrol* 2019;14(8):1193–9.
- [182] Dobrzycka M, Proczko-Stepaniak M, Kaska L, Wilczynski M, Deb-ska-Slizien A, Kobiela J. Weight loss after bariatric surgery in morbidly obese end-stage kidney disease patients as preparation for kidney transplantation. Matched pair analysis in a high-volume bariatric and transplant center. *Obes Surg* 2020;30(7):2708–14.
- [183] Outmani L, Kimenai H, Roodnat JJ, et al. Clinical outcome of kidney transplantation after bariatric surgery: a single-center, retrospective cohort study. *Clin Transplant* 2021;35(3):e14208.
- [184] Soliman BG, Tariq N, Law YY, et al. Effectiveness of bariatric surgery in increasing kidney transplant eligibility in patients with kidney failure requiring dialysis. *Obes Surg* 2021;31(8):3436–43.
- [185] Ku E, McCulloch CE, Roll GR, Posselt A, Grimes BA, Johansen KL. Bariatric surgery prior to transplantation and risk of early hospital readmission, graft failure, or death following kidney transplantation. *Am J Transplant* 2021;21(11):3750–7.
- [186] Zaminpeyma R, Claus M, Paraskevas S, Court O, Tchervenkov J, Andalib A. Outcomes of kidney transplant recipients who underwent pre-transplant bariatric surgery for severe obesity: a long-term follow-up study. *Surg Endosc* 2023;37(1):494–502.
- [187] Takata MC, Campos GM, Ciovia R, et al. Laparoscopic bariatric surgery improves candidacy in morbidly obese patients awaiting transplantation. *Surg Obes Relat Dis* 2008;4(2):159–64.
- [188] Lin MY, Tavakol MM, Sarin A, et al. Laparoscopic sleeve gastrectomy is safe and efficacious for pretransplant candidates. *Surg Obes Relat Dis* 2013;9(5):653–8.
- [189] Diwan TS, Lee TC, Nagai S, et al. Obesity, transplantation, and bariatric surgery: an evolving solution for a growing epidemic. *Am J Transplant* 2020;20(8):2143–55.
- [190] Ahmed Z, Khan MA, Vazquez-Montesino LM, Ahmed A. Bariatric surgery, obesity and liver transplantation. *Transl Gastroenterol Hepatol* 2022;7:25.
- [191] Howell RS, Liu HH, Boinpally H, et al. Outcomes of bariatric surgery: patients with body mass index 60 or greater. *JSLs* 2021;25(2):e2020.00089.
- [192] Banks J, Abouelazayem M, Kaur V, et al. Routine intra-gastric balloon insertion in the management of 'super-super-obese' patients: an obituary? *Obes Surg* 2021;31(5):2319–23.
- [193] Nasser H, Ivanics T, Varban OA, et al. Comparison of early outcomes between Roux-en-Y gastric bypass and sleeve gastrectomy among patients with body mass index ≥ 60 kg/m². *Surg Endosc* 2021;35(6):3115–21.
- [194] Mahmoud M, Hasanin AM, Mostafa M, Alhamade F, Abdelhamid B, Elsherbeen M. Evaluation of super-obesity and super-super-obesity as risk factors for difficult intubation in patients undergoing bariatric surgery. *Surg Obes Relat Dis* 2021;17(7):1279–85.
- [195] Dupree A, El Gammal AT, Wolter S, et al. Perioperative short-term outcome in super-super-obese patients undergoing bariatric surgery. *Obes Surg* 2018;28(7):1895–901.
- [196] Samuel N, Jalal Q, Gupta A, Mazari F, Vasas P, Balachandra S. Mid-term bariatric surgery outcomes for obese patients: does weight matter? *Ann R Coll Surg Engl* 2020;102(1):54–61.
- [197] Stephens DJ, Saunders JK, Belsley S, et al. Short-term outcomes for super-super obese (BMI $>$ or $=60$ kg/m²) patients undergoing weight loss surgery at a high-volume bariatric surgery center: laparoscopic adjustable gastric banding, laparoscopic gastric bypass, and open tubular gastric bypass. *Surg Obes Relat Dis* 2008;4(3):408–15.
- [198] Romero-Velez G, Pechman DM, Munoz Flores F, Moran-Atkin E, Choi J, Camacho DR. Bariatric surgery in the super-super morbidly obese: outcome analysis of patients with BMI >70 using the ACS-NSQIP database. *Surg Obes Relat Dis* 2020;16(7):894–9.
- [199] Schwartz A, Etchechoury L, Collet D. Outcome after laparoscopic gastric bypass for super-super obese patients. *J Visc Surg* 2013;150(2):145–9.
- [200] Gonzalez-Heredia R, Sanchez-Johnsen L, Valbuena VS, Masrur M, Murphey M, Elli E. Surgical management of super-super obese patients: Roux-en-Y gastric bypass versus sleeve gastrectomy. *Surg Endosc* 2016;30(5):2097–102.
- [201] Ochner CN, Jochner MC, Caruso EA, Teixeira J, Xavier Pi-Sunyer F. Effect of preoperative body mass index on weight loss after obesity surgery. *Surg Obes Relat Dis* 2013;9(3):423–7.
- [202] Arapis K, Macrina N, Kadouch D, Ribeiro Parenti L, Marmuse JP, Hansel B. Outcomes of Roux-en-Y gastric bypass versus sleeve gastrectomy in super-super-obese patients (BMI ≥ 60 kg/m²): 6-year follow-up at a single university. *Surg Obes Relat Dis* 2019;15(1):23–33.
- [203] Serrano OK, Tannebaum JE, Cumella L, et al. Weight loss outcomes and complications from bariatric surgery in the super super obese. *Surg Endosc* 2016;30(6):2505–11.
- [204] Mehaffey JH, LaPar DJ, Turrentine FE, Miller MS, Hallowell PT, Schirmer BD. Outcomes of laparoscopic Roux-en-Y gastric bypass in super-super-obese patients. *Surg Obes Relat Dis* 2015;11(4):814–9.
- [205] Nasser H, Ivanics T, Leonard-Murali S, Shakaroun D, Genaw J. Peri-operative outcomes of laparoscopic Roux-en-Y gastric bypass and sleeve gastrectomy in super-obese and super-super-obese patients:

- a national database analysis. *Surg Obes Relat Dis* 2019;15(10):1696–703.
- [206] Thereaux J, Czernichow S, Corigliano N, Poitou C, Oppert JM, Bouillot JL. Five-year outcomes of gastric bypass for super-super-obesity (BMI ≥ 60 kg/m²): a case matched study. *Surg Obes Relat Dis* 2015;11(1):32–7.
- [207] Peraglie C. Laparoscopic mini-gastric bypass (LMGB) in the super-super obese: outcomes in 16 patients. *Obes Surg* 2008;18(9):1126–9.
- [208] Madhok B, Mahawar KK, Boyle M, et al. Management of super-super obese patients: comparison between mini (one anastomosis) gastric bypass and sleeve gastrectomy. *Obes Surg* 2016;26(7):1646–9.
- [209] Gagner M, Gumbs AA, Milone L, Yung E, Goldenberg L, Pomp A. Laparoscopic sleeve gastrectomy for the super-super-obese (body mass index >60 kg/m²). *Surg Today* 2008;38(5):399–403.
- [210] Taylor JD, Leitman IM, Hon P, Horowitz M, Panagopoulos G. Outcome and complications of gastric bypass in super-super obesity versus morbid obesity. *Obes Surg* 2006;16(1):16–8.
- [211] Wilkinson KH, Helm M, Lak K, Higgins RM, Gould JC, Kindel TL. The risk of post-operative complications in super-super obesity compared to super obesity in accredited bariatric surgery centers. *Obes Surg* 2019;29(9):2964–71.
- [212] Abeles D, Kim JJ, Tarnoff ME, Shah S, Shikora SA. Primary laparoscopic gastric bypass can be performed safely in patients with BMI ≥ 60 . *J Am Coll Surg* 2009;208(2):236–40.
- [213] Parmar C, Abdelhalim MA, Mahawar KK, et al. Management of super-super obese patients: comparison between one anastomosis (mini) gastric bypass and Roux-en-Y gastric bypass. *Surg Endosc* 2017;31(9):3504–9.
- [214] Artuso D, Wayne M, Kaul A, Bairamian M, Teixeira J, Cerabona T. Extremely high body mass index is not a contraindication to laparoscopic gastric bypass. *Obes Surg* 2004;14(6):750–4.
- [215] Ece I, Yilmaz H, Alptekin H, et al. Comparative effectiveness of laparoscopic sleeve gastrectomy on morbidly obese, super-obese, and super-super obese patients for the treatment of morbid obesity. *Obes Surg* 2018;28(6):1484–91.
- [216] Sanchez-Santos R, Vilarrasa N, Pujol J, et al. Is Roux-en-Y gastric bypass adequate in the super-obese? *Obes Surg* 2006;16(4):478–83.
- [217] Schmitz SM, Alizai PH, Kroh A, et al. Clinical outcomes after one anastomosis gastric bypass versus sleeve gastrectomy in super-super-obese patients. *Surg Endosc* 2022;36(6):4401–7.
- [218] Moon RC, Nelson L, Teixeira AF, Jawad MA. Outcomes of Roux-en-Y gastric bypass in the super obese: comparison of body mass index 50–60 kg/m² and ≥ 60 kg/m² with the morbidly obese. *Surg Obes Relat Dis* 2016;12(2):292–6.
- [219] Farkas DT, Vemulapalli P, Haider A, Lopes JM, Gibbs KE, Teixeira JA. Laparoscopic Roux-en-Y gastric bypass is safe and effective in patients with a BMI ≥ 60 . *Obes Surg* 2005;15(4):486–93.
- [220] Gould JC, Garren MJ, Boll V, Starling JR. Laparoscopic gastric bypass: risks vs. benefits up to two years following surgery in super-super obese patients. *Surgery* 2006;140(4):524–9. discussion 9–31.
- [221] Kushnir L, Dunnican WJ, Benedetto B, et al. Is BMI greater than 60 kg/m² a predictor of higher morbidity after laparoscopic Roux-en-Y gastric bypass? *Surg Endosc* 2010;24(1):94–7.
- [222] Oliak D, Ballantyne GH, Davies RJ, Wasielewski A, Schmidt HJ. Short-term results of laparoscopic gastric bypass in patients with BMI ≥ 60 . *Obes Surg* 2002;12(5):643–7.
- [223] Fielding GA. Laparoscopic adjustable gastric banding for massive superobesity (> 60 body mass index kg/m²). *Surg Endosc* 2003;17(10):1541–5.
- [224] Hering I, Dorries L, Flemming S, et al. Impact of preoperative weight loss achieved by gastric balloon on peri- and postoperative outcomes of bariatric surgery in super-obese patients: a retrospective matched-pair analysis. *Langenbeck's Arch Surg* 2022;407(5):1873–9.
- [225] Wang C, Yang W, Yang J. Surgical results of laparoscopic Roux-en-Y gastric bypass in super obese patients with BMI ≥ 60 in China. *Surg Laparosc Endosc Percutan Tech* 2014;24(6):e216–20.
- [226] Singhal R, Omar I, Madhok B, et al. Effect of BMI on safety of bariatric surgery during the COVID-19 pandemic, procedure choice, and safety protocols - an analysis from the GENEVA Study. *Obes Res Clin Pract* 2022;16(3):249–53.
- [227] Myers JA, Sarker S, Shayani V. Treatment of massive super-obesity with laparoscopic adjustable gastric banding. *Surg Obes Relat Dis* 2006;2(1):37–40. discussion 40.
- [228] Tichansky DS, DeMaria EJ, Fernandez AZ, et al. Postoperative complications are not increased in super-super obese patients who undergo laparoscopic Roux-en-Y gastric bypass. *Surg Endosc* 2005;19(7):939–41.
- [229] Zerrweck C, Maunoury V, Caiazzo R, et al. Preoperative weight loss with intragastric balloon decreases the risk of significant adverse outcomes of laparoscopic gastric bypass in super-super obese patients. *Obes Surg* 2012;22(5):777–82.
- [230] Catheline JM, Fysekidis M, Dbouk R, et al. Weight loss after sleeve gastrectomy in super superobesity. *J Obes* 2012;2012:959260.
- [231] Torchia F, Mancuso V, Civitelli S, et al. LapBand System in super-superobese patients (>60 kg/m²): 4-year results. *Obes Surg* 2009;19(9):1211–5.
- [232] Date RS, Walton SJ, Ryan N, Rahman SN, Henley NC. Is selection bias toward super obese patients in the rationing of metabolic surgery justified?—a pilot study from the United Kingdom. *Surg Obes Relat Dis* 2013;9(6):981–6.
- [233] Di Betta E, Mitterpergher F, Nascimbeni R, Salerni B. Outcome of duodenal switch with a transitory vertical gastropasty, in super-super-obese patients in an 8-year series. *Obes Surg* 2008;18(2):182–6.
- [234] Spyropoulos C, Katsakoulis E, Mead N, Vagenas K, Kalfarentzos F. Intragastric balloon for high-risk super-obese patients: a prospective analysis of efficacy. *Surg Obes Relat Dis* 2007;3(1):78–83.
- [235] Gottig S, Daskalakis M, Weiner S, Weiner RA. Analysis of safety and efficacy of intragastric balloon in extremely obese patients. *Obes Surg* 2009;19(6):677–83.
- [236] Shuhaiber J, Vitello J. Is gastric bypass associated with more complications in patients weighing >500 lb (>227 kg)? *Obes Surg* 2004;14(1):43–6.
- [237] Fazylov RM, Savel RH, Horovitz JH, et al. Association of super-super-obesity and male gender with elevated mortality in patients undergoing the duodenal switch procedure. *Obes Surg* 2005;15(5):618–23.
- [238] Kaul A, Singla V, Baksi A, et al. Safety and efficacy of bariatric surgery in advanced liver fibrosis. *Obes Surg* 2020;30(11):4359–65.
- [239] Hanipah ZN, Punchai S, McCullough A, et al. Bariatric surgery in patients with cirrhosis and portal hypertension. *Obes Surg* 2018;28(11):3431–8.
- [240] Younus H, Sharma A, Miquel R, et al. Bariatric surgery in cirrhotic patients: is it safe? *Obes Surg* 2020;30(4):1241–8.
- [241] Quezada N, Maturana G, Irarrazaval MJ, et al. Bariatric surgery in cirrhotic patients: a matched case-control study. *Obes Surg* 2020;30(12):4724–31.
- [242] Singh T, Kochhar GS, Goh GB, et al. Safety and efficacy of bariatric surgery in patients with advanced fibrosis. *Int J Obes* 2017;41(3):443–9.
- [243] Salman MA, Mikhail HMS, Nafea MA, et al. Impact of laparoscopic sleeve gastrectomy on fibrosis stage in patients with child-a NASH-related cirrhosis. *Surg Endosc* 2021;35(3):1269–77.
- [244] Mumtaz K, Lipshultz H, Jalil S, et al. Bariatric surgery in patients with cirrhosis: careful patient and surgery-type selection is key to improving outcomes. *Obes Surg* 2020;30(9):3444–52.
- [245] Are VS, Knapp SM, Banerjee A, et al. Improving outcomes of bariatric surgery in patients with cirrhosis in the United States: a nationwide assessment. *Am J Gastroenterol* 2020;115(11):1849–56.

- [246] Miller A, Jalil S, Hussan H, et al. Apprising the choice of bariatric surgery in patients with compensated cirrhosis with morbid obesity: results of a national analysis. *Updates Surg* 2021;73(5):1899–908.
- [247] Klebanoff MJ, Corey KE, Samur S, et al. Cost-effectiveness analysis of bariatric surgery for patients with nonalcoholic steatohepatitis cirrhosis. *JAMA Netw Open* 2019;2(2):e190047.
- [248] Shimizu H, Phuong V, Maia M, et al. Bariatric surgery in patients with liver cirrhosis. *Surg Obes Relat Dis* 2013;9(1):1–6.
- [249] Dallal RM, Mattar SG, Lord JL, et al. Results of laparoscopic gastric bypass in patients with cirrhosis. *Obes Surg* 2004;14(1):47–53.
- [250] Mittal T, Ahuja A, Dey A, et al. Safety and efficacy of laparoscopic sleeve gastrectomy in patients with portal hypertension with liver function of Childs A. *Surg Endosc* 2022;36(5):2942–8.
- [251] Minambres I, Rubio MA, de Hollanda A, et al. Outcomes of bariatric surgery in patients with cirrhosis. *Obes Surg* 2019;29(2):585–92.
- [252] Vuppalachchi R, McCabe 4th ME, Tandra SR, et al. Safety and efficacy of bariatric surgery in cirrhosis patients with extreme obesity. *Ann Surg* 2022;275(1):e174–80.
- [253] Blumer V, Greene SJ, Ortiz M, et al. In-hospital outcomes after bariatric surgery in patients with heart failure. *Am Heart J* 2020;230:59–62.
- [254] Sun D, Schaff HV, McKenzie TJ, et al. Safety of bariatric surgery in obese patients with hypertrophic cardiomyopathy. *Am J Cardiol* 2022;167:93–7.
- [255] Balakumaran K, Jabri A, Haddadin F, et al. Bariatric weight loss surgery improves systolic function in obese patients with heart failure. *Curr Probl Cardiol* 2023;48(8):101231.
- [256] Mentias A, Aminian A, Youssef D, et al. Long-term cardiovascular outcomes after bariatric surgery in the medicare population. *J Am Coll Cardiol* 2022;79(15):1429–37.
- [257] Val FRD, Cheon O, Menser T, et al. Bariatric surgery in end-stage heart failure: feasibility in successful attainment of a target body mass index. *J Card Fail* 2020;26(11):944–7.
- [258] Alsabrook GD, Goodman HR, Alexander JW. Gastric bypass for morbidly obese patients with established cardiac disease. *Obes Surg* 2006;16(10):1272–7.
- [259] Vest AR, Patel P, Schauer PR, et al. Clinical and echocardiographic outcomes after bariatric surgery in obese patients with left ventricular systolic dysfunction. *Circ Heart Fail* 2016;9(3):e002260.
- [260] Naslund E, Stenberg E, Hofmann R, et al. Association of metabolic surgery with major adverse cardiovascular outcomes in patients with previous myocardial infarction and severe obesity: a nationwide cohort study. *Circulation* 2021;143(15):1458–67.
- [261] Doumouras AG, Wong JA, Paterson JM, et al. Bariatric surgery and cardiovascular outcomes in patients with obesity and cardiovascular disease: a population-based retrospective cohort study. *Circulation* 2021;143(15):1468–80.
- [262] Aminian A, Al-Kurd A, Wilson R, et al. Association of bariatric surgery with major adverse liver and cardiovascular outcomes in patients with biopsy-proven nonalcoholic steatohepatitis. *JAMA* 2021;326(20):2031–42.
- [263] Lundberg CE, Jamaly S, Adiels M, et al. Surgical treatment of obesity and excess risk of developing heart failure in a controlled cohort study. *ESC Heart Fail* 2022;9(3):1844–52.
- [264] Yuan H, Medina-Inojosa JR, Lopez-Jimenez F, et al. The long-term impact of bariatric surgery on development of atrial fibrillation and cardiovascular events in obese patients: an historical cohort study. *Front Cardiovasc Med* 2021;8:647118.
- [265] Ng M, Rodgers B, Rehman S, et al. Left ventricular assist device support and longitudinal sleeve gastrectomy combined with diet in bridge to heart transplant. *Tex Heart Inst J* 2022;49(1):e207521.
- [266] Benotti PN, Wood GC, Carey DJ, et al. Gastric bypass surgery produces a durable reduction in cardiovascular disease risk factors and reduces the long-term risks of congestive heart failure. *J Am Heart Assoc* 2017;6(5):e005126.
- [267] Hoskuldssdottir G, Sattar N, Miftaraj M, et al. Potential effects of bariatric surgery on the incidence of heart failure and atrial fibrillation in patients with type 2 diabetes mellitus and obesity and on mortality in patients with preexisting heart failure: a nationwide, matched, observational cohort study. *J Am Heart Assoc* 2021;10(7):e019323.
- [268] Yang TWW, Johari Y, Burton PR, et al. Bariatric surgery in patients with severe heart failure. *Obes Surg* 2020;30(8):2863–9.
- [269] Strzelczyk J, Kalinowski P, Zieniewicz K, Szmigielski C, Byra M, Styczynski G. The influence of surgical weight reduction on left atrial strain. *Obes Surg* 2021;31(12):5243–50.
- [270] Stenberg E, Cao Y, Jernberg T, Naslund E. Safety of bariatric surgery in patients with previous acute coronary events or heart failure: nationwide cohort study. *BJS Open* 2022;6(3):zrac083.
- [271] Busetto L, Dicker D, Azran C, et al. Practical recommendations of the obesity management task force of the European Association for the study of obesity for the post-bariatric surgery medical management. *Obes Facts* 2017;10(6):597–632.
- [272] Aarts MA, Sivapalan N, Nikzad SE, Serodio K, Sockalingam S, Conn LG. Optimizing bariatric surgery multidisciplinary follow-up: a focus on patient-centered care. *Obes Surg* 2017;27(3):730–6.
- [273] Gould J, Ellsmere J, Fanelli R, et al. Panel report: best practices for the surgical treatment of obesity. *Surg Endosc* 2011;25(6):1730–40.
- [274] Warman JL. The application of laparoscopic bariatric surgery for treatment of severe obesity in adolescents using a multidisciplinary adolescent bariatric program. *Crit Care Nurs Q* 2005;28(3):276–87.
- [275] Collazo-Clavell ML, Clark MM, McAlpine DE, Jensen MD. Assessment and preparation of patients for bariatric surgery. *Mayo Clin Proc* 2006;81(10 Suppl):S11–7.
- [276] Elte JW, Castro Cabezas M, Vrijland WW, Ruseler CH, Groen M, Mannaerts GH. Proposal for a multidisciplinary approach to the patient with morbid obesity: the St. Franciscus Hospital morbid obesity program. *Eur J Intern Med* 2008;19(2):92–8.
- [277] Apovian CM, Cummings S, Anderson W, et al. Best practice updates for multidisciplinary care in weight loss surgery. *Obesity (Silver Spring)* 2009;17(5):871–9.
- [278] Di Lorenzo N, Antoniou SA, Batterham RL, et al. Clinical practice guidelines of the European Association for Endoscopic Surgery (EAES) on bariatric surgery: update 2020 endorsed by IFSO-EC, EASO and ESPCOP. *Surg Endosc* 2020;34(6):2332–58.
- [279] van Hout GC, Vreeswijk CM, van Heck GL. Bariatric surgery and bariatric psychology: evolution of the Dutch approach. *Obes Surg* 2008;18(3):321–5.
- [280] Pories WJ, Aronne LJ. It's time for multidisciplinary obesity management centers. *Obesity (Silver Spring)* 2019;27(4):534.
- [281] Gill RS, Karmali S, Hadi G, Al-Adra DP, Shi X, Birch DW. Predictors of attrition in a multidisciplinary adult weight management clinic. *Can J Surg* 2012;55(4):239–43.
- [282] Andalib A, Bouchard P, Bougie A, Loiselle SE, Demyttenaere S, Court O. Variability in bariatric surgical care among various centers: a survey of all bariatric surgeons in the Province of Quebec, Canada. *Obes Surg* 2018;28(8):2327–32.
- [283] Aboueid S, Jasinska M, Bourgeault I, Giroux I. Current weight management approaches used by primary care providers in six multidisciplinary healthcare settings in Ontario. *Can J Nurs Res* 2018;50(4):169–78.
- [284] Vahiye A, Aizpuru MJ, Sarr MG, et al. Safety and efficacy of revisional surgery as a treatment for malnutrition after bariatric surgery. *J Am Coll Surg* 2023;236(1):156–66.
- [285] Vanetta C, Dreifuss NH, Schlottmann F, Baz C, Masrur MA. Bariatric surgery conversions in MBSAQIP centers: current indications and outcomes. *Obes Surg* 2022;32(10):3248–56.
- [286] Major P, Zarzycki P, Rymarowicz J, et al. Revisional operations among patients after surgical treatment of obesity: a multicenter Polish Revision Obesity Surgery Study (PROSS). *Wideochir Inne Tech Maloinwazyjne* 2022;17(2):372–9.

- [287] Xie J, Dreifuss NH, Schlottmann F, et al. Minimally invasive revisional bariatric surgery in a MBSAQIP accredited high-volume center. *Front Surg* 2022;9:880044.
- [288] Hernandez LA, Guilbert L, Sepulveda EM, et al. Causes of revisional surgery, reoperations, and readmissions after bariatric surgery. *Rev Gastroenterol Mex (Engl Ed)* 2023;88(3):232–7.
- [289] Gero D, Vannijvel M, Okkema S, et al. Defining global benchmarks in elective secondary bariatric surgery comprising conversional, revisional, and reversal procedures. *Ann Surg* 2021;274(5):821–8.
- [290] Dreifuss NH, Mangano A, Hassan C, Masrur MA. Robotic revisional bariatric surgery: a high-volume center experience. *Obes Surg* 2021;31(4):1656–63.
- [291] King K, Galvez A, Stoltzfus J, Claros L, El Chaar M. Robotic-assisted surgery results in a shorter hospital stay following revisional bariatric surgery. *Obes Surg* 2021;31(2):634–9.
- [292] Cheema F, Choi M, Moran-Atkin E, Camacho D, Choi J. Outcomes in revisional bariatric surgery: a high-volume single institution experience. *Surg Endosc* 2021;35(7):3932–9.
- [293] El Chaar M, King K, Pastrana M, Galvez A, Stoltzfus J. Outcomes of robotic surgery in revisional bariatric cases: a propensity score-matched analysis of the MBSAQIP registry. *J Robot Surg* 2021;15(2):235–9.
- [294] Mora Oliver I, Cassinello Fernandez N, Alfonso Ballester R, Cuenca Ramirez MD, Ortega Serrano J. Revisional bariatric surgery due to failure of the initial technique: 25 years of experience in a specialized unit of obesity surgery in Spain. *Cir Esp (Engl Ed)* 2019;97(10):568–74. Cirugia bariatrica de conversion por fallo de la tecnica inicial: 25 anos de experiencia en una Unidad especializada de Cirugia de la Obesidad en Espana.
- [295] Keren D, Romano-Zelekha O, Rainis T, Sakran N. Revisional bariatric surgery in Israel: findings from the Israeli bariatric surgery registry. *Obes Surg* 2019;29(11):3514–22.
- [296] Acevedo E, Mazzei M, Zhao H, Lu X, Edwards MA. Outcomes in conventional laparoscopic versus robotic-assisted revisional bariatric surgery: a retrospective, case-controlled study of the MBSAQIP database. *Surg Endosc* 2020;34(4):1573–84.
- [297] Clapp B, Liggett E, Jones R, Lodeiro C, Dodoo C, Tyroch A. Comparison of robotic revisional weight loss surgery and laparoscopic revisional weight loss surgery using the MBSAQIP database. *Surg Obes Relat Dis* 2019;15(6):909–19.
- [298] Aleassa EM, Hassan M, Hayes K, Brethauer SA, Schauer PR, Aminian A. Effect of revisional bariatric surgery on type 2 diabetes mellitus. *Surg Endosc* 2019;33(8):2642–8.
- [299] Qiu J, Lundberg PW, Javier Birriel T, Claros L, Stoltzfus J, El Chaar M. Revisional bariatric surgery for weight regain and refractory complications in a single MBSAQIP accredited center: what are we dealing with? *Obes Surg* 2018;28(9):2789–95.
- [300] Gray KD, Moore MD, Elmously A, et al. Perioperative outcomes of laparoscopic and robotic revisional bariatric surgery in a complex patient population. *Obes Surg* 2018;28(7):1852–9.
- [301] Pires Souto K, Meinhardt NG, de Azevedo Dossin I, et al. Revisional malabsorptive bariatric surgery: 29-year follow-up in a Brazilian public hospital. *Obes Surg* 2018;28(6):1504–10.
- [302] Fulton C, Sheppard C, Birch D, Karmali S, de Gara C. A comparison of revisional and primary bariatric surgery. *Can J Surg* 2017;60(3):205–11.
- [303] Daigle CR, Chaudhry R, Boules M, et al. Revisional bariatric surgery can improve refractory metabolic disease. *Surg Obes Relat Dis* 2016;12(2):392–7.
- [304] Shimizu H, Annaberdyev S, Motamarri I, Kroh M, Schauer PR, Brethauer SA. Revisional bariatric surgery for unsuccessful weight loss and complications. *Obes Surg* 2013;23(11):1766–73.
- [305] Kuesters S, Grueneberger JM, Baumann T, et al. Revisionary bariatric surgery: indications and outcome of 100 consecutive operations at a single center. *Surg Endosc* 2012;26(6):1718–23.
- [306] Fronza JS, Prystowsky JB, Hungness ES, Nagle AP. Revisional bariatric surgery at a single institution. *Am J Surg* 2010;200(5):651–4.
- [307] Spyropoulos C, Kehagias I, Panagiotopoulos S, Mead N, Kalfarentzos F. Revisional bariatric surgery: 13-year experience from a tertiary institution. *Arch Surg* 2010;145(2):173–7.
- [308] Lim CS, Liew V, Talbot ML, Jorgensen JO, Loi KW. Revisional bariatric surgery. *Obes Surg* 2009;19(7):827–32.
- [309] Nessel EM, Kendrick ML, Houghton SG, et al. A two-decade spectrum of revisional bariatric surgery at a tertiary referral center. *Surg Obes Relat Dis* 2007;3(1):25–30; discussion 30.