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ASMBS guidelines/statements

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

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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.)

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*/m^2 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/m^2 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/m^2** [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/m^2, 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/m^2. 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/m^2.*

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

Evidence-Based Medicine, Stony Brook University Libraries, 14 March 2023.

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/m2).	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/m^2 and one obesity-associated medical problem.*
- *MBS should be considered in patients with a BMI of 30–34.9 kg/m^2 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/m^2 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/m^2 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/m^2, 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 ad 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 at 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/m^2 *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/m^2.

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/m^2.

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/m^2*. 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		Goood 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

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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 compli-cations	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 $\geq$40 kg/m^2) 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/m^{2,} 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 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
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 operatated 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

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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
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 pulmunary embolism

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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
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 form the primary surgery, BS patients had less complications than THA/TKA alone

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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 bllod transfunsion, but lower pnuemonia than obese before TJA

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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 increasead in BS, a low increasead 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 necessarity 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 underwentBS 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

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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
Severson, 2012 [140]	Retrospective	5	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 complicatin

RCT = randomized controlled trial; RYGB = Roux-en-Y gastric bypass; LAGB = laparoscopic adjustable gastric banding; SG = sleeve gastrectomy; TWL = total weight loss; TKA = to 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/m^2) 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/m^2. 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/m^2. Third, MBS can decrease the need for joint arthroplasty in patients with BMI ≥30 kg/m^2. Fourth, the experts also reached a consensus that joint arthroplasty in patients with a BMI ≥30 kg/m^2 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/m^2, 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/m^2.

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 $\geq$60 kg/m^2.

Concerning weight loss, the mean initial BMI was $\geq$66.64 kg/m^2 (standard deviation [SD] $\pm$ 3.05). After a mean follow-up of 28 months, the mean excess of body mass index loss (%EBMIL) was 51.5 (SD $\pm$ 16) with a mean ΔBMI was 21.64 kg/m^2 (SD $\pm$ 7.16). Improvement or resolution of the obesity-related complications was reported in 17 studies, including patients with BMI ≥60 kg/m^2. The mean percentage of improvement/resolution of T2DM was 67.35% (SD ± 24.79). The mean percentage of improvement/resolution of HTN was 54.01% (SD ± .93). The mean percentage of improvement/resolution of obstructive sleep apnea (OSA) was 63.61% (SD ± 21.51), while the mean percentage of improvement/resolution of dyslipidemia was 70.95% (SD ± 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 ± 6.28), and the mean percentage of early complications requiring reoperation was 4.9% (SD ± 3.48). The overall mean mortality was 1.61% (SD ± 2.29).

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

Recommendation

- *MBS is safe and effective in patients with BMI ≥60* kg/m^2.
- *Evidence suggests a higher rate of perioperative complications after MBS in patients with BMI ≥*60 kg/m^2.
- *According to the literature, MBS appears safe in patients with initial BMI ≥70* kg/m^2.

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 (MAFDL) 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 postoperative 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, Hjelmesæth 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

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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

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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		

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Table 7 (*continued*)

Proposal for a multidisciplinary approach to the patient with morbid obesity: the St. Franciscus 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] Best practice updates for multidisciplinary care in weight loss surgery.	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. Obes Surg 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. Obes Surg 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? J Am Diet Assoc 2006;106:163. [PubMed: 16390679]

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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 Justifcation 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 insufcient for generalizability of fndings). Postoperative weight loss was more pronounced in the preoperative diet consultation group (SMD .4, 95% CI .03–.78 higher). No diference 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 fnancial 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: Efects 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			

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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, 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 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/m^2 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
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Ahmad Abdallah	Bashir	Jordan
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Helmuth Thorlakur	Billy	USA
Sonja	Chiappetta	Italy
Jean-Marc	Chevallier	France
Ricardo Vitor	Cohen	Brazil
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Shanu Nikhil	Kothari	USA
Lilian	Kow	Australia
Marina	Kurian	USA
Teresa LeAnn	LaMasters	USA
Silvia	Leite Faria	Brazil
Ken Wing King	Loi	Australia
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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
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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.

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