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ORIGINAL CONTRIBUTIONS

Metabolic and Bariatric Surgeon Criteria—An International Experts' Consensus

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Abstract

Purpose With the global epidemic of obesity, the importance of metabolic and bariatric surgery (MBS) is greater than ever before. Performing these surgeries requires academic training and the completion of a dedicated fellowship training program. This study aimed to develop guidelines based on expert consensus using a modified Delphi method to create the criteria for metabolic and bariatric surgeons that must be mastered before obtaining privileges to perform MBS.

Methods Eighty-nine recognized MBS surgeons from 42 countries participated in the Modified Delphi consensus to vote on 30 statements in two rounds. An agreement/disagreement among ≥ 70.0% of the experts was regarded to indicate a consensus.

Results Consensus was reached on 29 out of 30 statements. Most experts agreed that before getting privileges to perform MBS, surgeons must hold a general surgery degree and complete or have completed a dedicated fellowship training program. The experts agreed that the learning curves for the various operative procedures are approximately 25–50 operations for the LSG, 50–75 for the OAGB, and 75–100 for the RYGB. 93.1% of experts agreed that MBS surgeons should diligently record patients' data in their National or Global database.

Conclusion MBS surgeons should have a degree in general surgery and have been enrolled in a dedicated fellowship training program with a structured curriculum. The learning curve of MBS procedures is procedure dependent. MBS surgeons must demonstrate proficiency in managing postoperative complications, collaborate within a multidisciplinary team, commit to a minimum 2-year patient follow-up, and actively engage in national and international MBS societies.

Key Points
- MBS surgeons should have a degree in general surgery and participate or have participated in a dedicated MBS fellowship training program.
- The learning curves for the various operative procedures are approximately 25–50 operations for the LSG, 50–75 for the OAGB, and 75–100 for the RYGB.
- MBS surgeons should diligently record patients' data in their National or Global database registry.
- MBS surgeons should follow their patients for at least 2 years.

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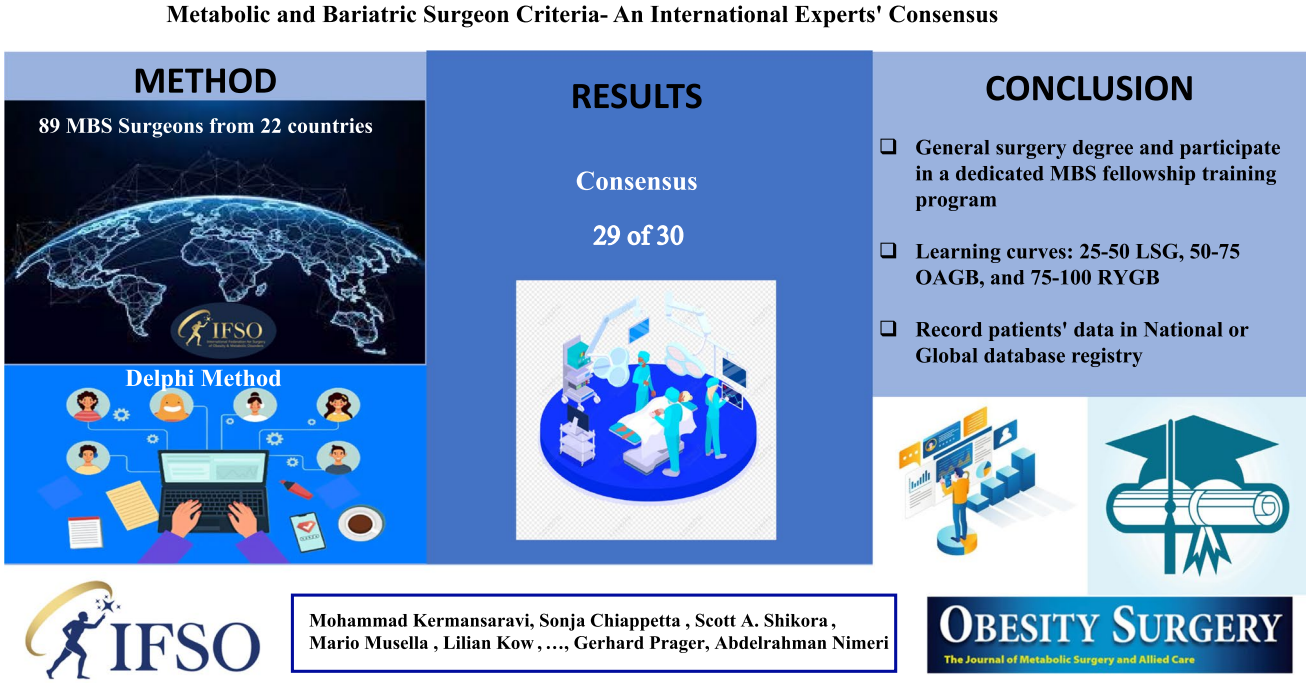
Graphical Abstract



Keywords Metabolic surgery · Bariatric surgery · Metabolic and bariatric surgeon · Fellowship · Learning curve

Introduction

As minimally invasive surgical techniques advance, metabolic and bariatric surgery (MBS) emerges as the most effective and enduring treatment for patients with obesity and associated medical conditions who do not respond to non-surgical interventions [1]. With the global epidemic of obesity [2], the importance of MBS is greater than ever before. Performing these surgeries requires academic training and the completion of a dedicated fellowship training program. In addition, passing through the learning curve is mandatory, for independent surgeons or first assistants, and may impact the surgical outcomes and patients' safety [3–5]. A recent Young-International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) Bariatric/Metabolic Surgery Training and Education Survey highlighted the lack of a standardized global surgical curriculum for MBS during residency training. Furthermore, it underlined the importance of advancing surgical education in MBS, including in accredited fellowship programs [6].

Currently, there is no universal consensus regarding the required number of MBS procedures that should be performed during the fellowship training to achieve the learning curves in MBS. In addition, although in many countries completing a fellowship or advanced courses at academic centers is mandatory, there is no consensus on the necessary learning objectives that must be completed during these courses and the post-graduate requirements that fellows must master to satisfactorily complete the fellowship. Furthermore, adherence to ethical behavior, regular patient follow-up, recording follow-up data, and complications, and the ability to manage complications are among the aspects which receive less attention without universal consensus. Since there is a lack of published data currently available, it is challenging to draw firm conclusions regarding the metabolic and bariatric surgeon criteria for acquiring privileges to perform MBS. Although expert opinion is typically classified as level IV scientific evidence, due to its availability, it often serves as the primary guidance for clinical practice. Achieving a consensus among experts, using robust methodologies like the Modified Delphi approach [7] can enhance clinical standards.

Hence, the objective of this study is to develop guidelines based on expert consensus using a modified Delphi method

to create the criteria for metabolic and bariatric surgeons that must be mastered before obtaining privileges to perform MBS.

Methods

Eighty-nine recognized metabolic and bariatric surgeons from 42 countries took part in this Delphi consensus study to establish criteria to obtain privileges to perform MBS. Due to the lack of robust evidence in many areas, this collaborative effort sought to provide expert guidance in the field.

An international core team, consisting of seven experts in MBS, who also serve as directors of MBS fellowship programs or other advanced MBS programs, formulated the initial statements (Table 1). To ensure comprehensive input, some MBS surgeons, including past presidents of the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO), American Society for Metabolic & Bariatric Surgery (ASMBS), IFSO chapters, IFSO member societies, as well as recognized academic and private expert surgeons, were invited to contribute their opinions and participate in any necessary modifications to the statements. Additionally, directors, co-directors, and opinion leaders of MBS fellowship programs were involved in the process. A meticulous selection process was employed to acquire these experts, including evaluation of their expertise in the subject matter, academic qualifications, and willingness to participate in the study. This approach ensured the inclusion of a diverse and knowledgeable international group of individuals who could provide valuable insights to the discussion.

Following thorough deliberation and exchange of opinions among the members, the core team selected 30 statements for the first round of voting (Table 2). The modified Delphi consensus method was employed, utilizing an online platform (@Survey Monkey), to facilitate the voting process and gather collective input from participants.

The link to the first round of consensus building was sent out on 8 February 2024 and was live until 23 February 2024. All invited experts voted on all 30 statements with only agree or disagree choices. An agreement/disagreement $\geq$ 70.0% was regarded as consensus (following previous Delphi consensuses in different aspects of MBS) [8–10]. Consensus was reached on 25 out of the 30 initial statements in the first round.

The core team conscientiously undertook an extensive literature review to augment the existing evidence about each of the five statements that did not achieve a consensus. Subsequently, the outcomes of the first round, including any available evidence related to the five statements that garnered less than 70.0% consensus, were shared with the experts. The experts were then invited to vote on the remaining five non-consensus statements during the second round of consensus building. The second round took place live from 4th March 2024 to 21st March 2024.

Table 1 List of the scientific core team (in alphabetical order)

Name	Country
Sonja Chiappetta	Italy
Mohammad Kermansaravi	Iran
Lilian Kow	Australia
Mario Musella	Italy
Abdelrahman Nimeri	USA
Gerhard Prager	Austria
Scott Shikora	USA

Results

Eighty-nine experts from 42 countries (Table 3) voted on the 30 and 5 statements in the first and second rounds, respectively. Table 2 summarizes the detailed results of the first and second rounds of voting on each of the 30 statements. Consensus was achieved for 29 of 30 statements (Table 2).

Approximately 95.4% of experts agreed that before getting privileges to perform MBS, surgeons should have a degree in general surgery and participate or have participated in a dedicated fellowship training program that included specialized education about obesity and MBS.

All experts concur that specialized education on obesity and MBS should include the mechanisms of MBS, the pathophysiology of obesity, ethical considerations surrounding MBS, benefits and risks of each MBS procedure, and a foundational understanding of the potential short- and long-term MBS implications and complications. Ninety-two percent of experts concurred that beginner metabolic and bariatric surgeons should demonstrate proficiency in performing different standard MBS procedures that are endorsed by ASMBS and IFSO.

Although many factors can contribute to the learning curve for sleeve gastrectomy (SG), Roux-en-Y gastric bypass (RYGB), and one anastomosis gastric bypass (OAGB), according to the published studies, the learning curves for the various operative procedures are approximately 25–50 operations for the LSG, 50–75 for the OAGB,75–100 for the RYGB. The experts agreed that currently, there is not enough published literature to suggest a learning curve for performing the laparoscopic single anastomosis duodenoilostomy with sleeve gastrectomy (SADI-S).

Table 2 Consensus statement voting results

Statements	Round 1	Round 2	Final result
1. Before getting privileges to perform metabolic and bariatric surgery (MBS) surgeons should have a degree in general surgery and participate in a dedicated fellowship training program that includes specialized education about obesity and MBS	Consensus Agree (95.4%)		Consensus
2. Specialized education about obesity and MBS should include the mechanisms of metabolic and bariatric surgery (MBS) and the pathophysiology of obesity and MBS	Consensus Agree (100%)		Consensus
3. Specialized education about obesity and MBS should include familiarity with the ethical considerations surrounding MBS	Consensus Agree (100%)		Consensus
4. Specialized education about obesity and MBS should include the benefits and risks of each MBS procedure, enabling them to effectively communicate these aspects to their patients	Consensus Agree (100%)		Consensus
5. Specialized education about obesity and MBS should have a foundational understanding of the potential short- and long-term MBS implications and complications	Consensus Agree (100%)		Consensus
6. Before starting to practice MBS, bariatric surgeons must demonstrate an operative log of cases during fellowship training for different MBS procedures	Consensus Agree (95.4%)		Consensus
7. Beginner metabolic and bariatric surgeons should be proficient in performing different standard MBS procedures that are endorsed by the American Society for Metabolic and Bariatric Surgery/ International Federation for the Surgery of Obesity and Metabolic Disorders (ASMBS/IFSO)	Consensus Agree (91.9%)		Consensus
8. Although many factors can contribute to the learning curve for sleeve gastrectomy (SG), published studies place it between 25–50 operations	Consensus Agree (79.3%)		Consensus
9. Although many factors can contribute to the learning curve for Laparoscopic Roux-en-Y Gastric Bypass (RYGB), published studies place it between 75 and 100 operations	No Consensus Agree (58.6%)	Consensus Agree (80.7%)	Consensus
10. Although many factors can contribute to the learning curve for laparoscopic One Anastomosis Gastric Bypass (OAGB), published studies place it between 50—75 operations	No Consensus Agree (63.5%)	Consensus Agree (81.8%)	Consensus
11. Currently, there is not enough published literature to suggest a learning curve for laparoscopic Single Anastomosis Duodenal-Ileal Bypass with Sleeve Gastrectomy (SADI-S)	No Consensus Agree (66.3%)	Consensus Agree (92.1%)	Consensus
12. The OAGB learning curve could serve as a valuable preparation for the RYGB practice learning curve	No Consensus Agree (68.6%)	Consensus Agree (82.9%)	Consensus
13. Beginner metabolic and bariatric surgeons should do at least 50 MBS procedures/year within the first 2–3 years after starting a career as a bariatric surgeon	Consensus Agree (89.7%)		Consensus
14. Metabolic and bariatric surgeons should possess the skills to effectively manage any complications that may arise during or after the MBS procedure they perform	Consensus Agree (93.1%)		Consensus
15. Beginner metabolic and bariatric surgeons should be knowledgeable in performing revision, conversion, and reversal procedures if necessary although it's better the redo MBS procedures are better to be performed by more experienced surgeons	Consensus Agree (81.6%)		Consensus
16. Beginner metabolic and bariatric surgeons should know endoscopic complications management	Consensus Agree (86.2%)		Consensus
17. Metabolic and bariatric surgeons should be adept at collaborating with a multidisciplinary team to provide comprehensive patient care	Consensus Agree (98.8%)		Consensus
18. Metabolic and bariatric surgeons should hold active membership in reputable organizations such as IFSO or ASMBS	Consensus Agree (91.9%)		Consensus

Table 2 (continued)

Statements	Round 1	Round 2	Final result
19. Metabolic and bariatric surgeons should strive to be members of specialized international societies such as IFSO, ASMBS, or their National Society	Consensus Agree (94.2%)		Consensus
20. Metabolic and bariatric surgeons should diligently record patient' data in their National or Global database registry	Consensus Agree (93.1%)		Consensus
21. Metabolic and bariatric surgeons should collaborate in providing their data to the registry of their national society to facilitate the data collection for the IFSO registry	Consensus Agree (89.7%)		Consensus
22. Metabolic and bariatric surgeons should obtain certification from their National Society or recognized organizations such as IFSO or ASMBS	Consensus Agree (90.8%)		Consensus
23. Metabolic and bariatric surgeons should establish and maintain a systematic follow-up process for each patient they treat, at least for the short to medium term (2 years)	Consensus Agree (88.5%)		Consensus
24. Beginner metabolic and bariatric surgeons should possess knowledge about research methodologies and ethical considerations in the field of MBS and its basic science	Consensus Agree (91.9%)		Consensus
25. Metabolic and bariatric surgeons should actively participate in national and international conferences dedicated to MBS	Consensus Agree (98.8%)		Consensus
26. Metabolic and bariatric surgery fellowship graduates should engage in mentorship programs during their first year after graduation to further enhance their skills and knowledge	Consensus Agree (93.1%)		Consensus
27. Metabolic and bariatric surgeons must record their patient outcomes, morbidity, and mortality rates and annually review them to compare them to national benchmarks	Consensus Agree (95.4%)		Consensus
28. Metabolic/Bariatric fellows should not participate in surgery on high-risk patients because the literature has shown them to have a higher perioperative complication rate	No Consensus Disagree (66.7%)	No Consensus Disagree (53.4%)	No Consensus
29. Fellow or trainee participation in the operating room is not associated with worse early postoperative outcomes following sleeve gastrectomy	Consensus Agree (79.3%)		Consensus
30. Fellow or trainee participation in the operating room is associated with longer operation time	Consensus Agree (93.1%)		Consensus

About 82.9% of participants concurred that the OAGB learning curve could serve as a valuable tool for the RYGB practice learning curve.

About 90% (89.7%) of experts agreed that novice metabolic and bariatric surgeons should aim to perform a minimum of 50 MBS procedures annually during the initial 2–3 years of their career in MBS.

Ninety-three percent of experts felt that metabolic and bariatric surgeons must have the ability to proficiently handle all complications that might occur during or after the MBS procedure they conduct.

A consensus of 81.6% of experts indicated that novice metabolic and bariatric surgeons should have expertise in conducting revision, conversion, and reversal procedures when required, although revision/conversion MBS procedures are preferably carried out by more experienced MBS surgeons.

The consensus among 86.2% of experts was that novice metabolic and bariatric surgeons should know endoscopic complications management.

About 94.2% of professionals reached a consensus that metabolic and bariatric surgeons should aim for membership in specialized international organizations like IFSO, ASMBS, or their National Society.

Approximately 93.1% of experts agreed that MBS surgeons should diligently record patients' data in their National or Global database registry and 89.7% of experts reached a consensus that metabolic and bariatric surgeons should collaborate in providing their data to the registry of their national society to facilitate the data collection for the IFSO registry.

Table 3 Voting experts (in alphabetical order)

Name	Institution	Country
1. Edo Aarts	Weight Works Clinics and Allurion Clinics	Netherlands
2. Syed Imran Abbas	Iranian Hospital	UAE
3. Ahmad Aly	University of Melbourne	Australia
4. Ali Aminian	Cleveland Clinic	USA
5. Luigi Angrisani	Federico II University of Naples	Italy
6. Syed Tanseer Asghar	Capital Hospital	Pakistan
7. Ahmad Bashir	Gastrointestinal Bariatric and Metabolic Center (GBMC)-Jordan Hospital	Jordan
8. Estuardo Behrens	New Life Center	Guatemala
9. Helmuth Billy	Ventura Advanced Surgical Associates	USA
10. Camilo Boza	Clinica Las Condes	Chile
11. Wendy A. Brown	Monash University	Australia
12. Daniel Oscar Caina	Dr. Federico Abete Hospital for Trauma and Emergency	Argentina
13. Miguel A. Carbajo	Centre of Excellence for the Study and Treatment of Obesity and Diabetes	Spain
14. Jean-Marc Chevallier	Université Paris 5	France
15. Sonja Chiappetta	Obesity and Metabolic Surgery Unit, Ospedale Evangelico Betania	Italy
16. Benjamin Clapp	Texas Tech HSC Paul Foster School of Medicine	USA
17. Ricardo V. Cohen	Hospital Alemão Oswaldo Cruz	Brazil
18. Amir Hossein Davarpanah Jazi	Hazrat-E Fatemeh University Hospital	Iran
19. Maurizio De Luca	Rovigo Hospital	Italy
20. Bruno Dilemans	AZ Sint Jan Brugge-Oostende	Belgium
21. Martin Fried	OB Clinic	Czech Republic
22. Michel Gagner	Department of Surgery, Westmount Square Surgical Center	Canada
23. Manoel Galvao Neto	Endovitta Institute	Brazil
24. Pierre Y. Garneau	Université de Montréal	Canada
25. Khaled Gawdat	Ain Shams University	Egypt
26. Omar M Ghanem	Mayo Clinic	USA
27. Mohammed Al Hadad	Bariatric and Metabolic Surgery Centre, Healthpoint	UAE
28. Ashraf Haddad	Gastrointestinal Bariatric and Metabolic Center (GBMC)-Jordan Hospital	Jordan
29. Mohamad Hayssam ElFawal	Makassed General Hospital	Lebanon
30. Miguel F. Herrera	Endocrine and Bariatric Surgery, UNAM at INCMNSZ	Mexico
31. Kelvin Higa	Fresno Heart and Surgical Hospital	USA
32. Jaques Himpens	Bariatric Surgery Unit, Delta Chirec Hospital	Belgium
33. Farah Husain	University of Arizona College of Medicine	USA
34. Kazunori Kasama	Yotsuya Medical Cube	Japan
35. Radwan Kassir	The View Hospital	Qatar
36. Mohammad Kermansaravi	Iran University of Medical Sciences	Iran
37. Mousa Khoursheed	Taiba Hospital	Kuwait
38. Haris Khwaja	Chelsea and Westminster Hospital	UK
39. Lilian Kow	Flinders University of South Australia	Australia
40. Jon A Kristinsson	Oslo University Hospital	Norway
41. Matthew Kroh	Cleveland Clinic	USA
42. Marina S. Kurian	New York University Grossman School of Medicine	USA
43. Muffazal Lakdawala	Sir H.N. Reliance Foundation Hospital	India
44. Teresa LaMasters	UnityPoint Clinic Weight Loss Specialists	USA
45. Wei-Jei Lee	China Medical University Shinchu Hospital	Taiwan
46. Brijesh Madhok	University Hospital of Derby and Burton NHS Foundation Trust	UK
47. Kamal Mahawar	South Tyneside and Sunderland Foundation NHS Trust	UK
48. Tarek Mahdy	Sharjah University	UAE
49. Hazem Almomani	NMC Royal Hospital	UAE
50. John Melissas	Heraklion University Hospital, University of Crete	Greece

Table 3 (continued)

Name	Institution	Country
51. Karl Miller	Diakonissen Wehrle Private Hospital	Austria
52. Mario Musella	Federico II University	Italy
53. Alexander Neimark	Almazov National Medical Research Centre	Russia
54. Abdelrahman Nimeri	Brigham and Women's Hospital, Harvard Medical School	USA
55. Taryel Omarov	Azerbaijan Medical University	Azerbaijan
56. Mariano Palermo	University of Buenos Aires	Argentina
57. Pavlos K. Papasavas	Hartford Hospital	USA
58. Chetan Parmar	Whittington Hospital	UK
59. Abdolreza Pazouki	Iran University of Medical Sciences	Iran
60. Ralph Peterli	Clarunis-University Center for Gastrointestinal and Liver Diseases	Switzerland
61. Tadeja Pintar	Department of Abdominal Surgery and Medical Faculty	Slovenia
62. Luis Poggi	Universidad Nacional Mayor de San Marcos	Peru
63. Jaime Ponce	Bariatric Surgery Program, CHI Memorial Hospital	USA
64. Gerhard Prager	Department of Surgery, Vienna Medical University	Austria
65. Arun Prasad	Indraprastha Apollo Hospitals	India
66. Janey S. A. Pratt	Stanford School of Medicine	USA
67. Almino C. Ramos	Medical Director of Gastro-Obeso-Center, Institute for Metabolic Optimization	Brazil
68. Masoud Rezvani	Inova Fair Oaks Hospital	USA
69. Karl Rheinwalt	St. Franziskus Hospital	Germany
70. Rui Ribeiro	Hospital Lusíadas Amadora e Lisbon	Portugal
71. Elena Ruiz-Ucar	Fuenlabrada University Hospital	Spain
72. Karim Sabry	Ain Shams University	Egypt
73. Bassem Safadi	Aman Hospital	Qatar
74. Asim Shabbir	National University of Singapore	Singapore
75. Shahab ShahabiShahmiri	Iran University of Medical Sciences	Iran
76. Scott A. Shikora	Brigham and Women's Hospital, Harvard Medical School	USA
77. Erik Stenberg	Örebro University	Sweden
78. Michel Suter	Department of Surgery, Riviera-Chablais Hospital	Switzerland
79. Safwan Taha	Bariatric and Metabolic Surgery Center, Mediclinic Hospital Airport Road	UAE
80. Halit Eren Taskin	Istanbul University Cerrahpasa Medical Faculty	Turkey
81. Antonio Torres	Complutense University of Madrid	Spain
82. Sergio Verboonen	Obesity Goodbye Center	Mexico
83. Ramon Vilallonga	Universitary Hospital Vall Hebron	Spain
84. Kelvin Voon	Penang General Hospital	Malaysia
85. Ala Wafa	Misurata University School of Medicine	Libya
86. Cunchuan Wang	The First Affiliated Hospital of Jinan University	China
87. Rudolf Weiner	Bariatric Surgery Unit, Sana Clinic Offenbach	Germany
88. Wah Yang	The First Affiliated Hospital of Jinan University	China
89. Natan Zundel	Department of Surgery, State University of New York, Buffalo	USA

88.5% of professionals agreed on the importance for metabolic and bariatric surgeons to implement and sustain a structured follow-up protocol for every patient they attend to, at least for a short to medium duration (2 years).

The consensus was reached among 93.1% and 95.4% of experts, indicating that MBS fellowship graduates should engage in mentorship programs during their first year after graduation to further enhance their skills and knowledge. They must also record their patient outcomes, morbidity, and mortality rates and annually review them to compare them to national benchmarks.

A consensus of 93.1% of the experts acknowledged that fellow or trainee participation in the operating room correlates with longer operation times. However, 79.3% of experts concurred that such participation does not lead to worse early postoperative outcomes following SG.

Discussion

Metabolic and bariatric surgery (MBS) is performed electively in high-risk patients with the disease of obesity and other obesity-related medical conditions. In addition, obesity is a complex multifactorial disease and surgical treatment should be adapted to the patient's weight, obesity-associated conditions, age, sex, nutritional behavior, and lifestyle. An accurate risk–benefit assessment should always be performed on every patient before MBS [11]. Long-term obesity care, including a realistic treatment goal and follow-up, is key to the success of MBS [12].

Since obesity is increasing worldwide, an increasing number of surgeons will be needed to perform surgery on patients with obesity and treat this chronic disease. Therefore, it is fundamental to have guidelines concerning the criteria for surgeons interested in performing MBS. These guidelines should include knowledge of the surgical procedures and perioperative and long-term risks and complications.

This Modified Delphi approach demonstrated different practices regarding MBS training and underlined the need for creating international agreements regarding educational standards.

Overall, 95% of the participants stated that before getting privileges to perform MBS, surgeons should have a degree in general surgery and have participated in a dedicated fellowship training program that includes specialized education about obesity and MBS. In addition, surgeons should have the basic surgical skills to treat complications that might occur during and after MBS [13]. Furthermore, metabolic and bariatric surgeons should possess the skills to effectively manage any complication that may arise during or after the MBS procedure they perform (Statement 14, consensus 93.1%). On the other hand, general surgeons are often not comfortable managing complications after metabolic and bariatric surgery [14, 15]. Therefore, dedicated fellowships regarding MBS are recommended for all general surgeons interested in performing MBS.

In summary, the participants agreed that specialized education about obesity and MBS should include the mechanisms of metabolic and bariatric surgery, the pathophysiology of obesity, familiarity with the ethical considerations surrounding MBS, the benefits and risks of each MBS procedure, and foundational understanding of the potential short- and long-term MBS implications and complications. It is well known that all patients with severe obesity and especially those with type 2 diabetes should be engaged in a shared decision-making conversation with their patients about the risks and benefits of MBS and procedure selection. Furthermore, they should compare surgical issues with continuing conventional medical and lifestyle treatment, The decision to proceed with MBS should be driven primarily by informed patient preferences [16].

The goal of obesity management should be to improve health and it is of great importance to determine optimal patient-specific treatment strategies, including combinations of lifestyle interventions, obesity management medications, and endoscopic and bariatric surgical procedures, and to ensure equitable access to effective treatments [17]. Therefore, it is of most importance that beginner metabolic and bariatric surgeons should be proficient in performing different standard MBS procedures that are endorsed by both ASMBS and IFSO. 91.9% of experts agreed with this statement.

Surgical training may be fundamental for acquiring the best surgical skills and to reduce perioperative morbidity and mortality [18, 19]. The experts agreed that an operative log of all cases performed during fellowship training should be maintained. In addition, the experts agreed that learning curves depend on the procedures performed. For example, the experts agreed that the learning curve for the SG is between 25 and 50 operations, for the OAGB is between 50 and 75 cases, and for the RYGB is between 75 and 100 cases. Furthermore, the experts agreed that surgeons should become proficient in performing different standard MBS procedures that are endorsed by the ASMBS and IFSO. In the current Young-IFSO statement, young bariatric surgeons (< 45 years of age) stated that they felt comfortable with performing a procedure after a learning curve of fewer than 25 patients [6]. The current literature is more in line with the statements of this Delphi Consensus. Gil et al. analyzed the learning curve of the SG and found that there is an early learning phase of 26 patients followed by an acquisition of skills phase with another 30 patients, and, lastly, a mastery of technique phase after more than 56 patients [20]. Another study by Fantola et al. showed that the mean number of consecutive interventions necessary to reach proficiency in SG was 58 [21]. Musella et al. showed that the safety and efficiency of OAGB were reached with a minimum of 57 operations and that 115 procedures are needed until the operation time reaches a plateau [22].

The learning curve of RYGB is known to be the longest. For example, Doumouras et al. showed that the true learning curve for RYGB is approximately 500 cases [23], while a systematic review indicated that for RYGB, the necessary procedure numbers were 30 to 70 for competency, 70 to 150 for proficiency, and up to 500 for mastery [24].

It is known has been stated that the OAGB learning curve could serve as a valuable tool for reducing the RYGB learning curve as well as reducing the operation time and length of stay without an increase in complications [25]. 82.9% of the experts agreed with this opinion. Furthermore, the experts agreed (92.1%), that currently, there is not enough published literature to suggest a learning curve

for laparoscopic SADI-S, one published study presented a learning curve of 58 cases for the robotic SADI-S [26].

Finally, the experts agreed that a beginner metabolic and bariatric surgeon should perform at least 50 MBS procedures/year within the first 2–3 years after starting a career as a bariatric surgeon and 89.7% of experts agreed with this statement. The statement is in line with the ASMBS standards, which state that a surgeon must have performed at least 125 bariatric operations on his or her own over a lifetime, and at least 50 cases per year [27].

The incidence of revisional and conversional bariatric procedures is rising globally [28]. Hjorth et al. reviewed the Swedish Obese Subjects Study and reported that during a median follow-up of 19 years, 27.8% of the patients underwent first-time revisional surgery after gastric banding and vertical banded gastroplasty [29]. In the future, even more revisional and conversional procedures might be performed after the SG, the RYGB, and the OAGB [30–32]. Therefore, it is important that beginner metabolic and bariatric surgeons should know how to perform revision, conversion, and reversal procedures. However, it might be better if revision/conversion MBS procedures are performed by more experienced surgeons (consensus agreement 81.6%).

Another important threshold when acquiring knowledge in MBS is the endoscopic treatment of obesity and mainly endoscopic complications management. The experts agreed with 86.2%, that beginner metabolic and bariatric surgeons should know endoscopic complications management. Since leakage [33, 34], stenosis [35], and intraluminal bleeding [36] are the main complications in MBS and are typically treated with endoscopy, it is of the highest importance that beginner metabolic and bariatric surgeons can manage these complications less invasively and with actual standards.

Collaborating with a multidisciplinary team (MDT) to provide comprehensive patient care is essential for metabolic and bariatric surgeons and this statement was approved by 98.8% of experts. It has been shown that consultation with MDT is necessary before and after MBS to have optimal results and prevention or management of complications [37]. A multidisciplinary approach to obesity can also enhance the patients' cooperation in lifestyle modification and changing nutritional habits after MBS to reach more durable outcomes [38, 39].

Membership in specialized national and international societies such as IFSO, ASMBS, or National Societies is important for metabolic and bariatric surgeons to actively engage in continuous professional development by actively participating in meetings, workshops, and congresses organized by relevant organizations [40]. This allows them to stay updated with the latest guidelines and instructions about metabolic and bariatric surgical practices. Additionally, maintaining accurate patient records in national or global registries facilitates ongoing functional monitoring. This practice also aids in the aggregation of national and global statistics concerning endorsed MBS procedures and methods sanctioned by esteemed organizations. Such efforts contribute significantly to the accurate estimation of MBS usage worldwide [41], as well as the assessment of their efficacy and safety [42–44]. Ultimately, this assists in establishing more standardized care procedures [45, 46] and high-volume cohort studies [47–49].

Establishing and maintaining a systematic follow-up process for each patient they treat, at least for the short to medium term, are essential for metabolic and bariatric surgeons. The follow-up is necessary to monitor the MBS outcomes including recurrent weight gain and suboptimal initial weight loss and prevention of nutritional complications [50, 51]. Additionally, studies have demonstrated that the patient's commitment to regular follow-up appointments between 2 and 3 years following MBS plays a crucial role in achieving more favorable long-term weight loss outcomes [50, 52].

There is a significant challenge in balancing MBS fellow/trainee education with ensuring patient safety. Previous studies have shown that fellow or trainee involvement in the operating room is correlated with prolonged operation times.[3, 5, 53–55], and this statement was agreed upon by 93% of experts.

Longer operative time does not necessarily lead to worse early postoperative outcomes. 79.3% of experts agreed that fellow or trainee participation in the operating room is not associated with worse early postoperative outcomes following sleeve gastrectomy. Similarly, some studies revealed that fellow or trainee participation does not increase the perioperative adverse events [3, 5, 56, 57] but can increase the readmission rates [3, 58], but few studies showed that their participation can increase the postoperative complications [59, 60].

In contrast to the participation of fellows and trainees in SG procedures and their outcomes, the participation of fellows and trainees in high-risk and complicated metabolic and bariatric surgical procedures may result in increased postoperative complications [3, 53]. However, more than half of experts disagreed with the statement suggesting that "Metabolic/Bariatric fellows should not participate in surgery on high-risk patients because the literature has shown them to have a higher perioperative complication rate," and emphasized the importance of providing fellows and trainees with opportunities to gain experience in more intricate procedures such as revisional and conversional MBS, as well as managing complex patients. Enhancing their education in metabolic and bariatric surgery is considered essential [61]. By doing so, it is believed that complication rates could potentially be reduced, subsequently minimizing malpractice claims in the future [62].

Conclusion

This study aimed to establish guidelines for practicing MBS through expert consensus using a modified Delphi method. The purpose was to define the specific criteria that metabolic and bariatric surgeons should master before being granted privileges to perform MBS. MBS surgeons should have a degree in general surgery and have been enrolled in a dedicated fellowship training program with a structured curriculum. The learning curve of MBS procedures is procedure dependent. MBS surgeons should have the skill to manage complications after procedures they perform, be a part of a multidisciplinary team, plan to follow their patients for at least 2 years, and join national and international societies for MBS.

Data Availability The data that support the findings of this study are available on request from the corresponding authors, [MK, SC].

Declarations

Ethics Approval This article does not contain any studies with human participants or animals performed by any of the authors.

Consent to Participate Informed consent does not apply.

Conflict of Interest The authors declare no competing interests.

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