

# Initial Approach to Childhood Obesity in Spain. A Multisociety Expert Panel Assessment

Ramon Vilallonga<sup>1,2,3</sup> · José Manuel Moreno Villares<sup>4</sup> · Diego Yeste Fernández<sup>4</sup> · Raquel Sánchez Santos<sup>5</sup> · Felipe Casanueva Freijo<sup>6</sup> · Francisco Santolaya Ochando<sup>7</sup> · Nuria Leal Hernando<sup>8</sup> · Albert Lecube Torelló<sup>9</sup> · Luis Antonio Castaño González<sup>10</sup> · Albert Feliu<sup>9</sup> · Gontrand Lopez-Nava<sup>11</sup> · Dolores Frutos<sup>1</sup> · Antonio J. Torres Garcia<sup>1</sup> · Juan Carlos Ruiz de Adana<sup>1</sup>

Published online: 17 October 2016  
© Springer Science+Business Media New York 2016

## Abstract

**Purpose** In recent years, the incidence of childhood obesity in Europe, and Spain in particular, has increased dramatically. Bariatric surgery could play a major role in treating of adolescents with severe obesity. However,

no specific guidelines for bariatric surgery currently exist in Spain.

**Methods** The Board of the Spanish Society for Obesity Surgery and Metabolic Diseases (SECO) proposed a study of childhood obesity by using the Delphi method. This

Represented societies' original names.

1. Sociedad Española de Cirugía de la Obesidad y enfermedades metabólicas (SECO)
2. Asociación Española de Pediatría (AEP)
3. Sociedad Española de Endocrinología y Nutrición (SEEN)
4. Asociación Española de Cirugía (AEC—Sección de obesidad)
5. Sociedad Española para el Estudio de la Obesidad (SEEDO)
6. Sociedad Española de Patología Digestiva (SEPD)
7. Consejo General de la Psicología de España.
8. Sociedad Española de Cirugía Pediátrica (SECP)
9. Sociedad Española de Endocrinología Pediátrica (SEEP)

Represented societies' translated names (translated into English)

1. Spanish Society for Surgery of Obesity (SECO)
2. Spanish Association of Pediatrics (AEP)
3. Society of Endocrinology and Nutrition (SEEN)
4. Spanish Association of Surgery (AEC—Section obesity)
5. Spanish Society for the Study of Obesity (SEEDO)
6. Spanish Society of Digestive Pathology (SEPD)
7. General Council of the Psychology of Spain
8. Society of Pediatric Surgery (SECP)
9. Spanish Society of Pediatric Endocrinology (SEEP)

✉ Ramon Vilallonga  
vilallongapuy@hotmail.com

- 1 SECO Sociedad Española de Cirugía de la Obesidad, Madrid, Spain
- 2 General Surgery Department, Endocrine, Metabolic and Bariatric Unit, Robotic Surgery, Universitat Autònoma de Barcelona, University Hospital Vall d'Hebron, Passeig de la Vall d'Hebron, 119-129 08035 Barcelona, Spain

- 3 Spanish Society for Obesity Surgery. General Secretary, Madrid, Spain
- 4 AEP Asociación Española de Pediatría, Madrid, Spain
- 5 AEC Asociación Española de Cirugía—Sección Obesidad, Madrid, Spain
- 6 SEEDO Sociedad Española para el Estudio de la Obesidad, Madrid, Spain
- 7 Consejo General de Colegios Oficiales de Psicólogos, Madrid, Spain

prospective study involved 60 experts from nine national societies. Each society leader recruited experts from their society in obesity-related fields. Two online questionnaires were taken, and consensus on guidelines for various obesity treatments was reached according to the percentage of answers in favor or against inclusion of a given guideline. Based on these results, preoperative, surgical management and follow-up of childhood obesity management among others were analyzed. **Results** The survey results indicated significant concern among all societies regarding obesity. There was strong consensus with regard to adolescents and obesity, medical treatment, dietary recommendations, environmental and social factors, and goals for adolescents with obesity. Consensus on the use of intragastric balloons and other techniques was not reached. However, biliopancreatic diversion was rejected as a primary treatment, and mandatory psychological/psychiatric assessment was agreed upon. Inclusion criteria accepted were similar to those for adults with the exception of surgery in those with a body mass index <40.

**Conclusions** Spanish obesity-related societies are aware of the societal problem of childhood obesity. Multisociety development of national approaches may arise from consensus-building studies among specialists.

**Keywords** Childhood obesity · Assessment · Consensus · Spain · Management · Bariatric surgery

## Introduction

Obesity is defined as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health is impaired. Today, obesity is a common disease not only in adults but also in young people. The worldwide prevalence of obesity has almost doubled between 1980 and 2008 and has reached pandemic status [1]. In the USA in 2007, 16.4 % of US children were obese and 31.6 % were overweight [2]. Furthermore, obesity has tripled over the last 30 years [3].

Spain currently has one of the highest rates of childhood overweight in Europe. Recent data from the 2008 Spanish growth studies showed that the rate of overweight in the population aged 4–24 years has increased by approximately 10 % over the past 20 years. It is estimated that at present, 20 % of children and young adolescent males and 15 % of adolescent girls and young women are overweight and that a further 5 %

of the population in this age range are obese according to the international criteria defined by Cole in 2000 [4]. The ALADINO study is even more recent and shows alarming numbers of childhood obesity in Spain; among 6–9.9 year olds, 30.8 % are overweight and 16.8 % are obese [5]. Moreover, the problem seems to be self-perpetuating because a significant percentage of adolescents with obesity go on to develop morbid obesity, nonalcoholic fatty liver disease, and other risk factors in adulthood [4, 6–9].

For this reason, and in view of the complexity of the problem of childhood obesity, the Spanish Society for Obesity Surgery (*Sociedad Española de Cirugía de la Obesidad* (SECO)) decided to carry out a study by using the Delphi method to analyze the points of consensus among experts on childhood obesity in Spain.

## Methods

The board of SECO proposed an online study into childhood obesity involving experts from various scientific societies throughout Spain by using the Delphi method. Letters were sent to the following Spanish national societies to select experts to be included in the study. The societies included were the obesity section of the Spanish Association of Surgery, the Spanish Society for the Study of Obesity, the Spanish Society for Pediatric Surgery, the Spanish Society for Endocrinology and Nutrition, the Spanish Society for Digestive Pathology, the Spanish Association of Pediatrics, the Spanish General Council of Psychology, the Spanish Society for Pediatric Endocrinology, and the Spanish Society for Obesity Surgery.

Each society was represented by an expert who, in turn, recommended experts in childhood obesity from that particular society. Experts were considered to be individuals with sufficiently diverse experience and knowledge of childhood obesity to enable them to express relevant judgments. All experts were proposed by the society leader, who recruited experts in obesity-related fields in their society. Some of the participant societies have their own obesity study groups.

The questionnaire was developed in September and October 2013 by a coordinating team of two surgeons and two endocrinology experts who led this work on the subject. Together, they produced a document with a total of 54 items. The questionnaire aimed to cover all aspects of childhood obesity. The first part of the questionnaire consisted of general questions regarding adolescents and obesity, medical treatment, dietary recommendations, and environmental and social factors. The second part of the questionnaire focused on indications and preparation for bariatric surgery in adolescents. There were also questions regarding surgical techniques and follow-up required by these patients.

A standard scale of seven valuation ranges was used for the degree of agreement (Table 1). An anonymous digital

<sup>8</sup> SECP Sociedad Española de Cirugía Pediátrica, Madrid, Spain

<sup>9</sup> SEEN Sociedad Española de Endocrinología y Nutrición, Madrid, Spain

<sup>10</sup> SEEP Sociedad Española de Endocrinología Pediátrica, Madrid, Spain

<sup>11</sup> SEPD Sociedad Española de Patología Digestiva, Madrid, Spain

**Table 1** Levels of agreement adopted for the study, regarding the Delphi methodology

	Levels of agreement						
	Strongly disagree	In disagreement	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
Score	1	2	3	4	5	6	7
Criteria	75 % of responses with equal or less than a score of 3				75 % of responses with scores greater or equal to 5		
Results	Consensus against			No consensus	Consensus in favor		
Rule	Refusal of recommendation			Indication that no consensus has been reached	Acceptance of recommendation		

platform was designed with a personal code that each of them could use to gain access. All administrative tasks were carried out by the technical secretariat of the SECO. The responses were anonymous and could only be accessed in their entirety by the study coordinators and expert coordinators from the various societies. The responses of individual experts could not be accessed.

The study was conducted in two rounds by using the Delphi method. Both rounds were conducted via an online platform through which each expert could answer the questionnaire. The first round was conducted online, and the experts anonymously answered the questionnaire. All data were recorded by a study secretariat and sent to the study coordinators. After the four study coordinators had analyzed the first results, they modified some of the items to make them easier to understand during the second round. The second round was carried out anonymously online. E-mail reminders were sent to all the experts to ensure maximum participation in the process. The final responses were received and analyzed by the expert group.

A team of independent statisticians analyzed the results in terms of percentages. Data were analyzed by using SPSS Statistics, release 21 (IBM Corp., Armonk, NY).

## Results

### Participation

During the selection process, 60 experts were recruited from nine different scientific societies working in the field of childhood obesity. In the first round, 48 experts (80 %) anonymously answered the online questionnaire. In the second round, 42 experts (70 %) completed the questionnaires.

### Questionnaire Content

The questionnaire aimed to cover all aspects of childhood obesity. The first part of the questionnaire consisted of general questions regarding adolescents and obesity, medical

treatment, dietary recommendations, and environmental and social factors. There was consensus on all topics in both rounds (Table 2). In fact, all the experts agreed that the goals of treatment of adolescent obesity are to achieve weight loss with normal growth and to change nutritional habits and lifestyles so as to prevent subsequent weight rebound, with prevention as the mandatory primary treatment.

There was no consensus among the experts on the use of intragastric balloons (IGBs) in adolescents, except that there is a need to maintain strict dietary control and participate in regular exercise after IGB withdrawal (Table 3). Having reached the section on adolescent indications and preparation for bariatric surgery, there were several points of consensus on the indications for surgery (Table 4). Some of these, such as the psychological and psychiatric assessment of adolescents, which most experts agreed should be mandatory, could be considered relevant. There was no consensus among the experts on other issues such as the inclusion criteria bariatric surgery. Likewise, there was no consensus on inclusion criteria for adults or for those with a body mass index (BMI) >35 with serious comorbidities who had previously undergone treatment. When asked to consider the use of laparoscopic adjustable gastric band (LAGB) treatment, the experts agreed only that LAGB was safe but interestingly did not agree that LAGB does not constitute a stomach amputation or that it can result in nutritional deficits (Table 5).

There was no agreement among the experts in the section on surgical techniques except for their rejection of the use of biliopancreatic diversion (BPD) in obese patients (Table 6). In the last section, the experts agreed that adolescents required similar monitoring to adult patients and that this should include family support and food re-education (Table 7).

## Discussion

Obesity is defined as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health is impaired. However, its definition and measurement in

**Table 2** Levels of agreement regarding medical treatment, dietary recommendations, and environment

Medical treatment—dietary recommendations—environment	First	Second
1. Obesity, whose etiology is not well known yet, is being considered a serious chronic disease, which if not corrected is associated with increased and premature morbidity and mortality.	91.6	100
2. Adolescent obesity is a risk factor for the development of endocrine, cardiovascular, orthopedic, respiratory, gastrointestinal, dermatological and neurological complications, certain forms of cancer, and generally a lower life expectancy.	91.6	100
3. The obese adolescent will become an obese adult.	89.5	97.7
4. Obesity is a chronic disease.	87.5	97.7
5. Obesity in adolescence tends to persist into adulthood causing alterations in the metabolism of carbohydrates and on the plasma lipid profile. This favors the development of hypertension, early atherogenesis, and higher risk of metabolic syndrome.	89.5	100
6. The treatment of adolescent obesity is aimed at preventing, controlling, and effectively reducing excess weight, allowing proper growth and development and maintenance in adulthood, which improves their self-esteem and facilitates their social integration.	93.7	97.7
7. The goals of treatment of adolescent obesity are to achieve weight loss with normal growth and create conditions through changes in nutritional habits and lifestyles that prevent subsequent weight recovery conditions.	93.7	97.7
8. The treatment of morbid obesity teenager should be more energetic, intense and aggressive.	79.1	90.9
9. The increase in the rate of child and adolescent obesity in Spain is a serious health problem that requires the involvement of each of the professional and social agents.	91.6	100
10. Drugs and endoscopic techniques such as ball intragastric (BIG) and bariatric surgery should be considered in the therapeutic arsenal in the morbidly obese adolescents.	75	84.0
11. Consider that the best treatment of obesity is prevention from early childhood.	93.7	97.7
12. It must raise awareness among health professionals of the importance and significance of monitoring the growth and weight gain using suitable reference standards from birth to adulthood.	93.7	95.5
13. It must implement the mandatory use of growth curves and weight in all children from birth to adulthood.	85.4	93.1
14. The techniques of behavior modification should be directed toward improving personal self-esteem and self-control regarding food.	91.6	93.1
15. Family involvement is very important, because the child will not follow a healthier diet if other family members are not actively involved.	93.7	95.4
16. It should be recommended practicing programmed physical exercise and perform it regularly.	95.8	95.4
17. Nutritional rehabilitation of obese adolescents and their families is essential and involves designing a varied, appetizing, workable, and adapted diet system to the teenager and his family. Meal programs directed by qualified personnel should include regimes, so the child and his family will be involved in making the diet.	95.8	95.4
18. The diet should be instituted with strict medical supervision, since they are not without risk and should provide all the nutrients needed to meet the growing needs.	89.5	93.1
19. The use of appetite regulator drugs or drugs that increase energy expenditure would not be indicated in childhood or adolescence without knowing their safety in obese adult subjects. Specific studies should be performed in this age group	91.6	86.3
20. One of the most important objectives in the treatment of adolescent obesity is to maintain the weight loss in adulthood.	89.5	93.1
21. Treatment should rest on the principles of implementing measures to promote changes in lifestyle and eating habits of obese children.	95.8	93.1
22. Health professionals should promote regular physical activity and reducing sedentary activities that should be integrated into programs to support the acquisition of this habits over the lifestyles of patients and their closer relatives.	93.7	93.1
23. There is no effective drug treatment for obesity in adolescents	91.6	79.5

children and adolescents of obesity in children and adolescents are controversial because the primary method used to measure it is BMI, which varies according to age, sex, stage of maturity, and type of obesity prevalent in the population. We

decided to use the criteria proposed by Cole in 2000 to define obesity and overweight [10, 11].

However, there is no unanimous agreed method of defining morbid obesity in childhood and adolescence, and some

**Table 3** Levels of agreement regarding intragastric balloons (IGB)

Use of Intragastric Balloon	First	Second
1. The intragastric balloon (IGB) may be used in patients with high or low body mass index because it is associated with few complications. Re-edited question	91.6	100
1b. The intragastric balloon (IGB) may be used in adolescents with severe not morbid obesity because it is a technique that has a low number of complications.		
2. The use of IGB eases to change eating habits and is only an aid more to adopt some changes in habits and lifestyles, necessary for long-term maintenance of weight loss. To ensure the success of this therapy, it is necessary that these patients are subject to a re-education program that are especially aimed at consolidating the achieved weight loss and the healthier lifestyles Re-edited question	91.6	100
2b. The use of IGB facilitates change of eating habits and is only an aid more to adopt some changes in habits and lifestyles, necessary for long-term maintenance of weight loss.		
3. After removal of the IGB, efforts must continue to encourage proper diet and maintain proper physical activity.	89.5	84.0

authors suggest that any child or adolescent with a BMI > 3.5 SD should be considered morbidly obese because at the age of 18, this value is equivalent to the definition of class III obesity in adult populations (BMI ≥ 40). When the corresponding

theoretical weight-to-height ratio for a given age and sex deviates by more than 20 %, the individual is classified as obese, and practical ways are sought to deal with overweight and assess the degree of obesity.

**Table 4** Levels of agreement regarding surgical criteria and preoperative management

Surgical criteria and preparation	First	Second
There is a relative paucity of published data on the application of bariatric surgery in adolescents.	87.5	86.3
Morbidly obese adolescent candidates for bariatric surgery should be evaluated and monitored in pediatric obesity specialist units integrated in tertiary hospitals. The comprehensive treatment of morbid obesity and its associated morbidity requires broad participation in a multidisciplinary team that integrates endocrinologists, nutritionists, psychologists, neurophysiologists, orthopedic surgeons, anesthesiologists, and surgeons experienced in bariatric surgery.	95.8	88.6
The criteria for inclusion of adolescents in bariatric surgery program should be stricter for an adolescent than for an adult.	77.08	75
The inclusion criteria for the practice of bariatric surgery in morbidly obese adolescents should be based on criteria including the morbidly obese adults.	31.2/7/14.5/54.2	27.2/11.3/54.5
There is a variability in the inclusion criteria for teenagers in different countries.	6.2/27.0/64.5	4.5/15.0/72.7
Surgery may arise in those adolescents with a BMI > 50 kg/m <sup>2</sup> or a BMI between 40 and 50 kg/m <sup>2</sup> with serious comorbidities and where changes in lifestyle and/or drug treatment have failed.	79.1	77.2
Surgical option should be considered in adolescents with a BMI > 35 kg/m <sup>2</sup> , with serious comorbidities, which have failed, properly supervised, other alternatives	75	13.6/11.3/68.2
It has to be clear that the obese adolescent has reached a pubertal development in Tanner 4–5 and at least 95 % of adult height based on bone age (14 years for girls and 15 for boys).	79.1	77.2
The surgery is highly recommended when the aim is to reduce comorbidities associated with obesity, such as metabolic syndrome, type 2 diabetes, dyslipidemia, obstructive sleep apnea syndrome, hypertension, severe trauma problems, and psychological and affective disorders.	77.0	75
In adolescents with Prader-Willi syndrome, surgery is contraindicated.	47.9/25/25	40.9/27.2/25
Psychological and psychiatric assessment to adolescents is especially important.	93.75	93.1
All eating disorder behaviors should be ruled out.	91.6	93.1
It should be achieved that the adolescent feels especially involved with the medical team in the resolution of the disease.	93.7	90.9
The adolescent must participate actively in decision-making related to his/her obesity.	93.7	93.1
In the obese teenager, presurgical assessment should include one fibrogastroscopy, an abdominal ultrasound, a full analytical study (to rule out the presence of diseases causing obesity and assess the consequences of obesity), a test of oral tolerance to glucose, and a polysomnography.	77	79.5
In the obese adolescent, a body composition study (DEXA) has to be provided prior to surgery	6.2/14.5/77.0	13.6/29.5/50
The antral biopsy determination of <i>Helicobacter pylori</i> is necessary before surgery.	18.75/25/54.1	9.0/43.2/40.9
The obese teenager needs a period of optimization and presurgery weight loss.	83.3	2.2/20.4/70.4

**Table 5** Levels of agreement regarding laparoscopic adjustable gastric band (LAGB)

Laparoscopic adjustable gastric band	First	Second
1. Laparoscopic adjustable gastric banding (LAGB) is an attractive treatment because it does not amputate an organ and generates nutritional deficits	29.1/12.5/56.25	31.8/18.2/43.2
2. The LAGB can offer acceptable weight loss, an increased quality of life, and resolution of comorbidities.	16.6/12.5/68.75	15.9/18.8/59.0
3. The LAGB generally offers a lower rate of perioperative complications, on the other hand, a higher rate of reoperation.	79.1	75

Given the almost total consensus on general points about obesity and adolescence, medical management, and the importance of family and social support, we can state that exogenous or simple obesity, which is caused by an imbalance between caloric intake and energy expenditure, represents 99 % of obesity cases. Consequently, there is a consensus on the overall need to promote a beneficial social and family environment for patients as the mainstay of their treatment. Obese adolescents need food re-education, integrated exercise, and a regulated environment to improve their prognoses. Better outcomes will not be achieved through the drugs in current use.

There is evidence, consistent with the consensus of the experts, that without proper medical treatment, extremely obese children will continue to suffer from obesity as adults. Overweight adolescents have a 70 % chance of becoming overweight or obese adults [12, 13]. This is a clear area of educational work that modern societies need to promote to reverse the increasing prevalence of obesity.

Obesity is a serious societal issue, and adolescents may face serious health problems between the ages of 40 and 60 [14] and a reduction of between 10 and 20 years of life expectancy. On a physical level, these health problems include an increased risk of cardiovascular disease, hypertension, dyslipidemia, type 2 diabetes mellitus, steatohepatitis, hepatocirrhosis, increased intracranial pressure, pseudotumor cerebri, obstructive sleep apnea, left ventricular hypertrophy, musculoskeletal pain that limits their physical function and quality of life, and atherosclerosis [1, 12, 15–19]. On a psychological level, depression, low self-esteem, little interaction with peers, anxiety, suicide, and serious psychosocial

problems have all been observed [20, 21]. All these comorbidities were understood as important in dealing with obese children and adolescents by all the participant experts.

The failure of medical therapy to manage obesity is probably due to a lack of understanding on the part of and social difficulties surrounding the disease [22]. This makes it impossible to control a patient's weight, which, in turn, leads to the use of more "aggressive" surgical alternatives, such as surgery [23].

The experts in this study shared a lack of confidence in endoscopic IGB treatment. The device is often the source of controversy, not least because its use has resulted in deaths. Its use in patients with high or low BMI has been accepted because it is associated with few complications [24, 25]. A recent report on the effectiveness and safety of the IGB shows an average weight loss and BMI  $14.5 \pm 8.2$  and  $5.3 \pm 2.8$ , respectively [26]. However, the IGB has only demonstrated long-term results with drastic dietary changes and ongoing psychological support, so there is no consensus as to its ability to provide improved results in obese adolescents.

Unlike the many reports regarding the results of bariatric surgery in adults, there is a relative paucity of published data on the application of bariatric surgery in adolescents. Therefore, despite the serious problems related to obesity, surgical treatment of obese adolescents remains a subject of debate [27]. Surgical interventions for treating obesity generally involve changes at multiple levels; for this reason, great care must be taken when treating children and adolescents. A multidisciplinary team treating this disease may assume that surgery will lead to changes in metabolism that could interfere with the development and growth of the adolescent [28].

**Table 6** Questions related to the use of different bariatric surgery

Gastric bypass, BPD-DS, sleeve gastrectomy	First	Second
Biliopancreatic diversion (BPD) despite its good results of excess weight loss and resolution of comorbidities should be abandoned in adolescents by high operative and serious nutritional deficits associated morbidity and mortality.	79.1	75
Gastric bypass Roux-Y (GBP) determines a more intense weight loss, but at the expense of an increased risk of developing metabolic and nutritional alterations that could compromise the nutritional status and adolescent development.	27.0/4.1/62.5	15.9/15.9/61.3
The GBP is a safe and reliable technique as mortality and morbidity in adolescents are very low, similar to adult.	6.5/22.9/64.5	4.5/15.9/72.7
Non "amputation" of the gastric pouch makes the GBP first alternative to the sleeve gastrectomy (SG). SG is being increasingly used, although there are still no medium/long-term data.	20.8/37.5/33.3	22.7/34.1/36.6
	75	75

**Table 7** Levels of agreement regarding follow-up of patients

Patient's follow-up	First	Second
1. It is very important to engage the entire family in monitoring the teenager, to enhance the degree of compliance with dietary behavioral rules following surgery.	89.5	90.9
2. The obese adolescents' analytical monitoring after the intervention should be similar to that of obese adults.	10.4/8.3/72.9	
Re-edited question		
2b. The obese adolescents' analytical monitoring after the intervention should be more intensive than in the obese adult.		77.2

The dramatic increase in the surgical treatment of adolescents (12–18 years) in the USA between 1997 and 2003 forced the American Pediatric Surgical Association and the American Society for Bariatric Surgery to establish protocols for bariatric surgery in adolescents [29–31] (Table 2).

Many other countries have published guidelines for bariatric surgery, and, in general, criteria for inclusion in a bariatric surgery program are more stringent for an adolescent than for an adult. The consensus of the experts in our study was also in favor of more stringent criteria.

Surgery is usually recommended for adolescents with a BMI > 50 or between 40 and 50 with serious comorbidities and where changes in lifestyle and/or drug treatment have failed. Another important requirement is that their pubertal development must have reached stages 4 or 5 on the Tanner scale of 4–5 and attained at least 95 % of their adult height as calculated based on their bone age. However, these conditions should be relative and should be further discussed and analyzed. In fact, and because of the methodology and questions posed to the experts, it could be seen as contradictory that the experts concluded that treatment of childhood obesity should not be delayed but also that all patients must have surpassed puberty according to the Tanner stage. The experts also agreed that it is important to exclude secondary causes of obesity and to conduct a psychiatric and psychological evaluation that enables the adolescent to make the changes in dietary and behavioral habits required for bariatric surgery [30, 31] (Table 3).

The experts did not reach a consensus on the variability of inclusion criteria or on suggestions to extend these criteria with regard to interventions in adolescents with BMI > 35 and comorbidities or Prader-Willi syndrome (Table 3). This lack of consensus is in our view entirely justified by the lack of scientific evidence based on high-quality, long-term data [32–34]. Further expansion of surgery remains a question for future debate.

The LAGB has not yet been approved by the US Food and Drug Administration (FDA) for use in teenagers. However, the LAGB could be a useful treatment because no organs are removed and it generates nutritional deficits. Several studies

have shown acceptable weight loss ranging between 15 and 87 % of body weight. Recent data show a mean 20-kg decrease in the first year, results consistent with previously studies showing reductions in body weight between 25 and 60 % [35–38]. Increases in the quality of life of these patients of 93 % have been reported [39, 40]. Other studies with more than 200 adolescents have also shown good reduction of body weight (37–63 %) over a period of 6 months to 7 years, with no deaths and a complication rate of 6 to 10 % [41, 42]. The AGB can maintain weight loss, ensure good quality of life, and resolve comorbidities. With regard to perioperative outcomes of AGB treatment, the literature shows, on one hand, a lower rate of perioperative complications, and on the other hand, a higher rate of reoperation due to failure in adolescents compared with those undergoing gastric bypass [22, 43, 44].

In fact, there was no consensus among the experts what the indications should be for rejection of this type of intervention. In fact, the US FDA has not approved any gastric band for use in patients under 18 because it has not reviewed the safety and effectiveness of gastric bands in patients of this age. The whole experience questions the alleged improvements regarding comorbidities and quality of life; however, there is consensus that the complication rate is low and that the rate of conversion to other techniques is high, which explains the lack of consensus on its use.

In the specific questions on surgical technique, the experts agreed only on the need to abandon BPD. BPD should be avoided as a surgical option in adolescents because it leads to excessive operative morbidity and severe nutritional deficiencies [45–47].

Consensus was not reached on Roux-en-Y gastric bypass (GBP) or on sleeve gastrectomy (SG), but the preference among experts seems for the more technical SG. However, there has recently been concern regarding long-term follow-up and gastroesophageal reflux disease with SG. In fact, no clear data are available in the literature for these two conditions, and more studies are needed to elucidate the possible effects of this procedure in the general population, as well as in adolescents. SG is a nonreversible procedure, and this has to

be taken into account when deciding its clear indications. SG's advantages such as staged strategy, simple construction, avoidance of internal hernia risk, and a possible staged strategy are often considered among experts, but nonreversibility must also be considered.

Until recently, GBP was the most commonly used surgical technique in adolescents. Compared with purely restrictive procedures, SG is better, but there is an increased risk of developing metabolic and nutritional disorders that may jeopardize the growth and development of adolescents because of weight loss [48, 49]. The largest series published to date shows reductions of 30–93 % of body weight, with the associated comorbidities resolved in almost all cases [35, 39–42, 45, 46, 50–53]. Unlike other operations such as gastric banding, potential complications include anastomotic leak, thromboembolic disease, intestinal obstruction, incisional hernia, symptomatic cholelithiasis, and micronutrient deficiencies, especially in iron, calcium, and vitamin B12. However, it is still a safe and reliable technique because of the very low rates of mortality and morbidity in adolescents (0–0.5 % and 3–7 %, respectively) [46].

SG is increasingly being used, becoming the most widely performed bariatric procedure as of 2015 worldwide, although there are still few publications that analyze medium-term to long-term data. This technique seems attractive because of the low rate of short-term nutritional complications. Preliminary data suggest that significant weight reduction, decreased associated comorbidities, and low morbidity can be achieved, but some caveats remain [1, 54–57]. In a recent paper published in the *New England Journal of Medicine* [58], among patients who had undergone SG 3 years before, mean weight had decreased in 26 %, and 85 % had a 10 % or greater reduction in BMI. Moreover, 100 % of patients with type 2 diabetes, prediabetes, or abnormal kidney function before undergoing SG experienced full remission of their conditions at the 3-year follow-up. Likewise, 55–56 % of patients with elevated blood pressure or dyslipidemia experienced full remission of their conditions at 3 years after SG. In the coming years, new data will be generated, especially in the adult population, to better elucidate the actual long-term results of the SG procedure. Some of the more important papers published at 11-year follow-up found that isolated laparoscopic SG can provide a long-term percentage of excess body mass index loss (%EBMIL) of 62.5 %. However, conversion to another construction was required in 25 % of the cases, resulting in a %EBMIL of 81.7 % [59].

There was clear consensus regarding follow-up, where, regardless of the technique, the experts considered monitoring by the adolescent's family to be very

important. Finally, it was considered very important to improve the degree of compliance with dietary and behavioral changes following the surgery [44] and to encourage adolescents to comply with postoperative dietary supplementation rules [60]. Consequently, bariatric surgery in adolescents is mostly effective and safe [61]. The quality of life in these adolescents increases and should be quantified to support the future use of these procedures at these ages.

The choice of the Delphi method may represent a methodological limitation because it may have limited the number of experts in the study and distorted the proportions of the types of participants. The questions may have been misunderstood by some of the experts when not clearly related to their knowledge area. More directed (provocative) questions could have been considered or rather a consensus meeting. However, we believe that this study can be applied to better inform experts, decision-makers, and all stakeholders on the merits of multidisciplinary management of obesity, including bariatric surgery, when applied to all deserving patients and not limited to only those included by unsupported dogma and misconceptions.

## Conclusion

The increase in the rate of child and adolescent obesity in Spain is a serious health problem that requires the involvement of all members of society. Because of its serious nature, morbid obesity in adolescents requires a stronger, intensive, and aggressive treatment than in adults. In this regard, surgery should occupy a more prominent role given its excellent results with regard to weight loss and ability to correct comorbidities that, when treated during the early stages, are easier to reverse. Results from recent studies indicate the possibility that adolescents may have a greater potential than adults for reversal of the cardiometabolic consequences of obesity [58]. Delay in adopting surgery only prolongs the unnecessary suffering of patients and families.

Surgery should be performed in centers specializing in bariatric surgery and under the supervision of a multidisciplinary team to ensure the strict selection of surgical candidates and adequate short-term and long-term monitoring of these patients. Although there is no consensus on the best surgical intervention, SG is increasingly emerging as the technique of choice for operating on adolescents, and recently, the long-term sustainability of clinically meaningful weight loss and improvements in key health conditions and weight-related quality of life among adolescents has been documented [58].

**Acknowledgments** The authors would like to thank the participants for their time to answer the questionnaires and all the other persons who have collaborated on this project.

### Compliance with Ethical Standards

**Conflict of Interest** None of the authors has any conflict of interest.

**Ethical Approval** This article does not contain any studies with human participants or animals performed by any of the authors. Additional informed consent from all individual participants: does not apply in this article.

**Disclosures for the Societies** The authors would like to mention that although experts have been involved in obtaining the results for this study, the various societies have not approved the manuscript individually. This report is an initial step in the continuing work on this complex topic.

### References

- Pérez RC. Current mapping of obesity. *Nutr Hosp.* 2013;28(Suppl 5):21–31.
- Singh GK, Kogan MD, van Dyck PC. Changes in state-specific childhood obesity and overweight prevalence in the United States from 2003 to 2007. *Arch Pediatr Adolesc Med.* 2010;164:598–607.
- Cheung PC, Cunningham SA, Naryan KM, et al. Childhood obesity incidence in the United States: a systematic review. *Child Obes.* 2016;12(1):1–11.
- Carrascosa A, Fernandez JM, Fernandez C, et al. Estudio transversal español de crecimiento 2008. Parte II: valores de talla, peso e índice de masa corporal desde el nacimiento a la talla adulta. *An Pediatr (Barc).* 2008;68:552–69.
- Estudio de prevalencia de la obesidad infantil. Estudio ALADINO (Alimentación, Actividad física, Desarrollo Infantil y Obesidad). *Rev Pediatr Aten Primaria.* 2011;51:493–5 [http://www.naos.aesan.mspes.es/naos/ficheros/investigacion/Articulo\\_ALADINO.pdf](http://www.naos.aesan.mspes.es/naos/ficheros/investigacion/Articulo_ALADINO.pdf).
- Nobili V, Vajro P, Dezsofi A, et al. Indications and limitations of bariatric intervention in severely obese children and adolescents with and without nonalcoholic steatohepatitis: ESPGHAN hepatology committee position statement. *J Pediatr Gastroenterol Nutr.* 2015 Apr;60(4):550–61.
- Michalsky MP, Inge TH, Simmons M, et al. Cardiovascular risk factors in severely obese adolescents: the teen longitudinal assessment of bariatric surgery (teen-LABS) study. *JAMA Pediatr.* 2015;169(5):438–44.
- Franks PW, Hanson RL, Knowler WC, et al. Childhood obesity, other cardiovascular risk factors, and premature death. *N Engl J Med.* 2010;362:485–93.
- Yeste D, Carrascosa A. Obesity-related metabolic disorders in childhood and adolescence. *An Pediatr (Barc).* 2011;75:135 .e1-9
- Cole TJ, Bellizzi MC, Flegal KM, et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ.* 2000;320:1240–3.
- Calañas-Continente A, Arrizabalaga J, Caixàs A, et al. Grupo de Trabajo sobre Obesidad de la Sociedad Española de Endocrinología y Nutrición. *Med Clin (Barc).* 2010;135:265–73.
- Inge TH. Baseline BMI is a strong predictor of nadir BMI after adolescent gastric bypass. *J Pediatr.* 2010;156:103–8.
- U.S. Department of Health and Human Services. The surgeon general's call to action to prevent and decrease overweight and obesity. *Overweight in Children and Adolescents.* Updated January 2007. [Cited April 2010]. [http://www.surgeongeneral.gov/topics/obesity/calltoaction/fact\\_adolescents.htm](http://www.surgeongeneral.gov/topics/obesity/calltoaction/fact_adolescents.htm)
- Koebnick C, Smith N, Coleman KJ, et al. Prevalence of extreme obesity in a multiethnic cohort of children and adolescents. *J Pediatr.* 2010;157:26–31.
- Skinner AC, Steiner MJ, Henderson FW, et al. Multiple markers of inflammation and weight status: cross-sectional analyses throughout childhood. *Pediatrics.* 2010;125:e801–9.
- Xanthakos SA, Jenkins TM, Kleiner DE, et al. High prevalence of nonalcoholic fatty liver disease in adolescents undergoing bariatric surgery. *Gastroenterology.* 2015;149(3):623–34 e8.
- Bout-Tabaku S, Michalsky MP, Jenkins TM, et al. Musculoskeletal pain, self-reported physical function, and quality of life in the teen-longitudinal assessment of bariatric surgery (teen-LABS) cohort. *JAMA Pediatr.* 2015 Jun;169(6):552–9.
- Speiser PW, Rudolf M, Anhalt H, et al. Consensus statement: childhood obesity. *J Clin Endocrinol Metab.* 2005;90:1871–87.
- Collins J, Qureshi F, Warman J, et al. Initial outcomes of laparoscopic roux-en-Y gastric bypass in morbidly obese adolescents. *Surg Obes Relat Dis.* 2007b;3:147–52.
- Sinha A, Kling S. A review of adolescent obesity: prevalence, etiology, and treatment. *Obes Surg.* 2009;19:113–20.
- Daniels SR, Arnett DK, Eckel RH, et al. Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. *Circulation.* 2005;19(111):1999–2012.
- Jen HC, Rickard DG, Shew SB, et al. Trends and outcomes of adolescent bariatric surgery in California, 2005–2007. *Pediatrics.* 2010;126:e746–53.
- Longitudinal Assessment of Bariatric Surgery (LABS) Consortium, Flum DR, Belle SH, King WC, Wahed AS, Berk P, et al. Perioperative safety in the longitudinal assessment of bariatric surgery. *N Engl J Med.* 2009;361:445–54.
- Vilallonga R, Valverde S, Caubet E. Intestinal occlusion as unusual complication of new intragastric balloon Spatz Adjustable Balloon system for treatment of morbid obesity. *Surg Obes Relat Dis.* 2011 Dec 22.
- Pratt JS, Lenders CM, Dionne EA, et al. Best practice updates for pediatric/adolescent weight loss surgery. *Obesity (Silver Spring).* 2009;17:901–10.
- Mion F, Napoléon B, Roman S, et al. Effects of intragastric balloon on gastric emptying and plasma ghrelin levels in nonmorbid obese patients. *Obes Surg.* 2005;15:510–6.
- Imaz I, Martínez-Cervell C, García-Alvarez EE, et al. Safety and effectiveness of the intragastric balloon for obesity. A Meta-analysis *Obes Surg.* 2008;18:841–6.
- Iqbal CW, Kumar S, Iqbal AD, et al. Perspectives on pediatric bariatric surgery: identifying barriers to referral. *Surg Obes Relat Dis.* 2009;5:88–93.
- Barlow SE. Expert committee and treatment of child and adolescent overweight and obesity: expert committee recommendations regarding the prevention. *Assess, Rep Pediatr.* 2007;120:S164–92.
- Xanthakos SA, Daniels SR, Inge TH. Bariatric surgery in adolescents: an update. *Adolesc Med Clin.* 2006;17:589–612.
- Inge TH, Krebs NF, Garcia VF, et al. Bariatric surgery for severely overweight adolescents: concerns and recommendations. *Pediatrics.* 2004;114:217–23 Review.
- Whitlock EA, O'Connor EP, Williams SB, et al. Effectiveness of weight management programs in children and adolescents. *Evid Rep Technol Assess (Full Rep).* 2008;170:1–308.
- August GP, Caprio S, Fennoy I, et al. Prevention and treatment of pediatric obesity: an endocrine society clinical practice guideline based on expert opinion. *J Clin Endocrinol Metab.* 2008;93:4576–99.
- Scheimann AO, Butler MG, Gourash L, et al. Critical analysis of bariatric procedures in Prader-Willi syndrome. *J Pediatr Gastroenterol Nutr.* 2008;46:80–3.

35. Yitzhak A, Mizrahi S, Avinoach E. Laparoscopic gastric banding in adolescents. *Obes Surg.* 2006;16:1318–22.
36. DeMaria EJ, Pate V, Warthen M, et al. Baseline data from American Society for Metabolic and Bariatric Surgery–Designated bariatric surgery centers of excellence using the bariatric outcomes longitudinal database. *Surg Obes Relat Dis.* 2012;6:347–55.
37. Dolan L, Creighton G, Hopkins, et al. Laparoscopic gastric banding in morbidly obese adolescents. *Obes Surg.* 2003;13:101–4.
38. Fielding GA, Duncombe JE. Laparoscopic adjustable gastric banding in severely obese adolescents. *Surg Obes Relat Dis.* 2005;1:399–405.
39. Silberhumer GR, Miller K, Kriwanek S, et al. Laparoscopic adjustable gastric banding in adolescents: the Austrian experience. *Obes Surg.* 2006;16:1062–7.
40. Angrisani L, Favretti F, Furbetta F, et al. Obese teenagers treated by lap-band system: the Italian experience. *Surgery.* 2005;138:877–81.
41. Horgan S, Holterman MJ, Jacobsen GR, et al. Laparoscopic adjustable gastric banding for the treatment of adolescent morbid obesity in the United States: a safe alternative to gastric bypass. *J Pediatr Surg.* 2005;40:86–90 discussion 90–91.
42. Alqahtani AR, Elahmedi MO. Pediatric bariatric surgery: the clinical pathway. *Obes Surg.* 2015 May;25(5):910–21.
43. Nadler EP, Brotman LM, Miyoshi T, et al. Morbidity in obese adolescents who meet the adult National Institutes of Health criteria for bariatric surgery. *J Pediatr Surg.* 2009;44:1869–76.
44. O'Brien PE, Sawyer SM, Laurie C, et al. Laparoscopic adjustable gastric banding in severely obese adolescents: a randomized trial. *JAMA.* 2010;303:519–26.
45. Papadia FS, Adami GF, Marinari GM, et al. Bariatric surgery in adolescents: a long-term follow-up study. *Surg Obes Relat Dis.* 2007;3:465–8.
46. Buchwald H, Avidor Y, Braunwald E, et al. Bariatric surgery: a systematic review and meta-analysis. *JAMA.* 2004;13(292):1724–37.
47. Aikenhead A, Lobstein T, Knai C. Review of current guidelines on adolescent bariatric surgery. *Clin Obes.* 2011;1:3–11.
48. Paulus GF, de Vaan LE, Verdam FJ, et al. Bariatric surgery in morbidly obese adolescents: a systematic review and meta-analysis. *Obes Surg.* 2015 May;25(5):860–78.
49. Maggard MA, Shugarman LR, Suttorp M, et al. Meta-analysis: surgical treatment of obesity. *Ann Intern Med.* 2005;142:547–59.
50. Barnett SJ, Stanley C, Hanlon M, et al. Long-term follow-up and the role of surgery in adolescents with morbid obesity. *Surg Obes Relat Dis.* 2005;1:394–8.
51. Collins J, Mattar S, Qureshi F, et al. Initial outcomes of laparoscopic roux-en-Y gastric bypass in morbidly obese adolescents. *Surg Obes Relat Dis.* 2007a;3:147–52.
52. Lawson ML, Kirk S, Mitchell T, et al. One-year outcomes of roux-en-Y gastric bypass for morbidly obese adolescents: a multicenter study from the pediatric bariatric study group. *J Pediatr Surg.* 2006;41:137–43 discussion 137–143.
53. Boza C, Viscido G, Salinas J, et al. Laparoscopic sleeve gastrectomy in obese adolescents: results in 51 patients. *Surg Obes Relat Dis.* 2012;8:133–7 discussion 137–9.
54. Pedroso FE, Gander J, Oh PS, et al. Laparoscopic vertical sleeve gastrectomy significantly improves short term weight loss as compared to laparoscopic adjustable gastric band placement in morbidly obese adolescent patients. *J Pediatr Surg.* 2015;50:115–22.
55. Oberbach A, von Bergen M, Blüher S, et al. Combined serum proteomic and metabolomic profiling after laparoscopic sleeve gastrectomy in children and adolescents. *J Laparoendosc Adv Surg Tech A.* 2012;22:184–8.
56. Inge TH, Xanthakos S. Sleeve gastrectomy for childhood morbid obesity: why not? *Obes Surg.* 2010;20:118–20.
57. Alqahtani AR, Antonisamy B, Alamri H, et al. Laparoscopic sleeve gastrectomy in 108 obese children and adolescents aged 5 to 21 years. *Ann Surg.* 2012 Apr 16.
58. Inge TH, Corucoulas AP, Jenkins TM, et al. Weight loss and health status 3 years after bariatric surgery in adolescents. *N Engl J Med.* 2016;374:113–23.
59. Arman GA, Himpens J, Dhaenens J, et al. Long-term (11 + years) outcomes in weight, patient satisfaction, comorbidities, and gastroesophageal reflux treatment after laparoscopic sleeve gastrectomy. *Surg Obes Relat Dis.* 2016 19.
60. Gussinyer S, García-Reyna NI, Carrascosa A, et al. Cambios antropométricos, dietéticos y psicológicos tras la aplicación del programa Niñ@s en movimiento en la obesidad infantil. *Med Clin (Barc).* 2008;131:245–9.
61. Inge TH. Reversal of type 2 diabetes mellitus and improvements in cardiovascular risk factors after surgical weight loss in adolescents. *Pediatrics.* 2009;123:214–22.