Should BMI Be Considered the Most Appropriate Measure to Determine Bariatric/Metabolic Surgery Cutoffs?

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Yes, body mass index (BMI, kg/m²) should be considered an important measure with which to determine the best candidates for bariatric/metabolic surgery. However, should BMI be the only or primary criterion for surgery? Is the BMI cutoff for surgery of 40, or 35 with comorbidities, a clinically meaningful one today? How were these BMI cutoffs from the original 1991 National Institutes of Health (NIH) Consensus Conference [1] derived? Is it time for a new consensus on bariatric/metabolic surgery indications?

The Obesity—Adiposity Paradox

While BMI is an accepted indicator of obesity, it is not a measure of adiposity. BMI, calculated as absolute weight (kg) divided by height (m²), cannot comprehensively evaluate adiposity, a status that incorporates physiologic as well as anatomic parameters and that provides a more complete view of an individual's fat distribution.
measure of a patient’s metabolic condition. Adipose tissue functions as the largest endocrine organ in the body, secreting an array of peptides, sex steroids, and inflammatory markers. Thus, obtaining body height and weight measurements and calculating a BMI does not reveal the extent of an obese patient’s lipotoxicity, and his or her resulting metabolic derangements and their potential medical consequences. It is in our power today to calculate and assess additional risk factors—not to do so creates potential errors in our evaluation of patients for surgical candidacy and can lead to dangerous consequences in both the short and long term.

A broader set of data than provided by BMI is vital to determining the best course of treatment for distinctly different patients, since the aim of bariatric surgery is restoration or approximation of normal, healthy metabolism, as a result in part of weight loss and, certainly, to do no harm. Therefore, measures of the metabolic syndrome in association with body composition, gender, and genetic (not geographic) ethnicity, are warranted to differentiate obese patients, and to aid in evaluating the best surgical candidates.

**Body Composition Differences**

Data suggest that body composition and fat distribution form important indicators of metabolic syndrome. Individuals with more fat content in the body, particularly visceral adiposity, experience heightened sequelae of type 2 diabetes mellitus (T2DM) and metabolic syndrome when compared with individuals with matched BMI but lesser fat content and with visceral adiposity. Therefore, in association with BMI, measurement of waist circumference is additively needed. Also, visceral obesity is more prevalent in certain ethnic groups, and is evident even at lower BMIs accompanied by severe metabolic syndrome. Use of BMI alone as a measure of obesity ignores these patients, exposing them to unchecked advancement of their illnesses and increased risk of death. These individuals, in fact, require more aggressive therapy than medical treatment alone provides, and a sense of urgency in assessing their needs.

**Gender Differences**

BMI does not take into consideration the different body composition of males and females, particularly their different range of waist circumference measurements. Even the definition of ”normal” body fat
percentage varies for males and females. As gender plays a significant role in determining body fat composition, again, BMI, alone, is completely insufficient to the task of measuring obese patients’ metabolic status and candidacy for surgery.

**Ethnic Differences**

Measuring obesity rather than adiposity via BMI also disregards ethnic metabolic differences between patients, as illustrated in Fig. 1. Even in weight- and fat-matched patients, leptin values, for example, appear to be higher and adiponectin levels, lower, in Asian Indians relative to European Caucasians [2]. Asian Indians develop metabolic syndrome and T2DM with the risk of cardiovascular disease at a much lower BMI but higher adiposity than many other ethnic groups. Classification of the obesity of Asian Indians and other ethnicities must incorporate measures of central adiposity.

**Figure 1. Is it all about measurements and BMI? The Ethnicity Paradox**

![Body Fat Comparison]

**Toward a New Consensus**

The 1991 Gastrointestinal Surgery for Severe Obesity National Institutes of Health Consensus Development Conference formed their recommendations for bariatric surgery cutoffs based on the knowledge that risk for morbidity and mortality is proportional to the degree of overweight in BMI ranges from 20 to ≥40. The ≥40 weight category was deemed a level of potential risk sufficiently high so as to judge bariatric surgery an appropriate option for treatment. Data were insufficient at the time for the consensus group to consider differences in the surgical candidacy of obese patients based additively on body habitus, gender, genetic/ethnic predisposition, or the underlying mechanisms of obesity.
Since the 1991 NIH Consensus Conference and Statement, major changes in the practice of bariatric surgery and in the medical approach to obese populations have occurred. The advent of laparoscopic technique, the development of new procedures (e.g., duodenal switch, sleeve gastrectomy), and better understanding of the metabolic and neurogenic mechanisms underlying obesity, T2DM, and the metabolic syndrome as well as those underlying specific surgical procedures (e.g., “diabetes surgery”) have had a transformative impact on the practice of bariatric surgery. Most profoundly, a dramatic global increase in the prevalence of metabolic syndrome, T2DM, and the comorbidities of obesity [3] has focused attention on the urgent need for effective treatments, particularly in the increasingly “diabesogenic” demographic of Asia [4], especially India and China.

These shifts in capability, populations, and knowledge have caused rethinking not only of the nature of bariatric surgery (expanding the term to “metabolic surgery” in 2008 and 2009, with organizational name changes reflective of this broadened perspective in the role of the surgeon and scope of needed research and treatments), but the basis upon which surgery may be offered to patients. Rising T2DM morbidity and mortality at BMIs markedly lower than 35 and in younger patients, has stimulated review and revision of obesity and metabolic syndrome definitions as well as the 1991 NIH bariatric surgery cutoffs. Other consensus bodies have convened and published new and more focused recommendations based on the accumulation of evidence: The Asian Indian Consensus Group, in which I participated as a core faculty member, lowered the BMI for both surgical and medical treatment of Asian Indians to 32.5 with comorbidities, and 25, respectively [4]. The American Diabetes Association (ADA) now indicates visceral adiposity and ethnicity as important factors in T2DM diagnosis [5]. In addition, redefinition of the metabolic syndrome has been undertaken by the International Diabetes Federation (IDF), the World Health Organization (WHO), and the American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI), each of which now mandate waist circumference as a requirement of diagnosis of the metabolic syndrome (Fig. 2) [6–8].
Our group’s pilot study, published in 2009 in *Surgery for Obesity and Related Diseases*, demonstrated significant resolution of T2DM following gastric bypass as well as significant reduction in cardiovascular risk, per the United Kingdom Prospective Diabetes Study (UKPDS) risk calculation engine, in a small subset of Indian patients suffering from uncontrolled T2DM at a BMI <35 [9]. A growing number of similar, recently published studies, demonstrate reduction or significant resolution of T2DM in a subset of patients whose obesity is not classified as “morbid,” or “severe,” and yet, whose risk of morbidity and death often significantly exceeds that of those currently classified by current BMI-based surgery cutoffs as morbidly obese. Broader application of early observational studies depends on their confirmation by additional studies, particularly larger randomized controlled clinical trials.

**Is Treatment Delayed Treatment Denied?**

Severe obesity or morbid obesity can also be defined as the grade of obesity at which it induces chronic life-threatening diseases. By the time the diagnosis of T2DM is made in a high-risk, low-BMI individual, complications have already set in years before: 80% of a patient’s beta cell mass has already been destroyed at the time of diagnosis. If, as in the example in Fig. 3, a moderately obese Asian Indian with a
BMI of 31, uncontrolled T2DM, progressive metabolic syndrome on medical treatment has failed control of the progression of these diseases, should we wait until he/she gradually achieves a BMI of 35 or 40 to offer surgery as a treatment? Data show that many of the Indian patients would not even live to qualify!

With the knowledge we now possess, such a course would seem an abject failure to treat patients in clear medical distress.

**Figure 3. 38 male preoperatively, and 3 months later**

<table>
<thead>
<tr>
<th>UKPDS CVD risk: 33.2% (preoperatively)</th>
<th>UKPDS CVD risk: 5.7% (3 months postoperative)</th>
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<tbody>
<tr>
<td>• BMI 31</td>
<td>• BMI 28</td>
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<tr>
<td>• Waist 102 cm</td>
<td>• Waist 90 cm</td>
</tr>
<tr>
<td>• Diabetes x 7 yrs / on insulin &gt;150 units, +OHA high dose + diet &amp; lifestyle</td>
<td>• Triglycerides 210</td>
</tr>
<tr>
<td>• Triglycerides 766</td>
<td>• Cholesterol 190</td>
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<tr>
<td>• Cholesterol 270</td>
<td>• HbA1c 6.7</td>
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<tr>
<td>• HbA1c 12.5</td>
<td>• Off all medications</td>
</tr>
<tr>
<td>• C-peptide 2.8</td>
<td></td>
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<tr>
<td>• Elder brother DM, with AMI at 42 yrs</td>
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It is my perspective, based on studies published to date, and in my own practice experience, that, at a minimum, the BMI cutoff for metabolic surgery should be lowered to 32, and waist circumference should be incorporated as an indispensable parameter. Additional indications for consideration when treating low-BMI patients with a high degree of adiposity include: body composition, gender, ethnicity, and metabolic markers. An unrecognized and grossly undertreated subset of obese patients awaits our notice and assistance.
References


About the Author

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Dr. Shah is Director of the Laparo-Obeso Centre, a comprehensive treatment institution for obesity and related metabolic diseases, as well as a training center for laparoscopic and bariatric surgery, in Pune, Maharashtra, India. He is also Director of the Department of Laparoscopic and Bariatric Surgery at the Ruby Hall Clinic, Pune. Dr. Shah is a surgical innovator who has conducted numerous hands-on and video courses in laparoscopic and bariatric surgery and has participated as an invited lecturer and faculty member at bariatric surgical meetings on several continents. He is a leader in the emerging area of low-BMI metabolic surgery, particularly as it applies to the Asian Indian experience. Dr. Shah serves on several international surgical steering committees and was the organizer of METASURG 2009: the 2nd International Conference on Bariatric and Metabolic Surgery (Mumbai) and the 1st Symposium on Bariatric Nutrition in India. He is the author of pioneering papers on topics including cardiovascular risk reduction after bypass in low-BMI patients, and the behavior of type 2 diabetes mellitus in obese Indian patients submitted to sleeve gastrectomy. Dr. Shah was recently appointed as a committee member of the IBSRC for the Asian-Pacific region.