A proposed clinical staging system for obesity

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Current classifications of obesity based on body mass index, waist circumference and other anthropometric measures, although useful for population studies, have important limitations when applied to individuals in clinical practice. Thus, these measures do not provide information on presence or extent of comorbidities or functional limitations that would guide decision making in individuals. In this paper we review historical and current classification systems for obesity and propose a new simple clinical and functional staging system that allows clinicians to describe the morbidity and functional limitations associated with excess weight. It is anticipated that this system, when used together with the present anthropometric classification, will provide a simple framework to aid decision making in clinical practice.

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Introduction

Obesity, characterized by the accumulation of excess body fat, is currently present in one-fifth or more of the adult population in most Western societies.1 The term obesity is derived from the Latin, obesus, which in turn is a contraction of two Latin words, ob and edere, meaning to devour and to eat away. In some individuals, the excess fat, in concert with other known and unknown factors, results in an impairment of health with reduced quality of life and increased morbidity and mortality. Known factors that influence health risks associated with obesity include the distribution of fat within the body, particularly within the abdominal region and within organs (ectopic fat), the individual’s genetics, dietary patterns and physical activity.2,3

Despite the fact that increased body fat can have important implications for health and well being, the presence of increased body fat alone does not necessarily imply or reliably predict ill health.4–6 Thus, the current anthropometric classification systems, based on simple clinical measures, such as height, weight or waist circumference (WC), do not accurately reflect the presence or severity of obesity-related health risks, comorbidities or reduced quality of life. Although the term ‘morbid’ is often added as a qualifier to describe severe obesity in cases where the health consequences of excess weight are evident, no clear definition or consistent use of this term exists. The current systems used to classify obesity therefore have limited application for clinicians and researchers alike.

In this paper we first discuss the past and current anthropometric classifications of obesity and highlight some of their limitations. We also propose that the current anthropometric definitions should be complemented by a clinical staging system that would provide a meaningful framework for medical decision-making, clinical research and reimbursement policies.

Historical approaches to classify obesity

Using the search term ‘obesity’ meshed with ‘classification’, ‘categorization’, ‘category’, ‘staging’ and ‘terms’ we searched MEDLINE to identify relevant articles and complemented this by using article bibliographies to identify further papers of potential relevance. Articles were scanned for terms used to describe or qualify different forms of obesity.

Based on this cursory review of the literature, it is evident that previous approaches have used various descriptive, anatomical and etiological systems of definition (Table 1). The descriptive classification terms have been primarily used to identify the most severe cases of obesity. Although some earlier descriptions of obesity used less pejorative synonyms such as stout and corpulent (meaning excessively fat), other terms such as mammoth, monstrous and grotesque clearly
reflect societal stigmatization against the obese individual and, although the stigma remains, these terms have long been abandoned.

In 1970, Scott and Law introduced the term ‘morbid obesity’ to recognize the adverse health consequences of attaining excessive weight. Regarding the health aspects of the definition, they state:

‘When an obese individual attains the gargantuan level of the fat man or fat woman in the circus and maintains this degree of massive obesity for many years, we believe the adjective morbid should be added to emphasize the serious health implications and severe, life-shortening hazards of such grotesque accumulations of fat. The social, economic, psychologic, and psychiatric aspects of massive obesity also have enormous importance for the individual who fits into this unfortunate category.’

They further rather loosely define ‘morbid’ as:

‘...any person whose weight has reached a level two to three or more times his ideal weight and who has maintained this level of obesity for five years or more despite efforts by himself, family, friends, and physicians to bring about effective and sustained reduction of weight to medically acceptable standards.’

The term ‘morbid’ was subsequently introduced into the International Statistical Classification of Diseases (ICD) for coding purposes in 1995 and once again redefined as being ‘at least twice a person’s ideal weight, 100 pounds over the ideal weight, or a body mass index (BMI) greater than 39 kg/m²’. Currently, morbid obesity is still used by the National Library of Medicine, in journals and texts, and is often used synonymously with extreme obesity, clinically severe obesity and class III obesity.

Past systems have also used anatomical terms to characterize different phenotypes of the condition, both at a cellular level (hyperplastic vs hypertrophic types) and based on the gross distribution of body fat depots. The observation by Vague in 1949 that individuals who have an android (upper body) vs a gynoid (lower body) distribution of body fat have an elevated risk of various metabolic disorders has been confirmed by multiple studies and serves as the basis for subclassifying patients by measurement of WC or waist-to-hip ratio.

Etiological classifications of obesity reflect eclectic attempts to identify the numerous origins and pathways for the development of the obesity(ies) and various obesity syndromes. This approach was, albeit inconsistently, also adopted by the ICD 10th Edition for classification of obesity. Although some of these recognized etiologies, such as endocrine- or drug-induced weight gain, have therapeutic implications, others such as ‘simple’ obesity, provide no meaningful reflection of etiology or guide to management.

### Anthropometric classification of obesity

Ideally, quantitative measurement of body fat would be the most direct determinant of obesity. However, there are no current methods that are precise, practical, economical and reliable for general use. Instead, for simplicity, past and present definitions of obesity are based on anthropometric approaches that utilize simple clinical measures such as weight and height to quantify and define obesity.

Before 1985, the Metropolitan Life Insurance Company height–weight tables were used as a reference to determine desirable body weight and define obesity, such that an increase in body weight of 20% or more above ideal body weight constituted an established health hazard. A major shortcoming of this system was that it relied on a select reference population to define ideal weight and was thus not generalizable to a more heterogeneous and diverse population.

At the 1985 National Institutes of Health (NIH) Consensus Development Conference on the Health Implications of Obesity, the Consensus Development Panel recommended that physicians adopt BMI (body weight in kilograms/(height in meters)²) as the measurement standard when evaluating patients for overweight and obesity. BMI,
Table 2  International classification of diseases (ICD-10) obesity terms*

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI, kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
</tr>
<tr>
<td>Normal range</td>
<td>18.5–24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>≥25</td>
</tr>
<tr>
<td>Preobese*</td>
<td>25.0–29.9</td>
</tr>
<tr>
<td>Obese class I</td>
<td>30.0–34.9</td>
</tr>
<tr>
<td>Obese class II</td>
<td>35.0–39.9</td>
</tr>
<tr>
<td>Obese class III</td>
<td>≥40</td>
</tr>
</tbody>
</table>

*aAdapted from reference.20

Table 3  WHO classification of weight status

<table>
<thead>
<tr>
<th>Weight status</th>
<th>Body mass index (BMI), kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
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*In other guidelines that have adopted the WHO classification, the term ‘preobese’ has been replaced by ‘overweight’.27

originally derived as Quetelet’s index, was adopted because it is closely associated with body fatness, avoids the bias of using a select reference population and thus allows for comparison between populations.23 Moreover in population studies, increased BMI is associated both with increased morbidity and mortality, albeit this association takes the form of a J-shaped curve rather than a linear relationship.5,25,26

In 1997, the World Health Organization (WHO) endorsed BMI as the most useful measure of obesity and provided a classification of overweight in adults (Table 3).27 Since then, the WHO BMI cut points for underweight, healthy weight, overweight and obese (classes I–III) have been internationally adopted by clinical guidelines and for population surveys.28–33 The additional anthropometric measurements of WC or waist-to-hip ratio have been recommended because abdominal fat has been shown to provide an independent risk estimate beyond BMI alone.16–19,28 Thus, current guidelines recommend the measurement and recording of both BMI and WC,28,34 albeit with different cut points for different ethnic groups.35,36

Limitations of anthropometric classifications of obesity

The anthropometric classifications of obesity based on BMI and WC are useful in population studies and have played a key role in delineating the marked increase in obesity and its relationship to morbidity and mortality. However, these anthropometric measures have clear limitations when it comes to guiding clinical decisions in individuals. For one, although in population studies BMI and WC are reasonable surrogate measures of body and visceral fat, respectively, they lack sensitivity and specificity when applied to individuals.29 Thus, individuals with the same BMI value can have an almost twofold difference in total body fat, whereas conversely, individuals with the same amount of total body fat can present with a wide range of BMI.40 Similarly, there is a large interindividual variation in the amount of visceral fat present in individuals with the same WC.58 This may, in part, explain the rather flat relationship between anthropometric measures and actual morbidity and mortality found in large epidemiological studies.4,5 Evidence suggesting that several factors including cardiorespiratory fitness may substantially modify the mortality risk associated with a higher BMI,6 further supports the notion that BMI alone is insufficient to guide clinical decision making in individuals.

Another shortcoming of the current anthropometric classification of obesity is that it does not assess the presence of concomitant comorbid conditions or disease risk, factors that according to current recommendations should be routinely taken into consideration when making treatment decisions.27–32 In fact, because the morbidity associated with excess body weight is so dependent on the presence of additional risk factors, measures of body weight have not made it into popular risk engines, including the Framingham risk score.41 Moreover, BMI alone provides no measurement of functionality, quality of life, or other prognostic contextual factors that may further characterize clinical risk and guide clinical management. Finally, given the rather poor correlation between anthropometric measures and health, it must be noted that changes in BMI or WC do not necessarily reflect improvement in overall health or functioning. Thus, in an individual, change in obesity class does not necessarily imply improvement or deterioration in overall health or well being. Conversely, relatively small changes in weight of only 5–10%, although associated with significant health benefits,27 may not be reflected by changes in obesity class.

Thus, the current anthropometric classification neither tells us whether or not a given patient has relevant risk factors, comorbidities or impairments in quality of life and whether or not the patient’s health would indeed improve with obesity treatment. For example, a patient with a BMI of 30 kg/m² who has type 2 diabetes, hypertension and reduced quality of life will generally require more aggressive treatment than a patient with the same BMI who has no concurrent medical problems. Yet both patients have class I obesity and meet the current guideline criteria for provision of lifestyle modification and consideration for pharmacotherapy. Similarly, based on current guidelines, a male with BMI 34 kg/m² who has severe sleep apnea and type 2 diabetes would not qualify for bariatric surgery, whereas an otherwise healthy female with BMI 41 kg/m² would.27
Given these limitations, it is perhaps not surprising that only a minority of physicians actively screen patients for obesity using BMI despite recommendations by the US Preventive Services Task Force and others to do so.42 Additionally, the US Department of Health Services Agency for Healthcare Research and Quality (AHRQ) Put Prevention Into Practice (PPIP) checklist for health recommends that all men and women have their BMI calculated to screen for obesity.43 Although general practitioners can guess BMI categories with reasonable accuracy,44 evidence shows that management strategies are more likely to be initiated when measures of obesity are recorded45–47 and patients who are advised to lose weight by health care professionals are significantly more likely to attempt to do so.47,48

Although multiple factors including lack of reimbursement for treatment, limited time during office visits, lack of training in counseling, competing demands, fear of stigmatization and low confidence in ability to treat and change patient behaviors may further account for the limited use of BMI or WC measures in clinical practice, it may be reasonable to speculate that a perceived lack of utility in making judgments based on these measures alone may also play a role.

Clinical classification systems for other diseases

Multiple disease conditions have adopted classification systems that provide a framework in which health professionals and researchers can record and communicate extent and severity of disease. For example, the tumor, node, metastasis (TNM) classification is widely used in oncology to describe and stage tumors and severity of disease. For example, the tumor, node, metastasis (TNM) classification is widely used in oncology to describe extent and spread of most forms of cancer.49 The New York Heart Association (NYHA) functional classification system, which relates symptoms in patients with congestive heart failure to everyday activities and the patient’s quality of life (class I = mild to class IV = severe), is widely used to describe the extent of heart failure and to determine the best course of therapy.50 Similarly, nephrologists have globally adopted the Kidney Disease Outcomes Quality Initiative (KDOQI) classification of renal failure, which stages patients’ renal function (stage 1 = normal function to stage 5 = endstage) based on estimated or measured glomerular filtration rate.51 Mental health workers routinely report on their patients using the five axes set out in the Diagnostic and Statistical Manual of Mental Disorders fourth revision (DSM-IV-TR),52 each of which refers to a different domain of information that helps the clinician plan treatment and predict outcome. (The five axes are Axis I: all mental disorders except personality disorders and mental retardation; Axis II: personality disorders and mental retardation; Axis III: general medical conditions connected to a mental disorder; Axis IV: psychosocial and environmental problems; Axis V: global assessment of functioning.)

Although these systems are not always simple or easy for the layman to understand, they are clinically useful and provide a standardized framework within which it is possible to describe the extent and impact of disease in a way that facilitates communication between health professionals, clinicians, researchers and payors. Furthermore, systems that reflect severity of disease and presence of comorbidities allow stratification of patients based on risk as well as help in the assignment of treatments and assessment of outcomes, a prerequisite for meaningful clinical trials. Significantly, staging systems provide frameworks that allow formal recognition of disease severity or presence of conditions that would lead to insurance reimbursement. Staging can also be used to measure early detection efforts (eg, to see what impact screening could have on the stage distribution of disease at the time of diagnosis). Finally, such staging systems facilitate the application of clinical practice guidelines, clinical performance measures and quality improvement programs. For example, the widely used NYHA classification of heart failure is highly predictive of cardiovascular rehospitalization, disease progression and mortality in a wide spectrum of ambulatory patients with chronic heart failure.53

In contrast, the current anthropometric definition of obesity provides little guidance to the individual risk and/or burden of disease to guide treatment plans or monitor outcomes.

Proposed functional and disease-related staging for obesity

Although the current anthropometric classifications continue to serve their function as surrogate measures for the magnitude of body fat and its distribution and to assess progress in management, complementing these parameters with a simple disease-related and functional staging system would provide additional clinical information to guide and evaluate treatment. The rationale for a clinical staging system is also based on the notion that patients with current health problems related to obesity should be treated more aggressively and that in the context of limited resources, a staging system must aid in the equitable identification and prioritization of patients, who would most likely benefit from aggressive and resource-intensive weight management.

The proposed staging system (Table 4) would be based on simple clinical assessments that include medical history, clinical and functional assessments as well as simple routine diagnostic investigations that are easily and widely available. Rather than simply categorizing patients based on anthropometric measures, the proposed staging system would provide a measure for presence and severity of risk factors, comorbidities and functional limitations that would serve as a guide to management as illustrated in the following cases.

Case 1

A 24 year-old physically active female with a BMI of 32 kg/m² with no demonstrable risk factors, functional limitations or
Severe (potentially end-stage) disabilities from obesity-related chronic diseases, severe disabling psychopathology, severe functional limitations and/or severe impairment of well being

Presence of established obesity-related chronic disease (e.g., hypertension, type 2 diabetes, sleep apnea, osteoarthritis, reflux disease, polycystic ovary syndrome, anxiety disorder, etc.), moderate limitations in activities of daily living and/or well being

Established end-organ damage such as myocardial infarction, heart failure, diabetic complications, incapacitating osteoarthritis, significant psychopathology, significant functional limitations and/or impairment of well being

Severe (potentially end-stage) disabilities from obesity-related chronic diseases, severe disabling psychopathology, severe functional limitations and/or severe impairment of well being

Identification of factors contributing to increased body weight. Counseling to prevent further weight gain through lifestyle measures including healthy eating and increased physical activity.

Investigation for other (non-weight related) contributors to risk factors. More intense lifestyle interventions, including diet and exercise to prevent further weight gain. Monitoring of risk factors and health status.

Initiation of obesity treatments including considerations of all behavioral, pharmacological and surgical treatment options. Close monitoring and management of comorbidities as indicated.

Aggressive obesity management as deemed feasible. Palliative measures including pain management, occupational therapy and psychosocial support.

Table 4 Proposed clinical and functional staging of obesity

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Management</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>No apparent obesity-related risk factors (e.g., blood pressure, serum lipids, fasting glucose, etc. within normal range), no physical symptoms, no psychopathology, no functional limitations and/or impairment of well being</td>
<td>Identification of factors contributing to increased body weight. Counseling to prevent further weight gain through lifestyle measures including healthy eating and increased physical activity.</td>
</tr>
<tr>
<td>1</td>
<td>Presence of obesity-related subclinical risk factors (e.g., borderline hypertension, impaired fasting glucose, elevated liver enzymes, etc.), mild physical symptoms (e.g., dyspnea on moderate exertion, occasional aches and pains, fatigue, etc.), mild psychopathology, mild functional limitations and/or mild impairment of well being</td>
<td>Investigation for other (non-weight related) contributors to risk factors. More intense lifestyle interventions, including diet and exercise to prevent further weight gain. Monitoring of risk factors and health status.</td>
</tr>
<tr>
<td>2</td>
<td>Presence of established obesity-related chronic disease (e.g., hypertension, type 2 diabetes, sleep apnea, osteoarthritis, reflux disease, polycystic ovary syndrome, anxiety disorder, etc.), moderate limitations in activities of daily living and/or well being</td>
<td>Initiation of obesity treatments including considerations of all behavioral, pharmacological and surgical treatment options. Close monitoring and management of comorbidities as indicated.</td>
</tr>
<tr>
<td>3</td>
<td>Established end-organ damage such as myocardial infarction, heart failure, diabetic complications, incapacitating osteoarthritis, significant psychopathology, significant functional limitations and/or impairment of well being</td>
<td>More intensive obesity treatment including consideration of all behavioral, pharmacological and surgical treatment options. Aggressive management of comorbidities as indicated.</td>
</tr>
<tr>
<td>4</td>
<td>Severe (potentially end-stage) disabilities from obesity-related chronic diseases, severe disabling psychopathology, severe functional limitations and/or severe impairment of well being</td>
<td>Aggressive obesity management as deemed feasible. Palliative measures including pain management, occupational therapy and psychosocial support.</td>
</tr>
</tbody>
</table>

self-esteem issues would have class I, stage 0 obesity. In this patient the focus would be on prevention of further weight gain. Health benefits of more aggressive obesity treatment would likely be marginal.

Case 2
A 32 year-old male with a BMI of 36 kg/m² who also has essential hypertension and obstructive sleep apnea would have class II, stage 2 obesity. This person would have a clear indication for obesity treatment.

Case 3
A 45 year-old female with BMI of 54 kg/m² who is in a wheelchair because of disabling arthritis and severe hypopnea would have class III, stage 4 obesity. This patient will either require aggressive obesity treatment or be deemed palliative. Thus, as illustrated in these cases, complementing the current anthropometric classification system with the proposed staging system, would provide a clear reflection of disease severity and a better measure of indication for treatment than BMI alone.

Limitations of the proposed staging system

Despite potential advantages, the proposed system has some limitations. Firstly, it relies on definitions of risk or comorbid conditions that are themselves subject to change. For example, definitions and cutoffs for hypertension, dyslipidemia or dysglycemia remain in flux. Secondly, clinicians may disagree about whether or not a given risk factor or condition is indeed causally related to or merely aggravated by obesity, and thus whether or not this condition would count toward defining the obesity stage. Thirdly, the proposed system includes subjective parameters such as psychological impact or functional performance where individual patients and clinicians may vary in their judgment of disease severity and thus staging. However, none of these issues are foreign to other classification systems, such as the NYHA classification of heart failure or the DSM-IV assessment of Axis V global functioning that have worked well in clinical practice to describe and monitor disease states.

Another limitation of the proposed staging system is that when used to merely complement the current anthropometric classification system, it fails to capture weight-related complications that may occur at lower body weights than the current BMI cutoffs. Thus, a male presenting with a BMI of 24 kg/m² and a WC of 87 cm, who also has impaired fasting glucose or prehypertension, would not be considered to have stage 1 obesity, because he fails to meet the current anthropometric cutoffs for obesity. Simply stating the BMI level together with the stage rather than using the current cutoffs of overweight and obesity could remedy this shortcoming. This approach would also help overcome the current limitations imposed by varying anthropometric cutoffs for different ethnic populations. Thus, the patient in the above example would have stage 1 obesity, irrespective of whether he is Caucasian or East Asian. Similarly, the proposed staging system would also have utility in children and adolescents.

A final limitation of the proposed system is that, although based on a simple clinical rationale, it would yet have to be studied with regard to its sensitivity, specificity, reliability and utility in clinical practice. Such studies are currently underway at the Alberta Health Services Bariatric Centre in Edmonton, Alberta. Based on this early experience, we feel confident that clinicians and other stakeholders will
welcome and rapidly adopt a system that provides a meaningful framework to guide treatment decisions and measure outcomes in individuals rather than in populations.

Conclusion

In this paper we have described past and current anthropometric systems of obesity classification and have discussed their limitations in clinical practice. We propose complementing the existing system using a simple staging framework that provides an indication of obesity-related disease extent and severity. The proposed staging system not only has the potential to enhance clinical decision making but also could serve as a useful tool for researchers, payers and policy makers to better define the impact of excess body fat on health and well being.

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