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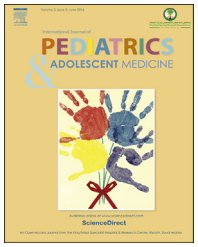

REVIEW ARTICLE

Assessment and preparation of obese adolescents for bariatric surgery

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Abstract Obesity is generally considered an adult disease, although there has been a constant increase in the prevalence of overweight and obese children in the last few decades. Childhood obesity is not limited to developed countries, with increasing numbers being reported from developing countries as well as from Saudi Arabia. Young populations with obesity suffer from similar comorbidities as obese adults, including type 2 diabetes mellitus, dyslipidemia, obstructive sleep apnea, polycystic ovarian syndrome, pseudotumor cerebri, and fatty liver disease. Recent advances in weight loss surgery have given hope to obese adolescents who are refractory to lifestyle changes and low-calorie diet plans. This review emphasizes a holistic approach for obese adolescents and describes in detail a multidisciplinary team and their role in adolescent bariatric surgery. There are unique medical, psychological, and nutritional requirements during the pre-operative, immediate post-operative, and long-term phases to achieve a desirable outcome. Identification of an appropriate candidate for bariatric surgery is critical and must balance the risks and benefits of weight loss surgery. Different surgical procedures are available and should be tailored to the needs of the patient and the expertise of the surgeon.

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1. Introduction

The prevalence of obesity has been rising in children and adolescents in recent decades, and a sustained increase in severe obesity has been observed at a young age. Nearly 2% of children and adolescents are morbidly obese in the United States [1]. Young age obesity is multifactorial and can result due to genetic, environmental and social factors, and energy imbalance [2]. Weight reduction plans with lifestyle changes including a healthy and low-calorie diet, exercise and specific counseling for pediatric obese patients has modest results with minimal sustainability [3,4]. Obesity-related comorbidities were once only considered to be associated with the adult obese population, but the adolescent obese population has exhibited an increase in the occurrence of type 2 diabetes mellitus, dyslipidemia, obstructive sleep apnea, polycystic ovarian syndrome, pseudotumor cerebri, and fatty liver disease [5]. In addition to medical comorbidities, youths with obesity are also at risk for psychiatric disorders such as depression, anxiety, and low self-esteem [6], and the probability of becoming an obese adult is much higher for obese children than for normal weight children. A body mass index (BMI) above the 99th percentile in children is strongly linked to a BMI above 30 kg/m^2 as an adult [7]. Comorbidities and mortality are higher in adults who were obese adolescents compared to those who become obese as adults [8]. These factors have resulted in increased bariatric surgery in adolescents [9].

2. Epidemiology and definitions

The most common way to measure the body fat is to calculate the body mass index (BMI) because direct measurement of fat is difficult. BMI is not always a true measure of body fat, as athletes with significant muscle mass can have high BMIs but a very low body weight fat percentage. However, body fat content can be reliably predicted with BMI in children and adolescents [10]. Adult BMI classifies a body fat content of 25 kg/m^2 and above as overweight; 30 kg/m^2 and above as obese; 40 kg/m^2 and above as morbidly obese; and 50 kg/m^2 and above as super obese [11]. The Centers for Disease Control and Prevention provide BMI centile charts accounting for age, gender, and growth pattern. Children with BMI growth curves between 85th—94th percentiles are defined as overweight, and those in or above the 95th percentile are obese [11]. More severe obese adolescents are defined by an expert committee of the American Academy of Pediatrics, which states a BMI of 30—32 for 10—12 year old and a BMI of 34 for 14—16 year old as the 99th percentile, and any value above the 99th is defined as extreme obesity [12].

The global prevalence of childhood obesity was estimated in 2010, and 43 million children (35 million in developing countries) were estimated to be overweight and obese, with 92 million at risk of being overweight [13]. The National Health and Nutrition Examination Survey reported US data from 2009 to 2010 stating 31.8% of children age 2—19 had BMI above 85th percentile, 16.9% were above the 95th percentile, and 12.3% were above the 97th percentile [14].

The prevalence of childhood obesity in Saudi Arabia has been increasing in the last 2 decades, and the reported prevalence falls between that of developed and developing countries. A cross sectional national epidemiological survey of 12,701 children (boys 6281; girls 6420) was published in 2002, which reported that 10.7% of boys and 12.7% of girls were overweight, and 6.0% of boys and 6.74% of girls were obese [15]. One study published in 2007 compared the two data sets from 1988 to 2005 to analyze the trend of body fat and obesity in primary school boys [16]. A significant rise in body mass index (16.5 $\pm$ 2.1 to 18.0 $\pm$ 4.0 kg/m^2; $P < .005$) was observed over this period. Another study in 2005 examined the frequency of overweight, obesity and severe obesity in Saudi children aged 5—18 [17] using the World Health Organization (WHO) 2007 reference to define overweight, obese, and severely obese children. There were 19,317 healthy children, of which 50.8% were boys. The prevalence of overweight, obesity, and severe obesity in different age groups was 23.1%, 9.3% and 2%, respectively.

3. Comorbid conditions with obesity

There is increasing evidence that pediatric obesity is associated with substantial medical and psychological comorbidity, similar to adults.

Type 2 diabetes mellitus (T2DM): Type 2 diabetes mellitus is linked to obesity, and as the prevalence of obesity rises, the incidence of type 2 diabetes mellitus has also increased in pediatric populations [18]. Children with T2DM are at higher risk for developing obesity-related problems early in life, including hypertension, dyslipidemia, fatty liver disease, and atherosclerosis [19].

Obstructive sleep apnea: Sleep disorders with symptoms of snoring, hypopnea, and apnea are highly associated with childhood obesity. Obstructive sleep apnea can cause variable degrees of fatigue, poor academic performance, hypertension, and ventricular dysfunction [20].

Non-alcoholic steatohepatitis: The incidence of non-alcoholic fatty liver disease is much higher in obese children compared to lean children. Of obese children, 38% exhibit steatosis compared to 5% of lean children, and non-alcoholic steatohepatitis is seen 9% in obese children and 1% of lean children [21].

Metabolic syndrome: Metabolic syndrome, including high waist circumference, dyslipidemia, hyperinsulinism, elevated inflammatory markers, and the presence of hypertension with ventricular hypertrophy has been reported in young obese adults. These factors are strong predictors of long-term cardiovascular morbidity [22].

Benign intracranial hypertension: Benign intracranial hypertension or pseudotumor cerebri is associated with high intracranial pressure without a mass lesion, has been associated with obesity and is resolved with weight loss management [23].

Quality of life: Obesity in adolescents has significant negative impact on quality of life with psychological