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Mini-Symposium: Obesity and the Respiratory system

Bariatric Surgery for Severely Obese Adolescents

Dominic A. Fitzgerald [1,2,*], Louise Baur [2,3]

[1] Department of Respiratory Medicine, The Children's Hospital at Westmead, Sydney, NSW, Australia
[2] Sydney Medical School, Discipline of Paediatrics & Child Health, University of Sydney, Sydney, NSW, Australia
[3] Weight Management Services, The Children's Hospital at Westmead, Sydney, NSW, Australia

EDUCATIONAL AIMS

The reader will come to appreciate:

- The numbers of severely obese teenagers are increasing and many of these people will suffer multiple lifestyle impacting co-morbidities including Type 2 diabetes mellitus, hypertension, obstructive sleep apnoea and arthritis.
- Severe obesity in the teenage years is associated with premature cardiovascular disease unless significant weight reduction occurs.
- Bariatric surgery is suited to mature, severely obese adolescents who have been unable to achieve significant weight reduction with medical and lifestyle interventions.
- Bariatric surgery should be provided in the setting of a multi-disciplinary weight management service with ongoing follow-up into the adult years.

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SUMMARY

Severe obesity is increasing in adolescents and is associated with cardiovascular disease, type 2 diabetes mellitus, obstructive sleep apnoea, polycystic ovarian syndrome and a range of musculoskeletal problems. Premature death is the inevitable outcome of persistent severe obesity in adolescents. In adults with severe obesity, medical and lifestyle interventions have been shown to be expensive and less effective in terms of weight loss than has bariatric surgery. The single completed randomised controlled trial in adolescents shows the same outcome. This is supported by meta analyses of bariatric surgery in adolescent subjects. A more aggressive approach to severe obesity, utilising bariatric surgery in selected cases, within the context of a multi-disciplinary team, is required.

The scale of the problem of obesity in society has outflanked medical service provision. Despite clear evidence of the changing physical demographics in developed and developing populations, governments and health systems have been unable to respond effectively to the problems associated with severe obesity. The health care cost of obesity was estimated in the United States alone to be $US147 billion in 2009 [1] or between 5% and 10% of the US health care budget by another estimation. [2]. The astounding costs merely reflect that obesity is entrenched in our societies and forebodes ominously of increased costs unless systematic measures are undertaken.

INCREASING OBESITY IS A GLOBAL PHENOMENON

Comparisons have shown that in the United States, United Kingdom and Australia, the prevalence of obesity in adults has doubled in the last 25 years, whilst the prevalence in Europe ranges between 40% and 60% [3]. In children, the proportion of obese children is increasing and the greatest increase is in those with the highest body mass index [BMI]. In the United Kingdom, the proportion of 11-15 years old with obesity was 14.7% in 1995 and this increased to 18.3% in 2010 [4]. In the United States, the National Health and Nutrition Examination Survey data from 2009-2010 revealed that 31.8% of children aged 2 to 19 years were overweight [BMI $\geq$ 85%] and 16.9% were obese [BMI $\geq$ 95%] [5]. Other data have shown that 84% of obese children will become obese adults [6] and 37% of obese male adolescents and 51% of obese female adolescents will become severely obese by their 30s

* Corresponding author. Department of Respiratory Medicine, The Children's Hospital at Westmead, Locked Bag 4001, Westmead, NSW, Australia 2145
Tel.: +61 2 9845 3397; fax: +61 2 9845 3396.
E-mail address: Dominic.fitzgerald@health.nsw.gov.au (D.A. Fitzgerald).

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[7].Consequently, obesity represents one of the greatest health concerns in the developed world, but its prevalence is also increasing in the developing world. Given the world's population distribution, obesity and severe obesity and their consequences appear to be one of the major threats to global healthcare in an era with improved infectious disease prevention through vaccination and treatment [eg HIV and TB] as well as improving childbirth mortality figures.

CONSEQUENCES OF OBESITY

The short to medium term consequences of obesity in children and adolescents are well established. These include insulin resistance and type 2 diabetes mellitus, hypertension, acanthosis nigricans, obstructive sleep apnoea, fatty liver disease, polycystic ovary syndrome and degenerative joint disease [8–10]. The longer term outlook is similarly guarded, with increased risks of premature death from cardiovascular events and malignancies, including bowel cancer [8,11]. The increased risk of premature death has been estimated to decrease the life expectancy of an obese adolescent by between 5 and 20 years, depending on race and gender [12]. The added burden of psychological stresses including bullying, isolation and discrimination, are pervasive [8].

OVERVIEW OF TREATMENT OF OBESITY

Systematic reviews of paediatric obesity show that behavioural lifestyle interventions can lead to positive, albeit relatively moderate, outcomes in weight, BMI, other measures of body fatness and cardio-metabolic risk factors [13,14]. While no one treatment programme can be recommended, the key elements of obesity treatment are well-established [13,14]: treatment of co-morbidities; family engagement; a developmentally appropriate approach; long-term behaviour change; dietary change; increased physical activity; decreased sedentary behaviours; improved sleep pattern and duration; long-term weight maintenance strategies; and consideration of the use of pharmacotherapy and other forms of nonconventional therapy. However, there can be major challenges in service provision, including inadequate clinic staffing, the need to treat patients with a range of medical and psychological co-morbidities, and the impact of social disadvantage on engagement in treatment plans. A further concern is that, for severely obese patients, particularly adolescents, medical management alone may be inadequate. In this situation, the option of bariatric surgery warrants consideration.

The magnitude of the problem has led to the establishment of weight management services in some large paediatric teaching hospitals in the developed world. Through these multi-disciplinary services a number of strategies are employed aimed at increasing physical activity, reducing caloric intake and the consideration of pharmacotherapies [3]. The success of such resource intense programmes may be slow and modest in terms of weight loss achieved, psychological benefits and impact upon the progression of underlying co-morbidities when compared to bariatric surgery. The reasons for the relative lack of traction with severely obese adolescents in weight management services are likely multi-factorial, involving lack of motivation, psycho-social problems within the family unit, socio-economic deprivation and mood issues [3].

The focus of care in severely obese adolescents [BMI $>$ 40 kg/m^2], and especially those with co-morbidities, who have failed to achieve significant improvements with an appropriate trial of medical therapy is consideration of surgery. Such an escalation of treatment must consider the cognitive competence of the adolescent, their physical maturity, their adherence with therapy to date and their continued engagement with the multi-disciplinary weight management services into their adult years [15].

This has prompted paediatric clinicians to follow their adult medicine colleagues in broadening treatment options in severely obese patients to consider bariatric surgery.

There is no universal agreement upon the minimum age or the degree of obesity threshold for consideration of bariatric surgery in adolescents. However, there are appropriate concerns regarding understanding of the procedure and its longer term consequences, cognition, intellectual competence and the ability to meet standards for informed consent. This has resulted in specialist groups combining to provide recommendations for bariatric surgery in severely obese adolescents. One recent joint recommendation from the Australian and New Zealand Association of Paediatric Surgeons, the Obesity Surgery Society of Australia and New Zealand, and the Paediatrics & Child Health Division of The Royal Australasian College of Physicians was published in 2010 [16]. This working party suggested that the threshold for bariatric surgical intervention would be a body mass index (BMI) $>$40 kg/m^2. However, the recommendation was extended to include adolescents with a BMI $>$35 kg/m^2 in the presence of severe obesity-associated complications such as type 2 diabetes, hypertension, non-alcoholic steatohepatitis, benign intracranial hypertension or obstructive sleep apnoea. Additional considerations about intellectual competence are summarised in Table 1 and contra-indications for bariatric surgery from the same consensus statement are listed in Table 2 [16].

TYPES OF BARIATRIC SURGERY

There are four types of bariatric surgery which are usually performed laparoscopically. These include gastric bypass surgery with a Roux-en-Y procedure [RYGB], adjustable gastric banding [AGB], sleeve gastrectomy [SG] and bilio-pancreatic diversion [BPD]. In obese adolescents, both the RYGB and AGB have been the techniques most commonly used [17]. The RYGB involves the creation of a 30 ml pouch of upper stomach that is anastomosed to the dissected jejunum which results in food bypassing the rest of the stomach and proximal small bowel which is re-connected to the jejunum, thereby creating a "Y' shape [18]. This allows biliopancreatic secretions to mix with food and facilitate absorption [17]. The AGB procedure is simpler and therefore easier to undertake [17,19]. It involves the positioning of a band around the proximal stomach, approximately 1-2 cm from the gastro-oesophageal junction to form a gastric pouch of approximately 30 ml volume [19]. The sleeve gastrectomy operation involves the resection of the greater curvature of the stomach which leaves a tubular stomach of less than 15% of its original volume [20]. The final operation is the biliopancreatic diversion which incorporates components of both the SG and RYGB [17]. The exact mechanisms

Table 1
Patient criteria for selection for bariatric surgery in adolescents with severe obesity.

- Age 15 years, although surgery may be considered in exceptional circumstances at age 14 years
- Tanner stage 4 or 5 pubertal development
- Attainment of final or near-final adult height (i.e. bone age $\geq$13.5 in females and $\geq$15.5 in males)
- Persistence of the level of obesity despite involvement in a formal multidisciplinary and supervised program of lifestyle modification and pharmacotherapy. A minimum of 6 months of supervised multidisciplinary therapy should be provided prior to bariatric surgery being performed
- The adolescent and family understand, and are motivated to participate in the on-going treatment, lifestyle change and review following surgery
- The adolescent is able to provide informed consent for the surgery