

APPROACH TO A CASE OF CHILDHOOD OBESITY

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Abstract: Prevalence of obesity is rapidly increasing in children and adolescents all over the world, mainly due to life style factors. This is particularly crucial in South East Asia, as population here tends to have a higher percentage of body fat, greater tendency for hyperinsulinemia for same weight, abdominal obesity and complications related to it. An obese child is twice as likely to become an obese adolescent, who in turn is 6-7 times more likely to become an obese adult. Childhood obesity is defined in as more than 20% of ideal body weight, while in adolescents adult criteria are applicable. Over 98% of obese children presenting to a pediatrician are likely to have exogenous or simple obesity i.e. caused by imbalance of energy intake and expenditure, which are easily managed and future obesity is prevented by promoting healthy life style. Less than 2% of children will have a pathological or endogenous basis for the weight gain, the most frequent being endocrinal cause. An easy way to differentiate between pathological or endogenous obesity from exogenous obesity is the height of the child which tends to be short in case of pathological obesity. Clinicians need to develop awareness and treat childhood obesity in time to prevent future epidemic of obesity in adults. These patients can be managed by simple application of dietary measures, exercise, behavioral modification techniques and social support. Drug therapy and surgery are infrequently advised in childhood. Prevention of weight gain is of utmost importance as timely input from clinician can help prevent much morbidity and unhappiness.

INTRODUCTION

Obesity is rapidly increasing in prevalence in childhood and adolescence in almost all parts of the world, mainly due to lifestyle factors. It is gaining more medical attention, because obesity and its consequent hypertension¹, dyslipidemia, diabetes, polycystic ovarian syndrome (PCOS) and sleep apnea frequently persist into adulthood. The obese child is twice as likely to become an obese adolescent², who in turn is 6-7 times as likely to become an obese adult. Obesity can impair mobility, interfere with daily living activities, reduce academic performance and self esteem. It also increases the risk in later life of osteoarthritis, coronary heart disease, gall bladder disease, gout, certain malignancies, and possible worsening of asthma and renal disease. Therefore the pediatrician must be alert not only to current but also future morbidity in the obese child. Because recurrence of weight gain is so common, the pediatrician needs to try strenuously to prevent obesity by identifying children at risk (small for dates, obese parent/s, urban, single or older parent families, poor lifestyle, predisposing condition e.g. steroid therapy, etc) and advocating a healthy lifestyle in them. This is especially crucial for us in South Asia, as we tend to have a higher percentage of body fat and greater tendency for hyperinsulinemia for the same weight, with more adverse body fat patterning including abdominal adiposity³. Children with low birth weight are most at risk for diabetes if they become obese later in life⁴. Fat children also tend to be teased and/ or dismissed as clumsy, lazy, stupid, or worthless. Fortunately, even a modest weight loss of 10-20% results in significant metabolic improvement.

CLINICAL PRESENTATION

Ideally each child should have height and weight monitored regularly and the pediatrician should alert parents if the weight starts crossing percentile lines upwards. Parents may bring the child if they (or the school) are concerned about rapid weight gain, awkward appearance, lethargy and drop in school

performance, breathlessness on exertion, snoring or poor sleep, darkening of skin folds (acanthosis nigricans: AN), "small genital size" or prominent breasts (in boys) or "early breast development" (in girls), intertriginous infections or slipped capital femoral epiphyses.

DEFINING OBESITY

Usually just a look at the child is enough to diagnose obesity! However, careful auxology is needed to decide how to proceed further. The child's height, weight, abdominal and hip circumferences are measured, and the weight-for-height, waist-hip ratio (WHR), and BMI [weight in kg/ (height in m)²] calculated⁵. If facilities are available, body fat and skinfold thickness can be measured⁶. Mid-parental height (MPH) is calculated and plotted on the growth curve. The child is overweight if she is up to 20% more than ideal body weight (IBW), and obese if > 20% above IBW. The Center for Disease Control (CDC) 2000 charts can be downloaded, and have age wise values and percentiles for BMI. In older adolescents, adult definitions apply: overweight if BMI > 25 kg/m², obesity if BMI > 27 kg/m², morbid obesity if BMI > 40, and super-obesity if BMI > 60. Care must be taken not to over-rely on simple weight measurements or BMI, as they do not distinguish muscle mass from fat mass. In case of doubt, actual measurement of fat mass using the impedance method may be needed. CT, MRI, ultrasound and DXA do quantitate fat tissue accurately, but are too cumbersome and expensive for routine clinical practice. WHR, an independent predictor of insulin resistance, is useful for follow-up.

CAUSES

Body weight is controlled by the balance of energy intake and expenditure, which respond to several inter-linked signals from the gastrointestinal, endocrine, and nervous systems. The rapidly increasing incidence of obesity points to environmental causation. Several factors contribute. For example, TV watching correlates with weight gain, by promoting both inactivity and increased calorie intake (directly, and indirectly through advertisements of food products). Predominant breast feeding for the first 6 months of life and high levels of physical

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activity reduce obesity⁷. Even a small sustained excess in energy intake leads to significant weight gain, e.g. a single order of French fries (450 calories) daily would result in a weight gain of 1.5 kg per month! The fetus exposed to overnutrition in utero (e.g. the infant of the diabetic mother) and born large for date is predisposed to obesity later, while babies born small for date have the highest risk of obesity and metabolic syndrome if they become obese⁴. Over 98% of obese children presenting to a pediatrician are likely to have exogenous or "simple" obesity, i.e. that caused by an imbalance of energy intake and expenditure. The exact mechanisms are unclear, but both genetic influences (shown by several studies on adopted children and twins) and environmental factors (differences in food choices, levels of physical activity, attitudes to food, activity, body image, etc) are equally important. Therefore obesity runs in families, who share both genes and environment, and parental obesity is a strong risk factor. Health care personnel, by encouraging a healthy lifestyle, especially in those at high risk, can reduce the incidence and extent of obesity and its comorbidities.

Less than 2% children will have a pathologic basis for the weight gain, the most frequent being hypothyroidism and Cushing syndrome. Rare single gene disorders result in obesity and dysmorphia: Prader-Willi (15q11-q12), Lawrence Moon Beidl (16q21, 15q22-q23), Carpenter (unknown), Cohen (8q22-q23), Beckwith Weidmann (11p15.5), Alstrom (2p14-p13), nesidioblastosis (11p15.1), pseudohypoparathyroidism type IA (20q13.2), leptin deficiency (7p31.1) and leptin receptor abnormalities (1p31-p32). Other disorders include growth hormone deficiency (GHD), hypothalamic disorders (some syndromes mentioned, tumors like craniopharyngioma, infections; trauma), and actual hypogonadism (e.g. Turner or Klinefelter syndrome).

ENDOCRINE CHANGES IN OBESITY

While endocrine causes of obesity are rare, it has several endocrine consequences. These include higher levels of growth hormone, with faster height gain; somewhat raised basal cortisol (which is easily suppressible); lower serum levels of T3 and T4 with normal levels of TSH; early onset of puberty or pubarche, especially in girls, and PCOS; and hyperinsulinemia with increasing incidence of type 2 diabetes (T2DM), more so in those with positive family history. The incidence of T2DM peaks around puberty, which is known to be an insulin resistant state. T2DM is particularly worrying because the chronic complications are the same as in adults, but appear earlier with pediatric onset⁸, this increasing societal disease burden many-fold.

CLINICAL EVALUATION

The most important clinical feature which distinguishes pathological or endogenous from exogenous obesity is the height. Children with pathological states are short, while those with endogenous obesity tend to be taller than expected for age and genetic background. See what percentile the child's height falls on, vis-à-vis age and MPH: if the child is tall, the problem is likely to be exogenous. If the child is inappropriately short, pathological causes should be looked for.

History should include details of diet (including total fat intake in cooking, fat content in milk, frequency of snacks and of

eating out), activity patterns and duration of TV viewing, mental development and school performance. As mentioned above, examination includes accurate auxology (including parents' heights and weights), BP, fat distribution, skin changes (striae, acanthosis nigricans, hirsutism), dysmorphic features, pubertal staging, fundus exam and mental assessment. In boys, measure stretched penile length (SPL), since the penis is usually buried in abdominal fat. Psychologic assessment, including assessing self esteem, and attitude towards food, exercise, and relationships, of the child and significant family members, is important.

The hypothyroid child is always significantly short (with delayed bone age). Cushing syndrome is characterized by short height, moderate obesity (truncal in adults and older children, generalized in infants), severe hypertension, red striae, and occasional glucose intolerance. In contrast, exogenous obesity is characterized by tall stature, mild hypertension, acanthosis, and white striae (occasionally, with rapid weight gain, striae may be reddish initially). Micropenis may be seen in panhypopituitarism and some syndromes. Far commoner is the buried penis of exogenous obesity: parents are concerned about "small" genitalia, but the actual SPL is normal. In hypothalamic syndromes, obesity is variable, ranging from very marked and difficult to control, to mild; other clinical features would help with the diagnosis. In craniopharyngioma, obesity is multifactorial, and tends to worsen after surgery.

INVESTIGATIONS

Investigations are guided by the clinical presentation, but the initial assessment could include bone age, serum T4, TSH, lipids, blood glucose and insulin (fasting and post-glucose). Children with exogenous obesity may have frank type 2 diabetes, impaired glucose tolerance, or just hyperinsulinemia with normal blood glucose levels. The levels of serum cortisol and urinary metabolites of cortisol may be somewhat raised, but are easily suppressible; urinary free cortisol levels are normal. Several authorities recommend the overnight dexamethasone suppression test straightaway rather than a basal serum cortisol: 1 mg dexamethasone is given orally at 11pm, cortisol is tested the next morning at 8 am. In hypopituitarism, low T4 would accompany normal/ low TSH; GH would not cross 10 ng/ ml on a stimulation test; gonadotrophins would be inappropriately low for age (e.g. low levels at age 8 are normal, but at age 16 are not). Androgen levels, karyotyping, or imaging studies (e.g. of the pituitary) will depend on the clinical picture.

MANAGEMENT

Management of obesity depends on age, severity, underlying cause and level of motivation. In infants less than 2 years of age, urgent thyroid evaluation is needed, because of the devastating mental retardation which occurs if replacement is delayed. Severe calorie restriction at this age is avoided even in syndromal obesity, because of the risk of treatment-associated brain growth and reduced height gain. In pathologic obesity, e.g. due to Cushing/ hypothyroidism/ GHD, appropriate management/ replacement is needed.

Before planning control of exogenous obesity, the level of motivation of the family should be assessed. There is no quick

remedy, the only way to keep off excess weight being lifelong control of diet with exercise. If the family is not concerned, therapy is likely to be unsuccessful, and may impair the child's self-esteem and the success of future attempts at weight loss. In this situation, the gravity should be explained, and advice deferred to a later visit. On the other hand, clinicians should not ignore obesity altogether, because even modest weight loss, which is attainable, is enough to significantly improve the metabolic profile. Therefore the aim of therapy should be achieving and *maintaining* a 5-20% weight loss. Trying for ideal body weight is usually unrealistic, and therefore frustrating. Even small, long term changes may have greater health benefits rather than a drastic weight loss followed by regaining the weight. Rapid weight loss is necessary only if there is a life-threatening situation like extreme obesity, severe sleep apnea, or other severe cardiopulmonary manifestations, as in the Pickwickian syndrome.

Management consists of dietary measures and exercise, supported by behavioral modification techniques. Close supervision and family involvement are very important for success. Drug therapy and surgery are infrequently advised in childhood. However, once established, obesity management is very frustrating, as weight gain recurs rapidly. The challenge for pediatricians is to prevent obesity and reduce the health impact in those who are already obese.

DIET THERAPY

Diet changes are critical, but drastic changes and a punitive attitude must be avoided. A balanced, healthy diet for the entire family is recommended (fat intake ~20-25% of total calories, protein 15%, remaining as carbohydrates, mostly complex carbohydrates, adequate fiber and micro-nutrients, and plenty of liquids). In most children, weight loss begins with just reduction of calorie-dense foods: chips, other fried foods, rich desserts, full fat milk and its products, and sweetened drinks. In their place the child is encouraged to take foods with low glycemic index (fruits, salads, whole wheat products, unsalted popcorn, roast gram or corn, whole daals etc.), low fat milk products and water⁹. The child should not remain hungry. Even in severe obesity, calorie restriction should be moderate. Very low calorie diets (400-800 calories per day) give rapid weight loss, with improvements in BP, blood glucose, insulin, leptin, and lipids, but losses are regained; long term losses are similar to those with low calorie diets. Moreover, they can be dangerous if not closely supervised, prolonged beyond 2-6 weeks, or not supplemented with adequate minerals and vitamins, and can also result in eating disorders, sagging breasts, and cholelithiasis. Unbalanced diets (very low fat/ very low carbohydrate, etc.) can cause cardiac arrhythmias, severe electrolyte disturbances, or other morbidities. Stringent dieting, a favorite technique of adolescents, must therefore be strongly discouraged, as it can slow height gain and pubertal development, cause weight loss plateau (due to slower metabolic rate), osteopenia, weakness, dizziness, poor academic performance, irritability, depression, and other behavioral problems.

EXERCISE

All forms of physical activity increase energy expenditure (during and after the exercise), muscle mass, and insulin

sensitivity¹⁰. Regular exercise also helps regulate increased appetite. Though the quantum of loss with exercise is modest, it is essential for prevention of obesity, healthy weight loss, and maintenance of the loss. However, it cannot compensate for high calorie intakes, so it must accompany a careful diet. Exercise should be both aerobic and anaerobic. Compliance is better if activity is enjoyable and fun: walking with friends, swimming, dancing, sports. Initially low impact, moderate-intensity exercise (e.g. walking 30 min 4-5 days/ week) is started to avoid injuries. For those easily tired, even this can be broken up into multiple short bouts. As fitness improves, time and intensity are built up to 50-60 min 5-7 days/ week for long-term loss and maintenance. Gymnasiums and supervised programs may be useful for adolescents as they encounter other obese persons and see that weight loss is possible. Formal exercise should be supplemented with increased activity (e.g. stairs instead of lifts, walking for errands, etc.).

Clinicians must push strongly for facilities for increased activity in schools and the community.

BEHAVIOR MODIFICATION AND SOCIAL SUPPORT

These are very important in all attempts to lose weight and sustain the loss, as long term changes in eating and activity patterns are necessary. Attempts are most successful if the entire family is convinced of the need for weight loss, and keen to participate whole-heartedly. To assess behavior patterns which need to change and track progress in changing them requires monitoring, usually by self report. Thus, the child and/ or parent maintain a food, activity and TV viewing diary daily for the first 6 months, one week per month later. A simple log can be downloaded from the website of the American Heart Association

http://www.deliciousdecisions.org/ff/eee_habits_eat.html. This helps track progress and identify problem areas. The second component is to avoid environmental cues which can trigger hunger, so parents are advised to keep undesirable foods out of the home, and reduce the frequency of eating out. The third component is reinforcement for better behaviors. Thus small low or zero calorie rewards (eg a hug/ praise/ sticker/ fancy pen/ red points...) and other motivational techniques ensure better compliance for a longer time. TV viewing and excessive tuitions should be discouraged in favor of healthier options like play. Occasional high calorie treats are a must to prevent frustration, which can lead to stealing food/ money and other dysfunctional behavior patterns. Group therapy, conducted by co-therapists (psychologist/ nutritionist/ exercise physiologist) with weekly treatment meetings over a 6 month period, and less intensive follow up contact, have been found to be successful. Recently, televised or internet based therapy has also been tried.

MEDICATION

Pharmacotherapy is not recommended for use in children, though several anorectic agents (amphetamines, other appetite suppressants, antidepressants) are available. Insulin sensitizers (primarily metformin, also glitazones) have been shown to safely and effectively achieve weight loss, decrease body fat,

plasma leptin, insulin and lipids, in obese diabetic and non-diabetic adolescents, especially those with PCOS. The only two drugs approved for obesity in adults in Europe and the US are sibutramine and orlistat. Sibutramine, a selective serotonin and noradrenaline re-uptake inhibitor which suppresses appetite, can reduce weight by 5-15%¹¹. Orlistat, an inhibitor of gastrointestinal lipases, decreases fat absorption by 30%, and causes significant weight loss, with improved lipid and glycemic profile. It may lead to flatulence, frequent stools, and deficiency of fat soluble vitamins like A and D¹². Rimonabant is contraindicated below age 18 years, and can cause depression.

SURGERY

Surgery is contraindicated in patients less than 18 years of age. Very rarely, e.g. in extreme obesity with severe sleep apnea or other complications, not responding to non-surgical treatment, gastroplasty may be considered¹³.

MAINTAINING WEIGHT LOSS

A questionnaire based study of persons who lost and maintained significant loss found that the common features were consumption of a diet low in calories (1380/day) fat and low in fat (24% calories from fat); and daily consumption of breakfast. Less than 1% had low carbohydrate diets.¹⁴ Continued self-monitoring of food intake and regular exercise of up to an hour daily were very strong predictors of weight maintenance. Decreased screen time (TV, computer, video games) has been shown to contribute significantly.

PREVENTION

Given the difficulty in achieving and maintaining weight loss, all attempts should be made to prevent obesity (Table). Pediatricians must educate parents and significant others from the beginning to adopt healthy attitudes. Several schools serve/sell food which promotes obesity, and pay little attention to physical activity. Clinicians must also work with school authorities to alter these malpractices, at the same time identifying and paying attention to high risk children (obesity/diabetes/hypertension/dyslipidemia in parent(s)/sibling(s), maternal age over 35 years at birth, single child, single parent, rapid weight gain). All children should have growth charted through childhood, and rapid weight gain picked up early. Children with rapid weight gain and their parents should be helped make lifestyle changes. This is one area where a clinician's timely inputs can help prevent much morbidity and unhappiness.

STRATEGIES FOR PREVENTION OF OBESITY

1. Physicians should recommend a healthy lifestyle rather than

thinness.

2. Physicians should encourage families to adopt sensible eating habits:
 - a. Avoid force feeding
 - b. Do not keep calorie dense foods and sweetened drinks at home
 - c. Do not use food as reward or punishment
 - d. Express affection and approval through ways other than food
 - e. Keep fat intake moderate
 - f. Encourage intake of unprocessed foods: fruits, salads, sprouts, etc.
3. Physicians and families should encourage physical activity, and minimize TV/ computer time.
4. Clinicians should identify high risk families and situations and emphasize prevention for the beginning.
5. Clinicians and families should emphasize that children need support not criticism, and that obesity is not only due to greed and sloth.
6. Clinicians and families must aim for gradual, permanent changes rather than drastic changes which are not sustainable.
7. Schools should influence attitudes by
 - a. Serving/ selling healthy food choices
 - b. Not allowing sweetened drinks and fried foods on campus
 - c. Increase time for physical activity
 - d. Allow premises to be used for sports after school hours
 - e. Identify high risk children and support weight loss attempts by them.
8. The community encourages physical activity, e.g. lobby for sports to be allowed in open spaces like parks (a major problem in cities).

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ETHICAL GUIDELINES FOR BIOMEDICAL RESEARCH

The need for uniform ethical guidelines for research on human subjects is universally recognised. It has acquired a new sense of urgency as the critical issues in the area of biogenetic research involving human subjects have become acute. Apart from the mandatory clinical trials on new drugs, a number of diagnostic procedures, therapeutic interventions and prevention measures including the use of vaccines, are being introduced which involve human subjects. Further the advent of new medical devices and radio-active materials and therapeutic benefits of recombinant DNA products have added a new dimension to the ethical issues that need to be considered before evaluating these for their efficacy, utility and safety.

Any research using the human beings as subjects shall bear in

mind the following principles of : i) essentiality, (ii) voluntariness, informed consent, (iii) non exploitation, (iv) privacy and confidentially, (v) precaution and risk minimisation, (vi) professional competence, (vii) accountability & transparency, (viii) maximisation of public interest and distributive justice (ix) institutional arrangements (x) public domain (xi) totality of responsibility and (xii) compliance.

Recent advances in the field of Assisted Reproductive technologies, organ transplantation, Human genome analysis, and gene therapy promise unquestionable benefits to mankind. At the same time, they raise many questions of law and ethics, stimulating public interest and concern.

(Source : ICMR Publication 2000)