

Medical complications in children and adolescents affected by eating disorders

Youth with eating disorders must be monitored for short-term consequences such as dehydration and metabolic alkalosis, and long-term consequences such as delayed puberty and osteopenia.

ABSTRACT: In North America, eating disorders are the third most common chronic health condition for females between 15 and 19 years of age. Short- and long-term medical complications associated with these disorders remain a major source of concern to parents and health care providers. Over the past three decades treatment has revolved around behavior modification and operant conditioning techniques. This approach has been successful for some patients but ineffective for a significant number of adolescents with chronic eating disorders. In an attempt to address this problem, an approach based on the concepts proposed by Prochaska and DiClemente in their transtheoretical model of change has been integrated into the philosophy of treatment over the past several years. Another change has been a shift toward outpatient treatment of eating disorders. Being aware of these changes and knowing how to manage possible medical complications can allow clinicians to contribute to the recovery of children and adolescents affected by eating disorders.

Eating disorders are a heterogeneous group of psychiatric disorders that commonly affect adolescent females and have a high morbidity risk.¹ Treatment is changing from a rigid prescribed medical approach to a more collaborative and participatory one involving the patient and family. At the BC's Children's Hospital (BCCH) Eating Disorders Program we have significantly shifted our philosophy and approach over the past 5 years. Today our program relies on the Stages of Change model proposed by Prochaska and DiClemente (see "A new treatment approach to eating disorders in youth," elsewhere in this issue) and is driven by principles that enhance motivation and readiness for change.

Acute medical issues

The following case-based discussion of medical complications provides an overview of an approach used to help children, adolescents, and their families deal with eating disorders.

Dehydration

Amy is 14 years of age. Her parents bring her to the emergency room at the local hospital, concerned that she

has lost a significant amount of weight over the past 6 months. After taking a complete medical history, performing a physical examination, getting blood work and an electrocardiogram, you determine that Amy is suffering from anorexia nervosa restrictive type. It is evident that Amy has chronic intravascular volume contraction and needs intervention.

Intravascular volume contraction may be one of the most common medical complications of an eating disorder. This chronic adaptive state is most likely related to restricting food and fluids, self-induced vomiting, and laxative abuse. For youth with anorexia nervosa, dehydration becomes a chronic state that he or she adapts to and usually does not experience associated symptoms with. We observe orthostatic changes in blood pressure and heart rate. These changes may become more pronounced, depending on the degree and acuity of the intravascular depletion. If the adolescent maintains

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a low but constant intake of fluids, the cardiovascular system adapts and shows lesser degrees of orthostatic shift. Other clinical signs of dehydration include livedo reticularis, acrocyanosis, cold extremities, decreased skin turgor, dry mucous membranes, and dizziness when going from lying to standing or sitting.² Results from laboratory investigations are usually normal when the dehydration state is chronic. Serum electrolytes, blood urea nitrogen, and creatinine are in the upper normal range. These findings in the setting of moderate to severe malnutrition are clear indicators of intravascular volume contraction.

In keeping with a collaborative approach to eating disorders and the Stages of Change model, we strive not to be reactive in the BCCH Eating Disorders Program. Most of the physical changes observed in an eating disorder are chronic in nature and are part of an adaptative mechanism to the malnutrition. Unless we are concerned about complications such as acute tubular necrosis (ATN) and severe electrolyte disturbances possibly related to prerenal failure, we do not aggressively rehydrate. Aggressive rehydration may tip a fragile cardiovascular system into congestive heart failure. Intravenous solutions used for rehydration are 0.9% sodium chloride, based on three-quarters to one-and-one-quarter maintenance daily fluid for body weight in the first 24 hours. For patients who are not acutely dehydrated, we recommend fluid intake on maintenance needs.

Bradycardia and hypotension

Amy's supine heart rate is 40 beats per minute and her blood pressure is 82/45 mm Hg. Her standing heart rate is 62 beats per minute and her blood pressure is 85/52 mm Hg. Amy has cold extremities and acrocyanosis. She has no complaints and tells you

that she feels well overall, and would like to be discharged home.

Bradycardia and hypotension are the most common cardiovascular changes seen in adolescents suffering from malnutrition. An ECG should be done when these signs are present and should be evaluated by a cardiologist. Complications such as premature ventricular contractions, arrhythmias, and long QT syndrome should be managed in conjunction with them. These well-described cardiovascular abnormalities are thought to be related to a complex adaptive process that involves not only the cardiovascular

system but also the endocrine system, and results in a decreased basal metabolic rate. The central and peripheral nervous system, along with sympathetic and parasympathetic nervous systems, are also involved.^{3,4} The chronic adaptive nature of these changes enable the adolescent to maintain homeostasis. It is important to note that the shorter the duration of the illness and the younger the adolescent, the less likely that she or he will be able to maintain homeostasis.

Hypokalemic, hypochloremic metabolic alkalosis

When reviewing Amy's blood work, you notice that her sodium is normal, potassium is 3.6 mmol/L (3.5–5.0), chloride is 98 mmol/L (95–107), blood urea nitrogen is 6.5 mmol/L (2.5–7.0), and creatinine is 72 mmol/L (35–110). You decide to re-evaluate Amy's eating disorder practices. Amy acknowledges that she has tried to vomit in the past on several occasions, but she also reassures you that she finds self-induced vomiting very difficult, and that she is not planning to do this again.

Bradycardia and hypotension are the most common cardiovascular changes seen in adolescents suffering from malnutrition. An ECG should be done when these signs are present and should be evaluated by a cardiologist.

For youth with binge-purge behaviors related to anorexia or bulimia nervosa, the clinical picture is different. Often the patients complain of dizziness, fatigue, and decreased energy. Clinically they have orthostatic hypotension and tachycardia, with heart rate changes over 30 beats per minute and a drop in systolic blood pressure of more than 20 mm Hg. Their serum biochemical parameters may be normal or may show a hypokalemic, hypochloremic metabolic

alkalosis. These changes have been attributed to chronic intravascular volume contraction associated with secondary hyperaldosteronism as a compensatory response to the dehydration. The self-induced vomiting leading to gastric fluid losses exacerbates the metabolic changes. There is a total body potassium depletion related to renal exchange of sodium for potassium in an attempt to maintain an effective intravascular volume and normal serum osmolality.⁵

complement these medical interventions with ongoing psychotherapeutic strategies. Where the electrolyte disturbance is more severe, a short admission to a medical unit to correct the metabolic changes may be necessary. Again, in the case of hypokalemic, hypochloremic metabolic alkalosis, the best intravenous solution is 0.9% sodium chloride, with a maintenance dose of potassium chloride to restore effective intravascular volume and serum osmolality. It is

Stunted growth with decreased adult final height is one of the most common long-term complications in children and adolescents with eating disorders.

It is our clinical experience that youth with normal weight bulimia nervosa appear to be able to tolerate these changes more readily than patients struggling with anorexia nervosa purging type. These metabolic changes are commonly associated with other serum mineral and metabolic abnormalities. We have found that using oral potassium supplements (K-Dur, 2 mmol/kg a day, divided in three equal doses) in the setting of normal renal function, may replete the total body potassium stores and decrease the serum hypokalemia. It is important to note that there is no literature that has critically evaluated this approach. It is also important to note that patients need to stop their purging behaviors for these therapeutic maneuvers to be effective. It is imperative to

important to monitor serum glucose, potassium, sodium, calcium, magnesium, and phosphate to avoid refeeding syndrome abnormalities as discussed elsewhere in this issue (see “Strategies for supporting youth with eating disorders when intensive treatment is needed”).⁶⁻⁸ Abnormalities that occur with refeeding syndrome include shifts in calcium, phosphate, and magnesium that need to be corrected on a daily basis. If electrolyte shifts are not corrected, cardiac failure is one of the consequences.⁶⁻⁸

Hypoglycemia

Amy’s random serum blood sugar is 3.3 mmol/L (3.3–7.0). Amy does not acknowledge any symptoms related to hypoglycemia. She acknowledges being somewhat tired.

When evaluating laboratory data we may see low-normal to low serum blood sugar that is asymptomatic. We bring it to the patient’s attention and repeat the blood work, and usually find that the hypoglycemia has corrected itself, and that it is a transitory phenomenon of unclear cause and long-term consequences.

Hypophosphatemia

Amy’s serum phosphate is normal.

Hypophosphatemia is commonly seen during the refeeding phase.⁹ This is a metabolic complication associated with fluid and electrolyte replacement. We recommend admission to hospital for monitoring and management. Congestive heart failure, rhabdomyolysis, and renal failure are some of the medical complications associated with this clinical situation.^{10,11} Intravenous potassium-phosphate or oral phosphate salts may be administered; at our centre we use oral Phosphate Sandoz (500 mg twice a day). Re-evaluate the serum phosphate on a daily basis.

Potential long-term complications

The following possible consequences of an eating disorder must be taken into account when treating children and adolescents.

Linear growth

When you plot Amy’s height and weight on the growth chart, you find that her weight is 40 kg (below the 3rd percentile) and her height is 158 cm (on the 10th to 25th percentile).

Stunted growth with decreased adult final height is one of the most common long-term complications in children and adolescents with eating disorders. There are reports of “catch-up growth,” depending on the length of the illness, the type of eating disorder, and when intervention was

started.¹² For adults who have suffered from eating disorders since early adolescence, stunted linear growth may be a reality.

Peak height velocity (growth spurt) during the adolescent years is dependent on many variables, including genetic potential (based on mid-parental height), general health status of the adolescent, length of chronic malnutrition, and degree of nutritional intake. It is known that for pubertal adolescent females peak height velocity occurs 2 years after “breast budding” (first sign of pubertal development) and 1 year prior to menarche (mean age in North America, 12.5 years). In the case of bulimia nervosa, linear growth complications are much less of an issue since this disorder tends to affect older adolescent females.^{13,14}

Linear growth patterns are somewhat different for pubertal males. Peak height velocity is a relatively late event for boys and tends to happen 2 years later than girls, around Tanner stages 3 to 4. An important fact in terms of growth and developmental patterns during puberty is that the changes are predictable and consistent, but the timing varies depending on genetic and environmental factors.^{13,14}

Pubertal development

Amy has had secondary amenorrhea for the past 4 months; her menarche happened when she was in grade 7. Her periods were somewhat irregular in the past, coming every 20 to 40 days, and lasting for 3 to 6 days, with an average blood flow.

Menarche happens, on average, between 12.4 and 12.8 years of age in North American females. Genetic and environmental factors affect this developmental milestone. For many adolescent females, menstrual periods may take more than 2 years to

become regular. After menarche, menstrual period irregularity is commonly attributed to anovulatory menstrual cycles.¹⁵

Delayed puberty is one of the cardinal features of anorexia nervosa during adolescence. Pregnancy, even though a rare event in a young female with anorexia nervosa, needs to be excluded by obtaining a detailed clinical history including health risk behaviors and, more specifically, sexuality issues. Anecdotally and based on our experience, adolescents with bulimia nervosa seem to engage in more health risk-taking behaviors than females with anorexia nervosa restrictive type. A possible explanation for this phenomenon is the impulsive nature of patients with bulimia.

The progesterone challenge is a common method to evaluate an adolescent with primary amenorrhea. Oral medroxyprogesterone acetate is administered in a dose of 10 mg daily for 5 to 10 days. A withdrawal bleed should occur 2 to 7 days after the medroxyprogesterone has been completed. This indicates the presence of endogenous estrogens, in the setting of a normal hypothalamic-pituitary-ovarian axis, and a functional uterus.

In order to estimate Amy's pubertal development, you decide to perform Tanner staging. You ask a nurse to assist you and serve as a chaperone while you examine Amy. Before proceeding, you ask for Amy's consent. Amy relates to you that she is uncomfortable with the breast examination. Amy also relates to you that she does not want you to examine her external genitalia since no one has done this before.

It has been our experience that for most youth struggling with an eating disorder, the breast and genital examinations can be a source of significant stress and embarrassment. This may be associated with the fact that health

care providers, mainly physicians and nurses, do not make it a routine part of the general physical examination unless deemed absolutely necessary. The body changes heralded by the appearance of secondary sexual characteristics may contribute to the fears associated with breast and genital examinations. These issues appear to be less relevant as youth grow older, experiment with aspects of their sexuality, and develop a sense of sexual adequacy.

At the BCCH Eating Disorders program we attempt to “demystify” this aspect of health care and make it part of a routine physical examination by educating youth about it. We introduce the concepts of confidential health care and consent to treatment prior to starting the interview. We always ensure that a chaperone is present for medicolegal purposes and also for the adolescent's comfort. We ask for consent and if the patient does not feel comfortable with the examination we do not proceed; we defer it until we have provided the adolescent with information about the pros and cons of the proposed procedure. In our experience, this practice fosters a sense of trust and respect between the health care provider and the adolescent. Another important issue to consider is the gender of the examiner. A female patient may be unwilling to have a genital examination conducted by a male physician; in this case, the male physician should defer to a female colleague.

Bone mass accretion

Both parents want to know Amy's risk for osteoporosis and if she should start taking the oral contraceptive pill. Amy's mother has read that this may protect her daughter from developing osteoporosis.

Bone accretion is one of the most salient features of puberty for both

genders. Many factors, including genetic predisposition, nutritional intake, weight, body composition, calcium and vitamin D intake, ethnic background, geographic location, exercise and hormonal balance, affect bone accretion during adolescence. A close relationship between the skeletal and endocrine systems plays a

velocity in relation to peak height velocity and menarche.

Fifty-three young females, from two elementary schools in Saskatoon, Saskatchewan, with a mean age of 10.06 years (7.97 to 13.26) were evaluated. The authors found that the timing of peak bone mineral content velocity and menarche were closely

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major role in the process of bone accretion. Growth hormone (GH), thyroid hormone, thyroxin, glucocorticoids, and sex steroids (estrogens, progesterone, testosterone, androstenedione, DHEA-S) modulate these changes by interfacing in the development of bone mass, and by accelerating epiphyseal maturation and closure. To date, the gold standard for evaluating bone accretion is dual energy X-ray absorptiometry (DXA).^{16,17}

In females, up to 50% of bone mass is attained during adolescence.¹⁸ In males, 67% of bone mass is attained during this time.¹⁹ McKay and colleagues investigated and reported over a 6-year period the magnitude and timing of peak bone mineral content

related and followed peak height velocity by approximately a year.²⁰

The literature offers no definitive answer to the question posed by Amy's parents about the potential benefits of using estrogen supplementation via oral contraceptives for improving bone accretion or preventing the development of osteopenia or osteoporosis. Based on the lack of evidence in the literature about the benefits of this intervention, it is our practice not to use oral contraceptives, particularly in our younger patients who have evidence of delayed pubertal development. For the postmenarcheal adolescent we recommend weight restoration and nutritional rehabilitation.

Psychological symptoms

Amy's parents relate to you that over the past year they have noticed a change in their daughter's behavior. She appears aloof, frequently eats at different times from the family, and prefers to spend time alone in her bedroom. Her counselor and teachers expressed concern about Amy's declining grades and a tendency toward spending time on her own and not with her peers. Teachers have also noted an increase in Amy's level of exercising at school.

In patients who are severely malnourished (75% to 80% of ideal body weight) and who have orthostatic changes in their blood pressure and heart rate (greater than 20 mm Hg and greater than 30 beats between lying and standing) we recommend that they do not exercise.²¹

In our program, we assess vital sign stability and state of malnourishment at admission. Based on acceptable parameters, we will allow the patient to start a graded exercise program with close supervision by a psychologist (who is certified by the American Council of Exercise and has provincial certification as a personal trainer) and a nurse (who is certified by the American Lifestyle Counselors Association and has a master's degree in Adaptive Physical Activity). The emphasis in this program is on increasing body awareness and self-awareness before increasing exercise intensity.^{22,23}

Interviews are conducted regarding the patient's exercise history, attitudes toward exercise, and exercise injury history. Progression and intensity of exercise are based on a review of the patient's overall progress in the program. Special consideration is given to the unique needs of the athlete with an eating disorder. These include allowing the patient to maintain participation in the sport only while in

treatment and continuing to make gains, dealing with irrational beliefs (e.g., low body fat enhances performance), involving the family and the coach, and helping patients reconnect with their bodies.²⁴

It is not uncommon to have comorbid depression, suicidality, impulsivity, self-harm, or borderline personality traits along with an eating disorder.⁵ Some of these co-morbidities may be a symptom of the malnutrition. It is the clinician's task to determine whether these symptoms were present before the eating disorder, or are a result of the eating disorder. Once the patient reaches maintenance weight, many symptoms—such as poor concentration and mood lability—improve.⁵ If the co-morbid condition existed prior to the eating disorder, then psychotropic medication and specific counseling strategies may be useful. Currently, the efficacy of selective serotonin reuptake inhibitors (SSRIs) as antidepressants for children and adolescents is being questioned. They should only be used for severe, persistent depression and comorbid anxiety. Bupropion (Wellbutrin) should not be used in bulimia as it can precipitate seizures.⁵ Recently, paroxetine (Paxil) and venlafaxine (Effexor) have been contraindicated in youth because of an association with increased suicidality. Some newer atypical antipsychotics are helpful for self-harming impulses and compulsive behaviors.

When patients engage in deliberate self-harm behaviors we advocate and use the Dawson approach,²⁵ a method that relies on relationship principles to manage patients with borderline personality traits. This approach emphasizes patient's self-responsibility and requires staff to remain consistent, calm, and nonjudgmental in response to suicidal threats and during emotional outbursts.²⁵

Hospitalization

While admission to hospital on a voluntary and collaborative basis is preferable, this may not always be possible. The physician must decide, in conjunction with the patient, the threshold for non-negotiable intervention such as hospitalization and IV rehydration. A number of factors need to be considered in establishing when intervention will be initiated. These factors include the patient's age and judgment abilities, acuteness of the illness, degree of physical compensation, and electrolyte abnormalities.

When involuntary admission to hospital is necessary, it is important to continue communicating with the adolescent and parents in an attempt to enhance motivation and strengthen the therapeutic alliance.^{26,27} The purpose for the admission needs to be clearly determined and discussed. The adolescent needs to understand that once the metabolic abnormalities are corrected, she or he will be discharged to the outpatient clinic to continue working toward recovery with the support of the multidisciplinary team.

Patients who are younger may have more lasting effects from the eating disorder and may be more at risk with certain symptoms. They may be too young to have sufficient insight into their eating disorder. Extreme emaciation and malnutrition can impair judgment so that the patient becomes a danger to herself or himself and others. These factors and the type of non-negotiable intervention need to be made clear to the patient as soon as possible and, if at all possible, prior to having to hospitalize. The physician must then be prepared to follow through by either certifying and admitting the patient, or by asking for the help of the local authorities to bring the patient into the hospital to start corrective treatment.

Consent, confidentiality, and therapeutic alliance

These are pivotal aspects of adolescent health care that need to be approached in a direct, concise, and clear manner with the adolescent and her or his parents. Based on the Infants Act of the province of British Columbia, a health care provider does not need to obtain parental consent to provide confidential treatment to any youth, as long as the youth understands the benefits and consequences of the proposed treatment.²⁸ These concepts should be introduced during the initial consultation. An approach found to be helpful in the process of establishing a therapeutic alliance with youth includes the well-described psychosocial assessment method called HEADSS,²⁹ which relies on the following assessment headings:

- Home situation and life.
- Education setting and concerns.
- Activity and time spent with friends.
- Drug, alcohol, and smoking use.
- Sexual activity and orientation.
- Suicidality.

By using this particular approach, the interviewer is able to identify potential health risk behaviors that the adolescent may be struggling with. This style of interviewing may also identify protective factors and strengths that may be used to build on and foster resiliency for the developing youth.

Conclusions

The good news is that there is a high recovery rate of approximately 75% for youth struggling with eating disorders. The more challenging news is that this process can be lengthy (average 2 years) and rarely progresses in a linear, straightforward fashion. With the support of a multidisciplinary team and the application of motivational enhancement principles, the recovery process may be more manageable.

Competing interests

None declared.

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