

Comorbidities Associated with Type 1 Diabetes

By Sobha Kollipara, MD, FAAP

Type 1 diabetes mellitus (T1DM) in children is a complex chronic condition. Optimal control is essential to reduce short- and long-term morbidity. This requires monitoring of blood glucose several times a day, adjustment of insulin doses to carbohydrate intake, and physical activity. The management of T1DM is complicated by many comorbid conditions that need regular screening, evaluation and treatment. These include autoimmune thyroiditis, celiac disease, eating disorders, and depression. All of these conditions have a great impact on the physical and mental well-being of the child with T1DM. Knowledge of these comorbid conditions will help school nurses to recognize them and provide additional help as needed.

Autoimmune Thyroiditis

Thyroid-specific autoantibodies cause varying degrees of thyroid disease. As in T1DM, there is no specific antigen trigger. There is higher prevalence in children with a family history of autoimmunity.

The incidence of thyroiditis in children with T1DM is higher than in children without diabetes, varying between 4 and 50 percent depending on the country or populations studied (Blilimoria et al., 2003; Kordonouri et al., 2002). Increasing prevalence is seen with longer duration of diabetes and in older children. Higher rates of autoimmunity are seen in girls compared to boys, and whites over blacks (Kordonouri et al., 2002; Burek et al, 1990). Children with thyroid autoimmunity have a higher risk of thyroid dysfunction that requires treatment. Annual screening for thyroid

function is recommended in all children by measuring antithyroid peroxidase antibodies or thyroid stimulating hormone (TSH). Data suggest that 70 to 80 percent of these children will develop clinical disease over time. Hypothyroidism is the most common comorbidity that occurs with T1DM.

Thyroid Disease and School

Understanding of the varied manifestations of thyroid dysfunction is essential, as

thyroid dysfunction will adversely affect the student's school performance, both academically and physically. The nursing care plan should include the diagnosis and treatment of thyroid disease. School nurses can be instrumental in identifying and alerting the parents of children with thyroid problems. At times, clinical symptoms of thyroid dysfunction are subtle and may mimic poor motivation for school work. Below is a summary of the thyroid symptoms that are commonly seen.

TYPE	CLINICAL FINDINGS	THYROID FUNCTION	THYROID ANTIBODIES
Hashimoto's with goiter	Thyroid enlargement	Normal TSH and T4	Anti TPO and/or Anti TG
Hashimoto's without goiter	No thyroid enlargement	Same as above	Same as above
With hypothyroidism	Fatigue, lack of energy noted during physical activity, poor school performance with decreased memory, poor growth, loss of appetite, constipation and cold intolerance	High TSH and Low T4	Same as above
With hyperthyroidism	Loss of weight, increase in appetite, unusual nervousness, tachycardia, palpitations (may need to be excused from strenuous physical activity), emotional lability, inability to concentrate, deterioration in hand-writing and heat intolerance	Low TSH and High T4 and T3	Anti TPO and/or Anti TG may be + TSI +
Graves' disease	Goiter and all of the above symptoms Exophthalmos (bulging eyes) may be present	Same as above	Same as above

TSH: Thyroid stimulating hormone, T4: Thyroxine, T3: triiodothyronine, TPO: thyro peroxidase, TG: thyroglobulin, TSI: Thyroid stimulating immunoglobulin

Types of Thyroiditis

Hashimoto's thyroiditis: This is the most common type. It can occur with and without goiter (thyroid enlargement) and clinical symptoms of thyroid dysfunction.

Graves' disease: Hyperthyroidism with goiter. A smaller number of T1DM children develop this condition.

Implications of T1DM

While some the thyroid symptoms are subtle and can also be seen with poorly controlled diabetes, it is important to suspect coexisting thyroid dysfunction and institute prompt treatment.

- No additional impact is seen with normal thyroid function.
- Hypothyroidism increases the risk of hypoglycemia, since insulin requirements will be lower.
- Growth failure worsens, associated with suboptimal control of diabetes.
- Hyperthyroidism causes wider fluctuations in blood glucose levels and increases insulin needs.

Screening and treatment recommendations

- Initial and annual assessment with anti TPO or TSH in all T1DM children.
- Hypothyroidism needs thyroid hormone replacement in the form of l-thyroxine.
- Dose of thyroxine depends on the severity of the dysfunction and the weight of the child.
- Monitor thyroid function and growth every 6 months until puberty and yearly thereafter.
- Hyperthyroidism requires prompt evaluation. Antithyroid medications are used for treatment. Radioablation with I¹³¹ and surgery are other treatment options for some persistent cases.
- Hyperthyroidism needs frequent monitoring.

Celiac Disease

Celiac disease (CD) is also known as gluten-sensitive enteropathy, which is associated with intolerance to gluten. The gluten-triggered autoimmunity damages the small bowel mucosa, leading to many intestinal and nonintestinal clinical manifestations. The disease occurs in geneti-

cally susceptible children, with increased prevalence in T1DM. The overall incidence of CD varies widely and is generally less in North America compared to other countries (Fasano et al., 2003; NASPGHAN, 2005). The prevalence of CD in children with T1DM is higher than in the general population. The prevalence ranges from 1 to 8 percent, compared to 0.3 to 1 percent in the general population, and some estimates suggest 10 to 20 percent higher rates in children with T1DM. The incidence is also higher in children with positive family history, younger age, and associated thyroid autoimmunity.

CD may remain asymptomatic or silent for a long time, only being detected by serological tests in children with T1DM. As such, there is the risk of children not being detected and treated in a timely manner. Although most of the children do not have any gastrointestinal symptoms, specific lesions can be present in the small intestine as seen by biopsy. Diagnosis requires intestinal biopsy even in the absence of gastrointestinal symptoms. Loss of intestinal villi and the mucosal damage lead to malabsorption (see picture). In symptomatic children, the gastrointestinal symptoms depend on the degree of gluten sensitivity and the amount ingested. Celiac disease has myriad presentations.

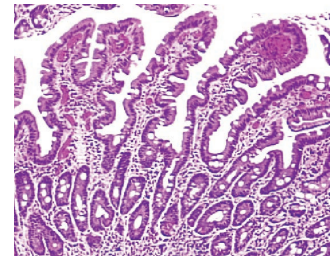
Celiac disease and school

The main problem that children with CD encounter at school is the limited availability of gluten-free foods. This presents a problem at school-provided meals and at classroom parties. Young children find it hard to understand the implications of a diet that is different from that of their classmates. School nurses could help by educating teachers and lunch program personnel about the special dietary needs of these children and also help the child make the right food choices. Providing gluten-free food choices in school cafeterias or asking the parents to provide appropriate foods would make school life easier for these children.

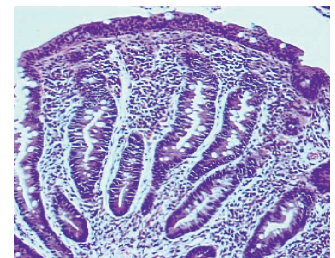
Treatment of CD

Treatment involves the elimination of gluten from the diet. The most important

foods to avoid are those made from wheat, rye, and barley. Many commercial companies manufacture gluten-free products, including breads and pasta.



Normal mucosa with villi
(Reproduced from NASPGHAN)



Atrophy of the villi in CD

Common clinical forms and features of CD

Type	Clinical features
Asymptomatic	None
Nongastrointestinal	Weight loss, poor growth, anemia, dermatitis herpetiformis, bone and muscle pains
Gastrointestinal	Abdominal pain, diarrhea, constipation, mouth ulcers, bloating and gas

CD impact on T1DM

- Variable absorption of carbohydrates leads to blood glucose fluctuations
- Increased risk of hypoglycemia from malabsorption of carbohydrates.
- Limitations in availability of gluten-free foods.
- Increased dietary restriction leads to more coping problems.

Diagnostic recommendations

Guidelines for screening and diagnosis by the North American Society for Pediatric Gastroenterology, Hepatology and

Nutrition are an excellent resource (NASPGHAN, 2005).

- Initial screening of all children with T1DM
- Tissue transglutaminase antibody (TTG) – the most sensitive and recommended test (TTG IgG is used in IgA deficient children)
- EMA (endomysial) antibody – less reliable
- Additional screening as needed in all clinically suspicious cases
- Periodic screening every 2 to 3 years
- Annual follow-up of antibody levels in all with biopsy-proven disease

Resources for CD

Refer to following web sites for additional information:

- <http://www.naspghan.org/sub/positionpapers.asp>
- <http://consensus.nih.gov/2004/2004CeliacDisease118html.htm>
- <http://www.celiac.org>
- <http://www.celiac.ca/EnglishCCA/ccenglish.html>
- <http://digestive.niddk.nih.gov/ddiseases/pubs/celiac/>

Psychological Disorders

Children with T1DM face many psychological stresses. Those with inadequate coping skills and family support may be more prone to psychological problems including eating disorders, depression, and anxiety. It is unclear if some of these psychological problems occur more frequently in children with T1DM compared to children without diabetes; however, data seem to support a link between psychological problems and poor diabetes control.

Eating Disorders

Eating disorders in children and adolescents are of major concern because of their grave health consequences. The prevalence of eating disorders is higher in adolescents and in females. It has been reported that the problem is twice as high in children with T1DM compared to children without diabetes. The etiology of this disorder is multifactorial and includes genetic, environmental, and social factors. The

principal factor that influences susceptible children is an obsession with thinness and body image. Further, the emphasis on eating (what, when, and how much) that children with diabetes experience from the time of diagnosis makes food issues a focal point for family conflict and predisposes these children to eating disorders, especially at the time of adolescence.

Types of eating disorders

- Anorexia nervosa – excessive aversion of food intake
- Bulimia nervosa – binge eating followed by purging
- Occasional binge eating
- Extreme dietary restriction – <500 kcal/day
- Excessive exercising for weight loss – >120 min. 5 times/week
- Abuse of laxatives and other medications

Implications for T1DM

The demands of diabetes management with difficulties in social and peer pressures increase the risk of eating disorders with diabetes. Anxiety related to the long-term diabetes complications and parental disapproval of their child's dietary habits further contributes to the child's development of eating disorders.

Specific risk factors with T1DM

- Weight gain associated with intensive therapy for diabetes as seen in Diabetes Control and Complications Trial (48 percent compared with 28 percent on conventional therapy)
- Insulin omission and missing meals to lose weight
- Higher body mass index
- Diabetes of longer duration (Diabetes Control and Complications Research Group)
- Poor coping skills for diabetes management
- Poor control of diabetes, with frequent ketoacidosis and hospitalizations

Eating disorders and school

Students with diabetes who often skip school-provided meals (breakfast and lunch) should alert the school nurse to the

potential for an eating disorder. Omission of insulin doses at school is another sign of this disorder. These behaviors can be brought to the attention of the parents and the healthcare team for further evaluation.

Depression and Anxiety

Adolescence itself is associated with many psychosocial challenges of peer acceptance, social relationships, and school adjustments. Diabetes and its complex management present additional stress. Some data suggest higher rates of psychological problems in children with T1DM. However, a recent report of a large group of youth with diabetes (The SEARCH for Diabetes In Youth Study) found the prevalence of depression to be similar to that in youth without diabetes (Lawrence et al., 2006).

Interaction and impact on diabetes

- Highest rates are observed in the first year after diabetes diagnosis.
- *Maternal* anxiety about diabetes increases the risk for anxiety disorder.
- Maternal depression increases the child's risk for depression.
- Increased frequency of hypoglycemia and ketoacidosis.
- Nonadherence to diabetes treatment.
- Lower quality of life.
- Increased episodes of ketoacidosis and hospital visits.
- Increased risk of other comorbidities.

Evaluation and treatment recommendations

Improved awareness of psychological disorders and their effects on T1DM is important when treating children with diabetes. Prompt recognition and intervention are needed to reduce the morbidity associated with these conditions. Depending on the severity of the disorder, treatment may require medications, hospitalization and/or intensive psychological intervention.

Impact on school life

Both depression and anxiety will adversely affect students' school behavior and performance. Students who exhibit unusual anxiety about common school issues, indulge in excessive blood glucose testing from fear of hypoglycemia, or

avoid participation in activities involving peer interaction may have underlying psychological problems. If such behaviors are noted by the school nurse, the concerns can be shared with the parents and the healthcare team.

Conclusions

Children with T1DM have many complex issues that they and their parents need to understand and cope with to reduce the risk of diabetes complications. Children who have the associated comorbid conditions will need to deal with these additional problems. Timely recognition, evaluation, and appropriate treatment of these conditions are essential to lessen the impact on the health of these children. The school nurse plays an important role in this undertaking by helping the child manage his or her diabetes and other comorbid conditions during the school day. 🐼

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