SUMMARY

In women, young age is associated with peaks in the risk of both eating disorders and diabetes type I. The physicians often presume that appropriate metabolic control of the otherwise lethal disease (type I diabetes) and delay in complications will oblige every patient to participate in insulin treatment. However, to an adolescent worried over weight gain, the body mass increase which they fear may result from regulation of the serum glucose levels represents a problem very difficult to resolve. As both pathologic entities are characterized by disruption in the physiology of nutrition processes, it is of interest to investigate whether the diseases represent risk factors for one another, and to review the suggested management and outcome of their concomitant occurrence.

INTRODUCTION

It is common knowledge that diabetes type I results from the lack of the pancreatic capacity to produce sufficient quantities of insulin. This disease typically occurs early in life, when eating disorders are also common, especially among young females (1). As both pathologic entities are characterized by disruption in the physiology of nutrition processes, it is of interest to investigate whether the diseases represent risk factors for one another, and to review the suggested management and outcome of their concomitant occurrence.

Eating disorders in young women are of a far more complex etiology and are more difficult to define and categorize than diabetes type I. They include a wide spectrum of false eating habits: from complete restriction of food intake, which leads to extreme malnutrition and possibly death, to uncontrolled excessive food intake, which may or may not be followed by vomiting and abuse of laxative agents and emetics. The syndrome can frequently be accompanied by the feeling of guilt, uncleanness or loss of control (1).

This paper will attempt to review the results of studies that previously investigated the correlation between diabetes type I and eating disorders in young female patients, then to critically assess their value and to investigate the consistency of the results of different studies. Furthermore, it will attempt to present the present knowledge by the following categories of interest: definition of clinical entities, correlation in their occurrence, guidelines for glucose control among patients with concomitant occurrence, complications and suggested therapeutic approaches.
METHODS OF LITERATURE REVIEW

The source of literature search was the PUBMED database, freely accessible on the World Wide Web (www.pubmed.com or www.pubmed.org). It includes the complete MEDLINE/Index Medicus reference database. The period under search was 1990-2003 and the key words were 'juvenile diabetes', 'diabetes type I', 'eating disorders', 'nutrition', 'anorexia (nervosa)', 'bulimia'. Further sources were obtained from the 'related articles' option available on PUBMED, and from the literature cited in the references of interest.

DEFINITION OF DIABETES TYPE I AND EATING DISORDERS IN REVIEWED STUDIES

Diabetes type I is readily identified through objective biochemical tests, so the selection of cases of the disease in all of the reviewed studies was unified and could not affect the reliability of the reported results (1). Eating disorders, however, are more complex entities and it is important that the definition is unified across the studies the findings of which are compared. Generally, historic sources of information used self-assessment of the subjects, such as EAT (Eating Attitudes Test) questionnaire, which included 26 questions categorized in 3 large groups: 1) Dietary habits; 2) Bulimia and obsession with food; and 3) Oral control (1).

More recent studies used the DSM III (Diagnostic and Statistical Manual of Mental Disorders) (2), DSM III-R (3) and DSM IV criteria (4) issued by the American Psychiatric Association (Table 1). According to the most recent DSM IV criteria, avoiding the application of insulin with the aim to control body weight is considered a mental disorder, under the category of 'Non-compliance in taking drugs for regulation of body weight'.

CORRELATION IN THE OCCURRENCE OF DIABETES TYPE I AND EATING DISORDERS

Since 1990, there have been at least 8 reports on eating disorders in young women with type I diabetes in the world literature (5-12). In seven of them (88%), the frequency of eating disorders (defined in a number of different ways across the studies, but most
frequently presuming anorexia and bulimia) among diabetic women was at least 1.5 times greater than in control samples. We may conclude that there is a convincing degree of consistency among the reported results, bearing in mind that all these studies were undertaken in different populations and during various time periods, often applying different methodology to assess the results. However, it also needs to be noted that in only two of seven studies reporting positive correlation between the two disorders the increase in the frequency reached statistical significance at a level of p<0.05 (11,12). This is primarily due to small sample sizes in both case and control groups, which then required enormous differences between the groups to reach the level of statistical significance. Still, the sample sizes were expected to be small because the investigated syndromes are rather rare and the eating disorder questionnaires had to be submitted to qualitative rather than quantitative analysis.

In the largest series of cases reported to date, which itself carries more weight than the other seven pooled together, Jones et al. (12) collected 356 female adolescents with type I diabetes. They found no cases of anorexia, but 5 (1%) of bulimia, 31 (9%) of unspecified eating disorders (UED) and 49 (14%) of borderline eating disorders (BED). When compared to the matched control group of patients with no evidence of diabetes type I, the risk of bulimia in the affected cases was 3.1-fold, of UED 2.1-fold, and of BED 1.9-fold. All these risk increases were statistically highly significant. It is this study that provided main evidence that diabetes type I and eating disorders in young females are indeed positively correlated. The strength of association, however, is probably not dramatic and the possible causal relationship cannot be inferred with the present, yet rather sparse evidence.

It has to be stated that the actual prevalence of eating disorders among female patients with diabetes type I varies according to the criteria and questionnaire applied to assess the former. The studies applying DSM III criteria report on a prevalence of eating disorders of 17%-35% (13-15), DSM III-R criteria yielded estimates between 5% and 6% (5,6), and DSM IV of 7%-11% (11,12). Although the variability in these estimates is quite high, the results of the studies of good design and quality control are still quite supportive of each other. For example, Villa et al. (8,10) used DSM III-R criteria in their two studies and report eating disorders in 8% of diabetic patients and 0-2% of controls. Engstrom et al. (11) report quite similar results using DSM IV criteria, i.e. 7% vs. 0%.

In their study, Wing et al. (16) found that female adolescents with type I diabetes had a greater score on EAT questionnaire than the control sample, implying less pathology of nutrition. However, Rosemark et al. (17) put these results in doubt after repeating the study using a design that also included men, and then revoked the questions related to dietary regimen. Their study has also yielded a conclusion that diabetes type I is a risk factor for nutrition disorders.

GLUCOSE LEVEL CONTROL AMONG PATIENTS WITH CONCOMITANT OCCURRENCE

According to the Diabetes Control and Complications Trial (DCCT), the control of glucose levels is the worst among adolescents due to complex interactions of biologic (insulin resistance during puberty) and psychosocial (non-compliance, disturbed family relationships) factors (18,19). Conversely, eating disorders are most common in adolescence and among younger adult women. It is thought that eating disorders could, at least partly, explain the inadequate regulation of glucose levels during puberty. The investigation showed that 11%-15% of adolescents (6,7,20) and 30%-40% of late adolescents and young women with type I diabetes and developed eating disorders (5,20) fail to comply with the suggested insulin treatment in order to control or reduce their body weight. The suggested underlying cause is that prior to the diagnosis of diabetes type I they often seek weight loss and a possibility to look slimmer than the peers even with increased eating, which is probably perceived as desirable by young women. With the initiation of insulin therapy and preserving the old nutrition habits, the weight gain is very likely, leading to body dissatisfaction (5,9,12).

Recently published studies mainly imply that the control of serum glucose levels in patients with diabetes type I and concomitant eating disorders is poor, with early development of microvascular complications. It should be noted that in adolescents HbA1c test is frequently out of range anyway, especially in females (21,22). This can partly explain what appears to be a poor metabolic control of diabetes.
in this age. In the study of eating disorders among 356 female adolescents with type I diabetes (12), the subjects meeting DSM IV criteria were shown to have significantly higher levels of HbA1c (9.4%) than those with no signs of eating disorders (8.6%). Similar results have been reported by Colas et al. (23), i.e. 10.8% in diabetics vs. 8.1% in those without eating disorders.

**COMPLICATIONS**

Eating disorders lead to an increase in the rate of acute complications of diabetes, such as hyperglycemia, repeated episodes of ketoacidosis, hypoglycemia and frequent hospitalizations. Cohn et al. (24) have reported that female adolescents with type I diabetes are more frequently receiving hospital treatment than their male counterparts with the disease. Although the most common eating disorders in this patient subpopulation are bulimia and its variants, there are also several documented reports on the restrictive eating disorders (13,25). The causes of hospitalization in such cases are hypoglycemic episodes caused by administration of insulin despite simultaneous avoiding of food intake.

Young women with this complex disorder have a statistically significantly increased risk of chronic microvascular complications including retinopathy (23,26,27). In the study by Colas et al. (23), patients with diabetes and eating disorder comorbidity had a prevalence of retinopathy of 62% and of autonomic neuropathy of 10% as compared to 20% and 0% in controls with diabetes but without eating disorders. In a study of a similar design, Takii et al. (27) showed the prevalence of retinopathy of 41% and of nephropathy of 46% in young diabetic females with bulimia. This was compared to a group of young female diabetics without eating disorders (6% and 6%, respectively), and those with eating disorders characterized by excessive food intake (0% and 9%, respectively). Bryden et al. (26) showed that among 11- to 18-year-old females with type I diabetes, 46% of patients who developed complications were skipping insulin administration to control their body weight.

Among the major risk factors for developing complications of diabetes type I concomitantly with eating disorders is the role of the family. Maharan et al. (28,29) showed that female adolescents likely to develop such complications were those with low level of communication with both parents, who lived in conflict environments without clearly defined roles in the family, and with a low degree of confidence in their parents.

**SUGGESTED THERAPEUTIC APPROACHES**

The literature on suggested therapeutic approaches for eating disorders is vast. The American Association of Psychiatrists regularly updates its handbook with guidelines (30), which include cognitive-behavioral treatment, interpersonal therapy, psychoanalysis, psychoeducation, group therapy, pharmacotherapy, day hospital and longterm hospital treatment.

However, despite all the literature available, until recently no guidelines for effective approach to treatment of concomitant diabetes type I and eating disorders were available. The rare references that addressed this problem had to conclude that this problem was very complex and very difficult to address indeed (31,32). One of the studies (31) has suggested cognitive-behavioral treatment.

All the sources seem to agree that the first step should be developing the motivation in the young woman to accept the treatment. The physicians often presume that appropriate metabolic control of diabetes with delay in complications of the disease is by itself a reason good enough for the patient to participate. However, to an adolescent worried over weight gain, the increase in body mass that results from good regulation of serum glucose levels represents a problem impossible to resolve. The insisting of the doctors and the family on diabetes control may increase the anxiety in the family of the adolescent and thus decrease the patient's motivation and lead to non-compliance. The key role of the physician is to balance the necessary enforcement of diabetes control with allowing the patient enough time to adapt to the changes, including weight gain. So, although an intensified insulin therapy is the preferable option in treating diabetes, perhaps two doses of insulin may also prove acceptable if the patient complies with such a regimen.

Psychotherapy is another suggested treatment option. Its main goal is to teach young people to accept themselves along with their limitations, and to face and better understand the feelings of fear, shame and
hopelessness without the need of attempting to take control over their lives through food intake restriction or excessive eating. Due to the seriousness of this complex disorder, the physician needs to attempt to establish in every young female with diabetes whether she tends to develop a concomitant eating disorder (Table 2). If the suspicion is justified, it is recommended to consult a nutritionist and assign him an appropriate role within the treatment process (33). The regular and frequent control of serum glucose is a conditio sine qua non throughout the treatment process and it should be monitored closely to alarm on any sign of non-compliance or development of complications.

**CONCLUSIONS**

Based on the reviewed evidence, we may draw the following conclusions.

1. Eating disorders and borderline nutritional insufficiencies are twice as common among female adolescents with type I diabetes than in the general population unaffected by the disease. The majority of eating disorders encountered were bulimia nervosa and its variants, along with the group of unspecified eating disorder syndromes.

2. Eating disorders in female adolescents with type I diabetes show positive correlation with inadequate glucose control, high levels of HbA1c and earlier onset of complications of diabetes type I, especially retinopathy.

3. Female adolescents and young women frequently tend to avoid taking insulin in order to control or decrease their body weight.

4. Support from the family, uninterrupted communication among family members and mother’s positive attitude towards body weight and body image all represent the factors of great importance for successful treatment. The opposites are, however, very likely to increase the risk of eating disorders among young females.

5. The importance of prevention and the value of early treatment of eating disorders in young females with diabetes type I still need to be evaluated.

**Table 2. Common manifestations of eating disorders in young women with type I diabetes (according to ref. 1)**

<table>
<thead>
<tr>
<th>Manifestations of insulin omission</th>
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<tr>
<td>- poor metabolic control as evidenced by high hemoglobin A1c levels</td>
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<td>- high blood lipid levels</td>
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<tr>
<td>- recurrent episodes of diabetic ketoacidosis</td>
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<tr>
<td>- refusal to allow parents or others to witness insulin administration</td>
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<tr>
<td>- admission of insulin omission or dose manipulation for the purpose of weight control</td>
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<tr>
<th>Manifestations of dietary dissatisfaction/manipulation</th>
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<tr>
<td>- admission to dieting for weight control</td>
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<tr>
<td>- admission to episodes of binge eating</td>
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<tr>
<td>- frequent requests for changes to meal plan, e.g., low-fat, low-carbohydrate, vegetarian, vegan or other diets</td>
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<tr>
<th>Manifestations of body dissatisfaction</th>
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<tbody>
<tr>
<td>- refusal to be weighed at clinic visits</td>
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<tr>
<td>- anxiety or upset at being weighed</td>
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<tr>
<td>- frequent complaints about weight and shape</td>
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<th>Manifestations of family dysfunction</th>
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<tbody>
<tr>
<td>- family functioning manifested by high conflict, low cohesion, and poor organization</td>
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<tr>
<td>- maternal preoccupation with weight and shape</td>
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<th>Other manifestations</th>
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<tr>
<td>- pervasive non-compliance with one or more aspects of the diabetes treatment regimen leading to poor metabolic control</td>
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<td>- smoking or other substance abuse</td>
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<td>- poor clinic attendance</td>
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<tr>
<td>- more frequent hospitalizations</td>
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<tr>
<td>- earlier-than-expected onset of diabetes-related microvascular disease (e.g., retinopathy, nephropathy)</td>
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REFERENCES


