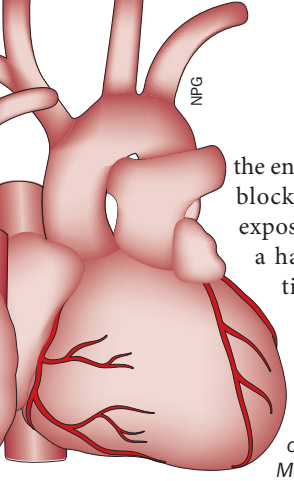

the enthusiasm for dual RAAS blockade and prevented the exposure of many patients to a harmful drug combination. It might have even resulted in trials with a smarter study design.

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PAEDIATRIC ENDOCRINOLOGY

Transatlantic differences in the management of T2DM in youth

Thomas Danne and Olga Kordonouri

If a child has diabetic keotacidosis and the type of diabetes mellitus is unclear, immediately start them on insulin. This recommendation is one of a number from a recent guideline on paediatric type 2 diabetes mellitus. However, differences in the management of type 2 diabetes mellitus between the USA and Europe remain.

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Clinical practice guidelines on the management of newly diagnosed type 2 diabetes mellitus (T2DM) in children and adolescents[1] along with a separate technical document on screening for comorbidities[2] were recently published in *Pediatrics*. The guidelines by Copeland *et al.* were developed by the American Academy of Pediatrics, with support from the American Diabetes Association, the Pediatric Endocrine Society, the American Academy of Family Physicians and the Academy of Nutrition and Dietetics. Despite the increasing prevalence of T2DM in youth, few data are available to guide treatment. Until the past decade, paediatricians on both sides of the Atlantic have mostly had to deal with type 1 diabetes mellitus (T1DM), which has a different aetiology and usually requires different management than T2DM.[3] Nowadays, structured guidelines are important for general paediatricians as well as paediatric endocrinologists.

Although most paediatric diabetologists usually have had no formal training in the care of children with T2DM, the International Society of Pediatric and Adolescent Diabetes have previously gathered worldwide consensus for recommendations; however, these recommendations largely relied on the current approaches in adults.[4] The rising pandemic of obesity has caused an increase in the prevalence of T2DM in children and adolescents worldwide. Different surveys indicate that between 8% and >50% of children with newly diagnosed diabetes mellitus have T2DM in the USA, whereas in Europe currently <1% of the newly diagnosed cases are classified as T2DM. The Centers for Disease Control and Prevention estimates that ~3,600 children are being diagnosed with T2DM in the USA every year, whereas in Germany current estimates show <200 new cases per year. Ethnic factors, pubertal insulin resistance and female sex have major roles in the development of T2DM.

In daily clinical practice, distinguishing immediately whether or not a child has T1DM or T2DM can be very difficult, especially if a child is overweight. Between 90% and 97% of children and adolescents with T1DM have one or more diabetes-associated antibodies as a sign of autoimmunity. Although it can take weeks to get the results of these tests, confirmation of the diagnosis of T1DM is a priority before other types of diabetes, including T2DM or maturity onset diabetes of the young, are considered. If someone with T1DM is mistakenly diagnosed with T2DM, and given only the first-line oral medication metformin instead of insulin substitution, they can develop life-threatening ketoacidosis in a short period of time. Thus, the new guideline recommendation is to start a child or teen on insulin if it is at all unclear whether the child has T1DM or T2DM and they have substantial metabolic derangement.

Once a child or adolescent is diagnosed with T2DM, management requires team care, with coordination between the primary care physician and a paediatric diabetes specialist, along with a nutritionist, diabetes educator and, importantly, a psychologist or social worker to address behavioural issues. Copeland *et al.* recommend that metformin should be prescribed once a diagnosis of T2DM is firmly established, and insulin treatment should be discontinued as soon as possible owing to the negative effects of unwanted weight gain.[1] Lifestyle changes need to be implemented, including improving nutrition, physical exercise of at least 1 h a day and limiting nonacademic 'screen time' (for example, video games and television) to <2 h per day.

The new guidelines were spurred by the discouraging results of the largest paediatric

T2DM trial to date, the TODAY (Treatment Options for Type 2 Diabetes in Adolescents and Youth) study.[5] The researchers randomly assigned participants to receive metformin (at a dose of 1,000 mg twice daily) given alone, metformin plus rosiglitazone (4 mg twice daily) or metformin plus a lifestyle-intervention programme. The programme, which focused on weight loss through family-based changes in eating and activity behaviours, was delivered in a series of in-person visits during the first 2 years, with continued contact at quarterly medical visits thereafter. Of the 699 participants in the study (mean duration of being diagnosed with T2DM was 7.8 months), 45.6% reached the primary outcome of loss of glycaemic control, defined as an HbA_{1c} of at least 8% for 6 months or sustained metabolic decompensation requiring insulin over an average follow-up of 3.86 years. Loss of glycaemic control was found in 51.7%, 38.6% and 46.6% for metformin alone, metformin plus rosiglitazone and metformin plus lifestyle intervention, respectively.

Clearly, the finding of considerably worse outcomes of current treatments in children and adolescents compared with those usually found in adults in the TODAY trial indicate that T2DM is different in children. In consequence, adult guideline recommendations should no longer be applied to the paediatric population, which makes the new guideline a timely document. However, a close look at transatlantic differences in the approaches in paediatric patient education is needed. In Europe, the SWEET group of reference centres for paediatric diabetes put great emphasis on age-appropriate individualized and group diabetes education.[6] Clinical visits are recommended every 2–4 weeks initially after the diagnosis and then at longer time intervals for follow-up. By contrast, weight management education in obese adolescents without diabetes is usually performed as peer-group education. Thus, the treatment approach should combine individual diabetes education with group education (Box 1).

Although a rapid reduction in weight might be desirable to reduce the intensity of antidiabetic treatment, the eventual goal has to be a stable long-term weight reduction (a reduction in fat mass). In the context of the whole family and peer group, a sustainable change in eating behaviour and lifestyle need to be achieved. The concept of flexible control has been proven to be superior to restrictive strategies that frequently lead to relapses.[7] An integral part of the long-term success is the establishment of effective strategies of self-monitoring. Implementing the frequent use of log-books for activities and food intake with self-monitoring of blood glucose requires ongoing motivation and feedback from the multidisciplinary team.[8] Indeed, these European programmes have been shown to be effective in terms of weight reduction as well as improving comorbidities.[9]

Box 1 | Combining a paediatric weight management programme with T2DM education

Flexible control as a basis for lifestyle counselling
- Restrained eating behaviour: moderate restrictions, long-term weight control
- Control of physical exercise: increase of everyday activity, reduction of inactivity per week
- Self-monitoring: training log-book, frequency of eating, blood glucose profiles

Weight management programme
- Exercise: exercising safely; body awareness, coordination, power and endurance; physical exercise and games
- Food: basic knowledge ('food-pyramid', amounts, servings); training of eating behaviour; shopping, cooking, eating meals as a family
- Psychosocial: social interaction, acceptance of yourself, self-perception; role-playing
- Family: parenting skills and family resources; nutrition and activities
- Health: definition, background, treatment and consequences of obesity; long-term complications

Additional modules for T2DM
- Exercise: hypoglycaemia
- Food: carbohydrate counting
- Psychosocial: talking about T2DM with peers, career choices and relationships, legal issues
- Family: self efficacy and gaining independence of the parental home
- Health: T2DM treatment, self-monitoring; ongoing care and check-up; future perspectives in relationship to late complications; alcohol, smoking, drugs; sexuality, contraception, family planning, T2DM risks of children

Abbreviation: T2DM, type 2 diabetes mellitus.

Carefully planned intervention studies with sufficient power to scientifically prove effectiveness for paediatric T2DM are urgently needed for promising new drugs such as glucagon-like peptide 1 analogues, but also for the nonpharmacological treatment approaches. Until these results become available, sharing best practices could help to improve the current poor prognosis of children and adolescents with T2DM. Sharing best practices can be achieved by benchmarking results with anonymized data from electronic health records, as has been done in the European SWEET project of reference centres for paediatric diabetes mellitus.[10]

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Competing interests
The authors declare no competing interests.

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