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Risk factors for discontinuation of insulin pump therapy in pediatric and young adult patients

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ABSTRACT

Background: Previous studies have shown that only a small number of pediatric and young adult patients discontinue pump therapy, but risk factors for discontinuation are unclear.
Objective: To identify characteristics of pediatric and young adult patients with pump therapy which are associated with discontinuation of treatment.
Subjects and methods: Retrospective cohort study using a representative nationwide database (LRx; IMS Health) in Germany covering >80% of all prescriptions to members of statutory health insurances in 2008–2011. All patients (age group <25 years) with new prescriptions of insulin pumps were identified (2009–2010) and were followed for 12 months.
Results: Overall, 2452 new pump users were identified, of whom 177 (7.2%) switched to other forms of insulin therapy within 12 months. In multivariate logistic regression, younger age (<6 years; reference 18 to <25 years: Odds ratio, OR, 95% CI: 0.36; 0.17–0.74) and use of teflon needles (reference steel needles: OR, 95% CI: 0.59; 0.41–0.83) were related to a lower odds of pump discontinuation. A non-significant trend was found for male sex (OR, 95% CI: 0.75; 0.52–1.08). Prescriptions of thyroid therapeutics (ATC H03A: OR, 95% CI: 1.79; 1.23–2.61) and antiepileptics (N03: OR, 95% CI: 3.14; 1.49–6.59) were significantly associated with discontinuation of pump therapy.
Conclusions: About 93% of pediatric and young adult patients maintained insulin pump therapy within 12 months. Age <6 years, male sex and teflon needle use were associated with a lower risk of discontinuation. Thyroid therapy (indicating autoimmunity) and antiepileptic drug prescriptions were associated with a higher likelihood for discontinuation of insulin pump treatment.

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1. Introduction

During the last 10–15 years there was a rapidly increasing use of insulin pump therapy, in particular, in the pediatric population [1]. Mainly younger age groups (preschoolers) benefit from pump treatment due to higher dosage flexibility and the possibility of very low insulin infusion rates [1,2]. Probably because of these advantages in pediatric patients, there is only a small number who discontinue pump therapy [3].

The reasons for discontinuation have not been well described. Acute side effects like local infections are frequent but did not lead to discontinuation of insulin pump treatment very often [4]. Associations of sex and age with stopping pump therapy have been found: girls discontinuated insulin pump treatment more frequently than boys [3,5]. A younger age at onset of pump therapy was related to a lower risk of stopping the therapy [3,5]. Furthermore, patients quitting pump therapy already had a more adverse glycemic control (HbA1c) at begin of pump therapy [5]. Finally, youth who discontinuated pump therapy less often monitored blood glucose already at start and during follow-up and experienced worse glycemic control [6].

A more concise description of characteristics that are related to a higher likelihood of insulin pump discontinuation would help to select appropriate candidates for this treatment. As an example, thyroid autoimmunity is highly prevalent in children and adolescents with type 1 diabetes (15–50%) and a subgroup of them is treated with thyroid hormones [7–10]. It has not been examined whether thyroid hormone treatment is associated with a higher discontinuation of insulin pump treatment.

The aim of the present study was to determine the proportion of pump discontinuation in children, adolescents and young adults using a large representative prescription database in Germany. In addition, the study addressed whether age, sex, thyroid hormone treatment and other prescriptions (antiepileptics, antihypertensives, lipid lowering drugs) are related to insulin pump discontinuation.

2. Methods

2.1. LRx database

The IMS LRx database has been described in detail elsewhere [11]. Briefly, data are assembled from nationwide pharmacy data centers processing prescription data of all German patients with statutory health insurance for reimbursement purposes. Data entries covered patient-specific data over time, such as anonymized identification number, age, sex, insurance company, and area of living as well as prescription information including prescriber's anonymized identification number, date, and package size. Information about diagnoses is not part of the datasets. The LRx database contains about 80% of all prescriptions issued nationwide since 2008 [11].

2.2. Patients and data collection

First, all patients (age < 25 years) with new insulin pump prescriptions from 2009 to 2010 (index date) were selected, who had subsequent insulin or needle prescriptions recorded during at least 12 months follow-up after index date. Incident pump therapy was defined as new pump prescription after other insulin therapy ≥6 months prior to index date. Daily insulin dosages were calculated based on prescriptions and the refill data. Patients with implausible values of >100 IU per day were excluded. Furthermore, the type of the most frequent needle prescriptions was assessed (teflon or steel). Finally, prescriptions (Anatomical Therapeutic Chemical (ATC) Classification System) of thyroid therapeutics (ATC H03A), antiepileptics (ATC N03), antidepressants (ATC N06), antihypertensives (ATC C03, C07, C08, C09) and lipid-lowering drugs (ATC C10) were assessed. Discontinuation of insulin pump therapy was defined as switch to other insulin therapies (rapid acting, basal, pre-mixed insulin, insulin pens).

2.3. Statistical methods

Differences in characteristics of patients with and without discontinuation were evaluated using age- and sex-adjusted regression models with indicator variables for the various parameters. The analysis of discontinuation-free "survival" was carried out using Kaplan–Meier estimates and log-rank tests. A multivariate logistic regression model was fitted with pump discontinuation as dependent variable during 12 months after index date. Age, sex, daily insulin dosage, type of insulin needle, and specific co-therapy with thyroid therapeutics, antiepileptics, antidepressants, antihypertensives and lipid-lowering drugs were included as independent variables. Two-sided p-values of <0.05 were considered as statistically significant. All analyses were carried out using SAS 9.2 (SAS Institute, Cary, USA).

3. Results

After applying the inclusion criteria, 2452 patients with new-onset insulin pump prescriptions in 2009–2010 were selected. The age-specific characteristics of the study population are given in Table 1. About 80% of patients used teflon needles with no difference between age groups. The median daily insulin dosage was 40 IU, which was almost twice as high in the age group 18–24 years than among those <6 years of age. Overall, 14% received thyroid hormones or antithyroid preparations with a strong increase with age. Antiepileptic drugs were prescribed in 2% of the patients with a slight age-increase. Antidepressants and lipid-lowering drugs were also rarely prescribed in this patient group. Antihypertensive agent use was observed in 6% of the population and showed a strong increase with higher age.

Overall, 177 (7.2%) had stopped insulin pump treatment within one year. The characteristics of those with and without discontinuation are shown in Table 2. Those who discontinuated pump therapy were slightly older and comprised more females (65% vs 55%; $p = 0.017$). Median daily insulin dosage was similar between the two groups. Those who continuated