Access of children and adolescents with type 1 diabetes to insulin pump therapy has greatly increased in France since 2001

V. Sulmonta,*, V. Lassmann-Vagueb, B. Guercic, H. Hanaired, H. Leblance, E. Leuteneggerf, M. Mihaileanug, N. Tubiana-Rufih, The French pediatric PUMP group1

a Service de pédiatrie A, American Memorial Hospital, CHU de Reims, 49, rue Cognacq-Jay, 51092 Reims cedex, France
b Centre médical Paul-Paret, 13015 Marseille, France
c Hôpital Jeanne-d’Arc, CHU Nancy I, 54201 Toul, France
d Hôpital Rangueil, CHU, 31059 Toulouse, France
e Hôpital Saint-Louis, CHU, 75010 Paris, France
f ABR Pharma, 75002 Paris, France
g VitalAire, 75341 Paris, France
h Hôpital Robert-Debré, AP–HP, 75935 Paris, France

Received 1st February 2010; received in revised form 11 July 2010; accepted 19 July 2010
Available online 13 December 2010

Abstract

Aim. – Insulin pump therapy is an emerging option in the management of type 1 diabetes (T1D), but it often remains unused. For this reason, in 2007, a French national survey was carried out to update the frequency of insulin pump use in the paediatric population compared with a previous survey done in 2001.

Methods. – The present survey was performed in hospital departments involved in paediatric diabetes management (n = 67) and in adult departments involved in adolescent diabetes management (n = 113). The number of T1D children (age < 18 years) treated in each department, with or without the use of insulin pump, and the number of insulin pump therapies initiated during the previous year were collected.

Results. – A total of 60 paediatric and 28 adult centres responded, involving 9073 T1D children and adolescents (93% in paediatric departments). Of these patients, 1461 (16%) were treated by insulin pump, 89% of which were managed in paediatric centres. However, pump use was more frequent in adult than in paediatric centres (32% versus 18%, respectively). Also, 38% of insulin pumps were initiated during the year prior to the survey. In addition, in 2001, 140 children were treated with insulin pump in 13 paediatric centres (versus 56 centres in 2007).

Conclusion. – The number of centres using insulin pump therapy for diabetic children and the number of children treated by insulin pump were increased fourfold and 10-fold, respectively, from 2001 to 2007, indicating greater access to pump therapy in the French paediatric population. The present survey is still ongoing to evaluate the decision-making criteria that influence the initiation of insulin pump therapy in T1D paediatric patients.

© 2010 Published by Elsevier Masson SAS.

Keywords: Type 1 diabetes mellitus; Children; Adolescents; Insulin pump therapy; CSII

Résumé


Objectif. – L’utilisation de la pompe à insuline est une thérapie émergente encore insuffisamment proposée. Nous avons conduit une enquête nationale pour actualiser les données concernant la fréquence d’utilisation de la pompe à insuline chez les enfants diabétiques de type 1 (DT1), suite à une précédente enquête réalisée en 2001.

Méthodes. – L’enquête a été conduite en 2007 dans des services hospitaliers de pédiatrie (n = 67) ou de diabétologie pour adulte (n = 113). Ont été renseignés : le nombre total d’enfants diabétiques de type 1 (âge < 18 ans) suivis, le nombre d’enfants traités par pompe à insuline et le nombre de traitements par pompe initiés l’année précédente dans chaque centre.

© 2010 Published by Elsevier Masson SAS.

Keywords: Type 1 diabetes mellitus; Children; Adolescents; Insulin pump therapy; CSII

Résumé


Objectif. – L’utilisation de la pompe à insuline est une thérapie émergente encore insuffisamment proposée. Nous avons conduit une enquête nationale pour actualiser les données concernant la fréquence d’utilisation de la pompe à insuline chez les enfants diabétiques de type 1 (DT1), suite à une précédente enquête réalisée en 2001.

Méthodes. – L’enquête a été conduite en 2007 dans des services hospitaliers de pédiatrie (n = 67) ou de diabétologie pour adulte (n = 113). Ont été renseignés : le nombre total d’enfants diabétiques de type 1 (âge < 18 ans) suivis, le nombre d’enfants traités par pompe à insuline et le nombre de traitements par pompe initiés l’année précédente dans chaque centre.

* Corresponding author. Tel.: +33 0 3 26 78 81 99; fax: +33 0 3 26 78 46 48.
E-mail address: vsulmont@chu-reims.fr (V. Sulmont).

1 Complete list of participants is available in the acknowledgements section.
1. Introduction

Type 1 diabetes (T1D) is a chronic disease with a major impact on quality of life, as it requires intensive medical treatment and follow-up. Continuous subcutaneous insulin infusion (CSII) using an insulin delivery pump is an effective therapy for T1D patient management. Indeed, international guidelines recommend this option when glycated haemoglobin (HbA1c) targets are not achieved, when there are too many hypoglycaemic episodes or when patients are very young [1–3]. In the paediatric population, studies have shown that CSII treatment reduces severe hypoglycaemic episodes, achieves long-term efficacy and is well tolerated [4–6]. Furthermore, the use of the pump optimizes quality of life while preventing the risk of therapeutic non-compliance [7].

Although the use of CSII has steadily increased worldwide, few specific data are available regarding its frequency of use. In the European paediatric population, this ranges from <2% in some countries (such as Spain and Great Britain) to 14% in Germany and Austria, and 20% in Sweden [8–10]. For data in the French paediatric population, a national survey was carried out in 2001, a year after the nationwide implementation of pump reimbursement. At that time, <2% of T1D children and teenagers aged <18 years were using CSII treatment [11]. Thus, the present study was performed to update the data regarding the frequency of CSII use in the French paediatric population.

2. Patients and methods

In 2007, a national survey was performed in French hospital units involved in paediatric and adolescent diabetes management. A questionnaire was sent to 67 paediatric and 113 adult diabetes centres involved in the management of adolescent patients asking for three figures:

1. the total number of T1D patients aged <18 years treated at the centre;
2. the number of T1D children or adolescents treated by insulin pump;
3. the number of insulin pump treatments initiated during the previous year in that patient population.

These data were collected and compared with the previous (2001) national survey performed in French paediatric centres. Continuous variables were presented as arithmetical means ± S.D.; categorical variables were expressed as frequencies or percentages. Differences between centres according to their structure (academic or non-academic) and size were assessed by the Kruskal–Wallis test, and \( P \leq 0.05 \) indicated statistical significance.

3. Results

Altogether, 60 paediatric (89%) and 28 (25%) adult diabetes centres responded to the survey. Among them, only 22 adult centres were actively involved in adolescent diabetes management. The responding centres declared taking care of a total of 9073 young patients: 93.4% (\( n = 8477 \)) in paediatric units and 6.6% (\( n = 596 \)) in adult units (Table 1). This sample represents 60–75% of the national estimated population of children and adolescents with T1D in France [12].

The median (minimum–maximum) number of patients in the paediatric cohort managed by paediatric centres was 85 (15–650) compared with 23 (1–60) managed by adult centres. The paediatric centres were also divided equally according to the size of the cohort of T1D children (<50, 50–100, 100–200 and >200 patients managed by 24%, 29%, 25% and 22% of centres, respectively). Table 1 shows the total number of diabetic children and adolescents in the French paediatric and adult centres, and the proportion of patients using CSII among them.

Of the 9073 paediatric patients with diabetes, 1461 (16%) were treated by CSII at the time of the survey. CSII treatment was being used by 1304 and 157 children in the paediatric and

---

**Table 1**

| Total number of type 1 diabetic children and adolescents, and number of patients (% means ± S.D., minimum–maximum), using continuous subcutaneous insulin infusion (CSII) in French paediatric and adult centres. |
|---------------------------------|-----------------|-----------------|
| **Pediatric center** (\( n = 60 \)) | **Adult center** (\( n = 22 \)) |
| **Patients with diabetes (n)** | 8477 | 596 |
| **Patients with CSII treatment (n)** | 1304 | 157 |

<table>
<thead>
<tr>
<th><strong>Per center</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients with diabetes (n)</strong></td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Min–max</td>
</tr>
<tr>
<td><strong>Patients with CSII treatment (%)</strong></td>
</tr>
<tr>
<td>Mean ± S.D.</td>
</tr>
<tr>
<td><strong>Min–max</strong></td>
</tr>
</tbody>
</table>
adult centres, respectively, and 93% of the paediatric centres were using CSII therapy for the management of T1D. Only four of the responding paediatric centres were not using CSII, and these four centres managed 46 ± 5 (mean ± S.D.) patients.

The mean rate of insulin pump therapy use per centre was 18% (±14%) and 32% (±22%) in paediatric and non-paediatric units, respectively. The geographical locations of the centres using insulin pumps in each region of France are shown in Fig. 1.

The mean frequency of CSII use did not differ between academic and non-academic paediatric centres (17.7 ± 14.8% and 18.4 ± 12.8%, respectively, of their diabetic populations). Furthermore, no significant variation in the rate of insulin pump therapy was observed according to the size of the centres (Fig. 2). Nevertheless, after excluding the centres not offering insulin therapy to their patients, the frequency of insulin pump use remained extremely variable, ranging from 1.3 to 53% of T1D paediatric patients.

Moreover, in paediatric centres, 38% (n = 491) of CSII treatments had been initiated during the year prior to the survey.

Compared with the results of the 2001 survey, the number of paediatric patients treated by pump in paediatric centres had increased nearly 10-fold within 6 years, while the number of paediatric centres using pump therapy had increased nearly fourfold (Table 2).

4. Discussion

In the paediatric population, the use of CSII treatment has become progressively more widespread around the world. In France, implementation of pump reimbursement has been in effect since 2000. The present 2007 survey provides information on the use of the insulin pump in a cohort that represents a significant and realistic overview of the present management of childhood T1D in France.

In the 2007 cohort, it appears that 16% of children and adolescents with diabetes were currently being treated by insulin pump therapy, and mainly in paediatric centres. However, over the past 6 years, the massive increase of CSII treatment use is most likely a recent trend, as 38% of these insulin pump treatments were initiated within the previous year. Medical training programmes for paediatric caregivers following the implementation of pump reimbursement and the development of appropriate medical care systems have contributed to this increased use, and improved the access of children in all regions of the country to pump therapy. Future surveys are now necessary to evaluate the progression of the use of CSII treatment over the next few years.

No significant influence of either the nature of the paediatric centres taking care of diabetic young people, or their size or structure (academic or non-academic), was observed on the rate of CSII use. In addition, the frequency of CSII use showed wide variability from one paediatric centre to another as well as among non-paediatric centres, which managed mostly adolescents compared with the paediatric centres.

Although the present data do not offer any information on decision-making criteria, the practitioner’s own experience is likely to constitute the most significant parameter influencing the decision to initiate (or not) insulin pump therapy in young T1D patients who have either been previously treated or are newly diagnosed [13]. Historically speaking, the rate of CSII use has depended on the given centre’s structure and organization.

<table>
<thead>
<tr>
<th>Date of the survey</th>
<th>2001</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric center using CSII treatment (n)</td>
<td>13</td>
<td>56</td>
</tr>
<tr>
<td>Patients treated with CSII treatment (n)</td>
<td>140</td>
<td>1304</td>
</tr>
</tbody>
</table>
and such differences might explain the wide discrepancy across centres. Also, in parallel with the widespread use of insulin delivery devices, clinical and environmental decision-making criteria need to be considered. In a recent French survey [14] investigating the modalities and goals of insulin therapy in an adult diabetic cohort, it was found that irregular habits, and frequent and severe hypoglycaemic or ketoacidosis episodes, were among the main reasons cited for its use. Other therapeutic goals were to improve diabetes monitoring and to reduce hypoglycaemic excursions.

However, the use of external pumps in a paediatric population is more frequent than in T1D adults in France, and the particular characteristics of T1D in the former population could be behind their greater use of CSII treatment. For this reason, the present French paediatric survey is currently ongoing in an attempt to elucidate the decision-making criteria for insulin pump therapy in paediatric centres. Such a study would also allow more accurate evaluation of glycaemic control, therapeutic education, monitoring and follow-up of paediatric patients using pump therapy in France.

5. Conclusion

Altogether, 16% of French T1D children and adolescents were being treated by pump therapy in France in 2007. This rate reflects a increase of nearly 10 times within 6 years, and is among the highest in Europe in paediatric patients and two times higher than in adult patients in France. Insulin pump therapy appears to be an increasingly popular therapeutic option in France. It is well suited for the specific characteristics of T1D paediatric patients (instability and insufficiency of glycaemic control), and is also able to improve quality of life. Access to pump therapy by paediatric patients is now considerably easier across the entire nation and its territories. The present national survey is currently ongoing to evaluate the specific indications for insulin pump therapy, treatment modalities and outcomes in the French paediatric population.

Conflict of interest statement

The authors have declared no conflicts of interest relevant to this article.

Acknowledgements

We gratefully acknowledge the following physicians of the French Paediatric Pump Group for their participation in this study.

In paediatric centres: I. Abadie, Creteil; C. Abdelrahman-Gambert, Poitiers; E. Baechler-Sadoul, Nice; P. Barat, Bordeaux; S. Baron, Nantes; A.M. Bertrand, Besançon; E. Bisnhuth, Paris; C. Blond-Metz, Brest; E. Bonnemaison-Gilbert, Tours; H. Bony-Trifunovic, Amiens; M.N. Bortoluzzi, Nice; M. Carre, Bayonne; M. Cessans, La Rochelle; G. Cottancin, Sallanches; R. Coutant, Angers; H. Crosnier, St-Germain-en-Laye; F. Dalla-Vale, Montpellier; S. Danner-Wolf, Strasbourg; C. Delcroix, Paris; A.C. Dieckmann, Blois; C. Durand, St-Julien-en-Genevois; N. Faure, Tours; P. Ferre, Montreuil; B. Gallois, Metz; P. Garandeau, Saint-Denis, La Réunion; H. Gouedard, Morlaix; S. Jellimann, Vandœuvre-les-Nancy; M. Jullien, Troyes; D. Kauffmann, Caen; F. Kurtz, Saint-Avold; D. Laplane, Marseille; C. Laurent-Athalin, Macon; C. Le Tallec, Toulouse; A. Lehnhrt, Montargis; A. Lienhardt, Limoges; G. Locuille, Dunkerque; N. Lucidarme, Béziers; L. Mathivon, Meaux; R. Maudinas, Dijon; C. Mignon, Boulogne/Seine; F. Monceaux, Orléans; B. Mukwamu, Soissons; C. Naud-Sauvadou, Lorient; M. Nicolini, Lyon; S. Nivot-Adamiac, Rennes; C. Orzechowski, Bry-sur-Marne; C. Petit-Bibal, Paris; J. Peyraud, Libourne; E. Questiaux, Aulnay-sous-Bois; R. Reynaud, Marseille; O. Richard, Saint-Étienne; J.J. Robert, Paris; P. Talon, Montfermeil; D. Terral, Clermont-Ferrand; H. Téstudard, Annemasse; V. Ventura, Nimes; M. Vercherat, Chambéry; J. Weill, Lille; M.C. Wieliczko, Rouen; and H. Ythier, Roubai.

In adult diabetology centres: G. Arnault-Ouary, Vannes; E. Benamo, Donmartin-les-Toul; C. Bressot, Chalon/Saone; P. Bressot, Vals-les-Bains; S. Clavel, Le Creusot; P. Cuny, Thionville; A. Cuperlier, Charleville-Mezieres; P. Darsy, Annecy; F. Desbiez, Clermont-Ferrand; H. Dubourg, Merignac; L. Dusselier, Metz; C. Fermont, Lille; T. Gabreau, Auxerre; P. Hassler, Haguenau; J.P. Hautot, Tulle; D. Houlbert, Alençon; P. Jan, Bar-le-Duc; V. Kerlo-Gillard, Nantes; F. Latil-Plat, Avignon; G. Matejka, Cabestany; G. Ozenne, Rouen; F. Penfornis, Besançon; F. Poncet-Laurens, Albi; E. Renard, Montpellier; I. Rivoal, La Roche/Yon; M. Rodier, Nimes; A. Schleitzer-Mari, Laval; and O. Verrier-Mine, Valenciennes.

References


