The impact of anxiety and depression on patients within a large type 1 diabetes insulin pump population. An observational study

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Abstract

Background. – Continuous subcutaneous insulin infusion (CSII) is generally successful for patients with type 1 diabetes in improving glycaemic control, alleviating the burden of hypoglycaemia and improving the quality of life. There is however, a cohort of patients who fail to thrive on pump therapy and psychological factors or “brittleness” have been postulated as a cause for this. We aimed to assess the extent and spectrum of psychological illness in a population of pump patients.

Methods. – We analysed the patient data and records of 350 patients with type 1 diabetes who formed the insulin pump patient population from a large teaching hospital and compared them with an age and sex matched reference population of patients with type 1 diabetes. We quantified the prevalence of anxiety and depression before and after the initiation of pump therapy and looked to see whether this had implications for changes in glycaemic control and hypoglycaemia reduction.

Results. – Mental health problems amongst patients selected for CSII occur significantly more frequently than in a matched population with type 1 diabetes (51% vs 40%, P<0.05). Depression and anxiety were more prevalent in the CSII group. Of those with mental health problems, there is a tendency to do less well in terms of improvement in glycaemic control as indicated by changes in HbA1c and hypoglycaemia reduction – the latter most notable in patients with co-existent depression.

Conclusions. – The incidence and prevalence of mental health problems in individuals with diabetes is greater than that of the general population. In patients who are selected to go onto insulin pump therapy, the incidence is again greater. We have shown that in those with psychological illness, they tend to do less well in terms of improving their overall diabetes control. These results suggest that CSII may not be a suitable route of therapy alone for all of those who would fulfill the traditional criteria and suggest that psychological assessment, therapy and intervention may be an altogether more appropriate or alternative or adjunctive course of action in supporting their diabetes self management. The wider implication is that all the patients with diabetes should be regularly assessed for psychological problems and that there needs to be greater psychology/psychiatric support available to intensive diabetes clinics, especially as part of a pre-pump pathway.

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Keywords: Continuous subcutaneous insulin infusion (CSII); Type 1 diabetes; Glycaemic control; Anxiety; Depression

Résumé

L’impact de l’anxiété et de la dépression chez les patients diabétiques de type 1 avec une pompe à insuline. Une étude observationnelle.

Contexte. – La perfusion de l’insuline sous-cutanée en continue (CSII) contribue chez les patients diabétiques de type 1 à améliorer le contrôle glycémique, à diminuer les hypoglycémies et améliorer la qualité de vie. Il y a cependant des patients qui restent en échec sous pompe. On pense que des facteurs psychologiques peuvent en être la cause. Nous avons cherché à évaluer l’importance des facteurs psychologiques dans une population de patients diabétiques de type 1 utilisant une pompe à insuline.

Métodes. – Nous avons analysé les données et les dossiers de 350 patients diabétiques de type 1 utilisant la pompe à insuline dans un grand hôpital, et avons comparé ces données avec celles d’un groupe de diabétiques de type 1 appariés pour l’âge et le sexe. Nous avons quantifié la prévalence de l’anxiété et de la dépression avant et après l’initiation du traitement par pompe et avons étudié l’impact des facteurs psychologiques sur le contrôle glycémique et les hypoglycémies.

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1. Introduction

Insulin pump therapy represents a significant technological leap forward in the management of type 1 diabetes. It has been shown to lead to improvements in glycaemic control, a reduction in hypoglycaemia frequency and severity, improved quality of life and increased feelings of normalcy for many – irrespective of indication [1,2]. However, not everyone responds successfully. It is important to recognise and ask the question, why do some people fail to thrive on pump therapy? What are the barriers? Do psychological factors precipitate a failure to respond to treatment?

In terms of chronic disease management, there is a corollary from the world of respiratory medicine with those patients who have “brittle” asthma. This is a condition characterised by difficult to manage disease, highly variable peak expiratory flow rates, frequent exacerbations, re-admissions to hospital and high care demands. Brittle asthma is associated with increased psychological morbidity and altered strategies for coping with deteriorating asthma symptoms. It is well recognised by respiratory physicians that attention should be paid to the presence of such factors in the management of such patients [3-4].

A subgroup of these patients may be treated with subcutaneous infusion therapy in the form of Bricanyl (Terbutaline) pumps (Fig. 1). These provide a prolonged, background infusion of bronchodilator medication to keep asthma under control. It has long been recognised that there is a high degree of psychological and social morbidity within this subgroup of patients and it is not always clear whether this is a cause or consequence of their vicarious disease state [3].

There has been relatively little work so far undertaken in the field of psychopathology in insulin pump patients. It is not clear whether this is a significant problem and if so, whether there are implications for the control of their diabetes whilst on a pump. An early paper from Pickup et al. in 1983 suggested that hormonal or psychological factors may play a part in patients with “brittle” diabetes regulated by CSII [5]. At that time there was a paucity of research on the subject. One study by McCaul et al. looked at factitious self-manipulation of insulin pumps by adolescents with type 1 diabetes [6]. Another study by Seereiner et al. looked at the attitudes of young people towards insulin pump therapy and the reasons behind rejection and discontinuation of CSII [7]. They found that uncommonly social and psychological factors were common. Hilliard et al. showed that there were psychosocial benefits of pump therapy compared with the conventional treatment of diabetes in terms of quality of life improvements; however, they did exclude from their study those individuals with serious mental health concerns. They made it clear that when transitioning younger patients to pump therapy, it is important to consider the developmental, psychosocial and demographic factors of individual patients. They suggest that these dimensions may aid in determining ideal candidates for the pump – however, this is not something that we generally tend to do in clinical practice. As if in answer to this issue, Sanfield et al. showed how they used a protocol for outpatient screening of those patients who they thought would be more suitable for initiation of pump treatment [8]. They developed a structured system with trial pump use, which identified patients who would start CSII and stay on it for two and a half years. But what was not clear from the study, was their exclusion criteria. Who were the pre-pump failures and why? Why were some patients deemed ill-suited?

Therefore, to what extent are psychological problems an indication for going on a pump in the first place; are they a driver of behavioural problems that have led to poor glycaemic control? Are all patients suitable for a pump in the first place – can we predict who will do less well? Does CSII bring about psychological distress? Does this all potentially have an effect on outcomes? Several researchers, including Pickup, have considered questions such as those previously [1,2,9].

The King’s College Hospital Diabetes service has a special interest in intensified insulin therapy and runs a tertiary referral service for patients with unstable diabetes, particularly problematic hypoglycaemia. Our current study explores the types of psychological/mental health issues which can occur in a population of pump patients and assesses whether they differ significantly from the average type 1 diabetes population attending the diabetes clinic in a teaching hospital setting. What are
the types of psychiatric disease common in the general diabetes and the pump population?

This is an important issue given that the recent NICE guidance suggests that the increasing numbers of patients are likely to fulfill the criteria of suitability for CSII [10], but diabetes healthcare professionals need to have more awareness of a patient’s potential psychological problems from the outset; are they a driver of behavioural and coping problems that have led to poor glycaemic control; are they suitable/able to cope with a pump; have they explored the roots of their sub-optimal control?

“Recurrent severe hypoglycaemia may lead you to insanity (sic) as much as insanity may drive you to have recurrent severe hypoglycaemia” [11].

Essentially, we aimed to examine the prevalence and spectrum of psychopathology in our population of pump patients in a major London teaching hospital and hope that this will help us to identify those less likely to succeed with insulin pump therapy and address common psychological conditions.

2. Methods

Our aim was to quantify the extent of mental health problems in the insulin pump population and then, compare the results with a matched group of non-pump patients with type 1 diabetes.

The information relating to patients on insulin pump therapy is maintained on a continually updated database which includes basic demographic data, information on the duration of diabetes, HbA1c, time on pump therapy, etc. Using the electronic patient records system (EPR), we were able to search for further data pertaining to their pre-existing and ongoing clinical issues, including problems with hypoglycaemia.

From the database, we were able to retrospectively obtain complete data on 350 patients enrolled in the Kings insulin pump service. Using this information, we were then also able to create an age and sex matched population of patients with type 1 diabetes who were not being treated with CSII for purposes of comparison.

In terms of the information collected, we recorded the following variables: sex, duration of diabetes, HbA1c, pre-existing diagnosis of mental health problem and the use of psychotropic medications. We found that there were no significance differences between the groups in terms of the demographics.

We then repeated the data collection exercise when patients attended follow up between 6–12 months later following the initiation of pump therapy to see what changes had occurred over time. We wanted to assess the impact of the presence of mental health problems, such as anxiety and depression on HbA1c and hypoglycaemia outcomes and explore whether there was a significant association in the pump patient group. We applied paired student’s t-test statistical analysis to look at before and after differences in glycaemic control and hypoglycaemia severity in those patients with and without anxiety and depression in order to assess the impact and association.

Potential problems with this method include the accuracy of having a mental health problem and the fact that such disorders exist on a spectrum of severity and can fluctuate with time. Comparing someone having a psychological illness on the basis of their previous records is not the same as an in-depth dependent psychological assessment and this would certainly be difficult to do as part of a retrospective analysis.

3. Results

Table 1 demonstrates the characteristics of the two patient groups and we use the paired student’s t-tests to assess any differences between them.

The groups were of similar ages and gender distribution, as well as duration of type 1 diabetes. The average HbA1c results were similar; however, there did appear to be a greater number of patients with problematic hypoglycaemia (prior to CSII) in the pump therapy and this would be consistent with the fact that this is a major criterion for consideration of CSII treatment. There is also a marked difference in the prevalence of psychological disorders in the pump group, with mental health problems of all types being more significantly more numerous.

Table 1
Characteristics of the two patient populations.

<table>
<thead>
<tr>
<th></th>
<th>Control T1DM group</th>
<th>Pump population</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>38.5 years (♀ 68%)</td>
<td>34.2 years (♀ 68%)</td>
<td>P = 0.07 CI 18.2–71.5</td>
</tr>
<tr>
<td>Gender</td>
<td>58%</td>
<td>68%</td>
<td>10%</td>
</tr>
<tr>
<td>Average duration of diabetes</td>
<td>14.2 years (♀ 51%)</td>
<td>9.3 years (♀ 51%)</td>
<td>P = 0.085 CI 0.8–42.4</td>
</tr>
<tr>
<td>Prevalence of psychological/Psychiatric disorders</td>
<td>40%</td>
<td>51%</td>
<td>11%</td>
</tr>
<tr>
<td>Average HbA1c (mmol/mol)</td>
<td>66 (8.2%)</td>
<td>62 (8.8%)</td>
<td>P = 0.081</td>
</tr>
<tr>
<td>Patients with problematic hypoglycaemia</td>
<td>11%</td>
<td>19%</td>
<td>P &lt; 0.05</td>
</tr>
</tbody>
</table>

Table 2
Distribution of the different types of mental health disorders between the pump population and the matched control group.

<table>
<thead>
<tr>
<th></th>
<th>Control T1DM group (%)</th>
<th>Pump population (%)</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>37</td>
<td>47</td>
<td>10%</td>
</tr>
<tr>
<td>Anxiety</td>
<td>13</td>
<td>18</td>
<td>6%</td>
</tr>
<tr>
<td>Personality disorders</td>
<td>2</td>
<td>2</td>
<td>0%</td>
</tr>
<tr>
<td>Severe needle phobia</td>
<td>4</td>
<td>6</td>
<td>2%</td>
</tr>
<tr>
<td>Chronic fatigue syndrome</td>
<td>4.2</td>
<td>8</td>
<td>3.8%</td>
</tr>
<tr>
<td>Eating disorders</td>
<td>3.5</td>
<td>5.5</td>
<td>2%</td>
</tr>
</tbody>
</table>
Table 3
Effect of depression and anxiety on glycaemic control following initiation of CSII therapy.

<table>
<thead>
<tr>
<th>Hypoglycaemia reduction (%)</th>
<th>Variance (change at 6–12 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump patients with no mental health problems</td>
<td>69</td>
</tr>
<tr>
<td>Pump patients with co-morbid depression</td>
<td>58</td>
</tr>
<tr>
<td>Pump patients with co-morbid anxiety</td>
<td>81</td>
</tr>
</tbody>
</table>

CI: Confidence interval.

Discussion

Diabetes perhaps exemplifies the perfect “bio-psychosocial” model of chronic disease. Substantial research has identified relationships between health behaviours, psychological adjustment, depression, anxiety, parental, family, environment, regimen adherence and glycaemic control [17,18]. Patients on insulin pumps could be viewed as having generally more difficult to control diabetes (for whatever reason) but there is an emerging evidence that psychological factors play an important part in how individuals cope with chronic disease self management [14,15].

Previous studies of the barriers to improving glycaemic control on CSII have not looked at psychological factors per se and do not demonstrate that expectations of increased hypoglycaemia, anticipatory reactions to lifestyle, mistrust of Hba1c results, the hard work associated with good glycaemic control all play a part [16]. It is recognised that the fear of hypoglycaemia is an issue and this needs to be addressed early in the CSII pathway because avoidance strategies have already been learnt and new strategies are needed to change behaviour.

We must also be cognisant of the possibility that the use of CSII itself, an invasive, technological, extra-corporeal treatment modality may be a precipitant of stress and anxiety for individual patients. Commencing insulin pump therapy may be seen as “a sign of failure” and increase the psychological burden of illness behaviour [17]. Fortunately, however in our patient population under study there was only a minimal increase (three patients) rise in the development of new anxiety and depression. Given that this was a retrospective analysis, it is therefore difficult to tease apart the cause for this but such a small increase was not found to be statistically significant and did not confound the results.

Many authorities list contraindications for CSII of which the most important are evidence of poor compliance with current treatment, recurrent failure to attend clinics, inability to follow a treatment plan, unwillingness to calculate meal dosages or to carry out at least four blood glucose tests per day; and evidence of psychiatric conditions [18]. In patients with such contraindications it is thought that there is a strong association with adverse outcomes [19]. However, an earlier study of the King’s patient cohort by Rodrigues et al. in 2005 [20] demonstrated that even outside the traditional indications for CSII, it was still able to confer benefit in some patients.

In the current King’s pump population, we have shown that there is a high incidence of mental health disorders when...
comparing with a type 1 diabetes control population who have no recorded psychological or psychiatric issues. There is a specifically strong and significant association of anxiety and depression in patients on insulin pump therapy, in comparison with their matched peers. The presence of anxiety and depression relate to less successful outcomes (those which one would normally expect following the commencement of CSII) in terms of improving glycaemic control. Interestingly patients with anxiety appear to do better in terms of hypoglycaemia rate/severity reduction.

What is not clear is whether this higher frequency of psychological illness is a cause or consequence of poor diabetes control, but certainly its presence is one that needs to be identified and addressed. In 1983, Pickup noted that there seemed to be a high proportion of obvious family problems in patients with hard to control (brittle) diabetes (e.g. patient or parents divorced, parent/sibling/spouse conflict, over-protective family) [9]. It was suggested that an abnormal degree of, or response to stress may contribute to counter-regulatory hormonal and metabolic swings and to impaired subcutaneous blood flow and hence, insulin absorption. This is a challenging dynamic to investigate in great detail, and again it is difficult to distinguish cause from effect. Any such studies would also need to use standardised assessments of psychosocial status to make meaningful data collection and interpretation.

The presence of depression and anxiety in a patient with diabetes may well lead to hopelessness, helplessness, a lack of ownership of their condition, a lack of interaction with the multidisciplinary care team, abnormal coping strategies, feelings of worthlessness and a denial of their chronic condition [21,22]. Treatments for such problems come in many forms and may have variable success rates (both generally and in the context of diabetes-related outcomes). The important issue here is that such issues are recognised and the need for appropriate highlighting.

Potential problems with our data relate firstly to the issue of ethnicity. Kings College Hospital is based in South London and the diabetes service sees a disproportionate number of patients of Afro-Caribbean origin although we did not include this information in our analysis. There are reports of different prevalences of mental health problems in patients of different ethnic groups [23]. Secondly it is also unclear whether the higher rate of mental health problems in a group of patients with difficult to control diabetes is a "sticking plaster" effect, being as it is a tertiary referral centre which seeks a significant number of patients with complex and "treatment-resistant" diabetes. One might assume that the incidence of mental health problems would therefore be higher in this setting. An aim of future work is to control for this factor by repeating our analysis in a district general hospital diabetes care center setting with a large pump service.

Further problems relate to the fact that this is a retrospective observational study and the issue of definitions of a mental health problem is a variable one. Undoubtedly, there is a large burden of mental health problems in the diabetes population (both diagnosed and undiagnosed). What is apparent is that patients within the pump population who have a co-existent label of psychopathology (activity and severity unknown) do less well than the control group. This should not mean that CSII is necessarily contraindicated in these patients, it instead suggests that we need to be more holistic in our chronic disease management and be aware of such issues and that alternative systems of insulin delivery are not the complete answer to an individuals problems [19,24].

5. Conclusions

We need to be careful about selecting patients for insulin pump therapy [8]. There is a high prevalence of mental health problems within this group, over and above the standard population of type 1 diabetes patients. It is not clear whether this association is a cause, consequence or chance finding.

Adequate psychological assessment needs to occur to eluciate whether mental health problems are contributing to the suggested need for pump treatment. We propose that by identifying early those patients who are less likely to do well on a pump, i.e. those with depression rather than anxiety, they can be assertively directed in the direction of psychological therapy and emotional peer support (as an alternative or adjunctive treatment) plus or minus a pump as appropriate. It should be considered that in a subgroup of patients with psychopathology an insulin pump represents a “sticking plaster” rather than a cure for the underlying issues.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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