

Experiences of people with diabetes using animal insulin in a pump: A survey

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Article points

1. A study was undertaken to explore the experiences of people with type 1 diabetes who use animal insulin in a pump, and to ascertain the feasibility of such practice.
2. Participants reported that successful use of animal insulin in pump therapy requires a good level of knowledge by the person with type 1 diabetes.
3. People using animal insulin (either porcine or bovine) in their pump were strongly committed to their insulin choice, and had based the decision on personal experience.
4. Participants reported varying levels of support by healthcare professionals for their choice to use animal insulin in a pump.

Key words

- Animal insulin
- CSII therapy
- Insulin pump
- Survey

Author details can be found at the end of this article.

Continuous subcutaneous insulin infusion, also known as insulin pump therapy, is becoming increasingly common in the management of people with diabetes. This article documents the experiences of a small group of people with type 1 diabetes ($n=9$) who use animal insulin in a pump. People using animal insulin (either porcine or bovine) in their pump were strongly committed to their insulin choice, and had based the decision on personal experience. All the people contributing to the survey found the use of animal insulin in a pump practicable as long as its activity profile was taken into account. Participants reported varying levels of support for their unusual choice, the majority feeling well supported by their healthcare team.

There is growing body of literature on the place of continuous subcutaneous insulin infusion (CSII) – also known as insulin pump therapy – in the management of type 1 diabetes. The technology has been shown to improve glycaemic control without exacerbating severe hypoglycaemia (NICE, 2008). Evidence on the relative merits of using animal, human and analogue insulins in pump therapy is less extensive, however, and does not compare their suitability for insulin pump use.

The sparsity of evidence relating specifically to the use of animal insulin in CSII therapy, combined with a lack of experience by healthcare professionals in using animal insulin in pumps, may mean that this combination is perceived as irregular and unusual. This article explores the evidence surrounding the use of animal insulin in CSII therapy, and describes a study

that was undertaken to ascertain the feasibility of using animal insulin in a pump. It sought the experiences of people with type 1 diabetes to see whether the commonly cited reasons for not using animal insulin in an insulin pump (discussed below) were seen in practice.

Animal insulin and CSII therapy: The evidence

The available evidence suggests that, while their use has declined, animal insulins have a continuing place in the repertoire of diabetes therapies and offer additional choice to people with diabetes (Richter and Neises, 2005; Teuscher, 2007), a minority of whom express a very strong preference for animal insulins (Becker, 1998).

As stated previously, published evidence relating specifically to the use of animal insulin

in CSII therapy is sparse. Most descriptions of the use and relative benefits of CSII therapy, such as those by Cefalu (2004) and Jeitler et al (2008), post-date the widespread use of animal insulin. As a result, only three articles were found which specifically addressed the use of animal insulin in a pump (Mecklenburg and Guinn, 1985; Weiland, 1985; Eichner et al, 1988). Of these, only one indicated any potential problems with the use of animal insulin in pumps, namely a hypothetical tendency to block the cannula (Eichner et al, 1988), based solely on a theoretical consideration of the different solubilities of the insulin molecules. Only one published account of an actual problem – soreness around the infusion site – relating to the use of some animal insulins was found (Mecklenburg and Guinn, 1985).

The relative lack of evidence on the use of animal insulins in CSII therapy is likely to reflect the decline in animal insulin use during the 1990s, along with a concurrent increase in insulin pump use. No evidence was found, either in the literature or in the present study, of definitive reasons to avoid the use of animal insulins in pump therapy.

Some potential factors that could influence insulin choice

Hypoglycaemia is a common side-effect of insulin therapy, and is an undesirable extension of the therapeutic action of all insulins. It is a source of anxiety for people with diabetes (Wild et al, 2007), and might, therefore, be expected to be an important factor influencing an individual's insulin choice.

In order to minimise the impact of hypoglycaemia, early warning symptoms are desirable (Forbes, 2001). Reduced or absent warning signs have been reported following a switch to a different insulin, sometimes associated with, but not exclusive to, the introduction of human insulin (Teuscher, 2007). The slower rate of absorption of animal insulins may be associated with a slower onset of hypoglycaemia and a corresponding increase in detection of warning signs (Teuscher, 2007). A reduction of warning signs has been noted in intensive insulin regimens, such

as CSII therapy (Porte et al, 2003), and the potential for minimisation of the reduction in hypoglycaemic warning signs through the use of animal insulin may be particularly attractive to certain people with diabetes.

Other side-effects associated with insulin infusion include lipodystrophy (Radermecker et al, 2007) and cannula blockage of pumps (Eichner et al, 1988), neither of which are confined to animal insulin (Brange and Langkjoer, 1997). While a greater tendency to inflammation at the infusion site has been linked to animal insulin, this problem can be prevented by using buffered, rather than unbuffered, animal insulin (Mecklenburg and Guinn, 1985).

A survey of people with diabetes using animal insulin in CSII therapy

Aims and objectives

A study was undertaken to find out about the experiences of people with type 1 diabetes who use animal insulin in a pump, and to ascertain the feasibility of such practice.

Methodology

A thematic synthesis approach was used, in which open responses were recorded and later analysed and grouped to identify common themes. The analysis was made of a small number of case studies, with a specific focus on patient perceptions of the feasibility of using animal insulin in a pump (Thomas and Harden, 2008). The findings are uncorroborated by clinical evidence, instead recording only participants' perspectives. Such views are, nevertheless, important since their perception impacts both on the management of their condition and their engagement with healthcare providers (Chatterjee, 2006).

The study captured participant observations on quality of life, which is recognised as an important feature of glycaemic control and one that is distinct from clinical outcomes (Colquitt et al, 2004; Barnard et al, 2007; NICE, 2008).

The study relied on volunteer participants recruited through a request circulated by two diabetes support groups in the UK, plus an online support group for insulin pump users and five major insulin pump centres

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2. The slower rate of absorption of animal insulins may be associated with a slower onset of hypoglycaemia and a corresponding increase in detection of warning signs.
3. A study was undertaken to find out about the experiences of people with type 1 diabetes who use animal insulin in a pump, and to ascertain the feasibility of such practice.

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1. All but one of the respondents had used other types of insulin and had based their decision to use animal insulin on a comparison of their experiences with different types of insulin, thereby acting to some extent as their own control group.
2. Respondents were asked about their duration of diabetes, their history of insulin use, including the reasons for their current choice of insulin, and their decision to use a pump.
3. Seventeen responses were received, nine (53%) from people using animal insulin via an insulin pump (eight porcine insulin, one bovine insulin). One further person who used porcine insulin in a pump was identified by one of the respondents, but the individual named did not respond to a request to participate.

in the UK. Ethical approval was granted by the Research Ethics Committee of Keele University, Staffordshire.

All but one of the respondents had used other types of insulin and had based their decision to use animal insulin on a comparison of their experiences with different types of insulin, thereby acting to some extent as their own control group. Respondents replied by email or phone, so little can be ascertained about their demographic representativeness, beyond the fact that responses were from across England, including Devon, Tyneside and Warwickshire. All except one person was contacted through self-help groups, which may be indicative of the respondents' commitment to managing their condition.

The sample size is small and composed of those who elected to respond to the request for information. Although the data-gathering method only captured self-selected respondents, this feature of the study should be seen in the context of how people with diabetes obtain insulin pumps. Since all users have decided to opt for CSII therapy, in preference to injections, all adult pump users can be considered self-selected.

A request for volunteers to talk about their experiences of using animal insulin in a pump was placed in the *Diabetes UK magazine Balance*, the newsletter of the International Insulin Dependent Diabetes Trust, on the Insulin Pumpers UK forum and sent to five regional centres, asking that the request be forwarded to any relevant people with diabetes. Respondents were offered the opportunity to complete a questionnaire or to answer the questions by phone. Those who chose the latter format had the transcribed questionnaire sent to them for agreement before the data were used.

Respondents were asked about their diabetes type, duration, their history of insulin use, including the reasons for their current choice of insulin, and their decision to use a pump. The questions asked are summarised in *Table 1*.

Results

Sample size

Seventeen responses were received, nine (53%) from people using animal insulin via an insulin

pump (eight porcine insulin, one bovine insulin). One further person who used porcine insulin in a pump was identified by one of the respondents, but the individual named did not respond to a request to participate. The remaining respondents either had experience of using animal insulin before using a pump (five) but were currently using a pump with a non-animal insulin, or were interested in the possibility of trying animal insulin in a pump (three).

Even allowing for the methodology, which cannot provide an exhaustive list of users, the number of respondents using this particular combination of therapies seems unduly small.

It is difficult to comment on this with precision, however, as there are no published data on the number of people using animal insulin. In 2006 the number was estimated to stand at around 30 000, decreasing to 15 000 in 2010 (Wilson, 2010) – the reduction in use being in keeping with a generalised fall in use of all soluble insulins. The extent of the decline is evident in a NICE (2009) report, which indicated that the use of all soluble insulins fell by 14% in 2008–9. Nevertheless, even allowing for much uncertainty in the number of users of animal insulin, if pump use among this population was comparable to that of the wider type 1 population (approximately 1%; NICE, 2008), appreciably more than the 10 people identified would be expected to be using this combination.

The apparent under-representation of animal insulin used in a pump may reflect the differences between the two existing paradigms for endogenous insulin administration – namely, injection and infusion. The gradual onset of animal insulin preparations means that they are conceptually suited to administration via subcutaneous injection, whereas pumps are typically used to deliver frequent, minute doses of rapid-acting insulin.

The apparent discrepancy in the use of animal insulin in pumps may also be linked to a disjunction in practice: the late 1980s and 1990s saw a decline in use of animal insulin and a simultaneous growth in insulin pump use. In association with these trends, there may have been a shift in staff expertise, with a decline in

familiarity with animal insulin accompanied by a growth in knowledge about insulin pump use. This possible explanation is in keeping with the previously described paucity of literature on animal insulin use in pumps.

Incidence of technical difficulties

While some early literature suggested that the lower solubility of animal insulin might lead to difficulties with insulin crystallisation in infusion sets (Weiland, 1985; Brange and Langkjoer, 1997), none of the respondents in the present study reported any problems with this. Nor were difficulties at the injection site reported; indeed, one respondent reported an improvement in soreness at the cannula site when switching to porcine insulin. However, this is not to suggest that there are no technical adjustments to be made when using animal insulin in a pump. As might be expected, alterations are needed to account for the use of insulin with a slower onset and longer duration of action than the standard (analogue) insulin used in pumps.

Two people described having problems when using a “smart” pump, which are programmed to use insulin analogues.

One respondent described needing to look at basal rates for the preceding 6 hours to interpret blood glucose results, rather than the 4 hours that insulin analogue users might typically analyse; two respondents described needing to bolus in advance of eating rather than during or after eating, as insulin analogue users do. Another reported needing to make allowances for the persistence of animal insulin for up to 4 hours after bolusing.

Two of the nine respondents reported feeling that planning and having a routine were necessary to successfully using animal insulin in a pump. Adherence to such a regimen is not entirely compatible with the notions of freedom and flexibility commonly associated with pump use.

Decision-making regarding insulin choice

When asked about the quality of their glycaemic control, respondents gave subjective qualitative (such as feeling well or clear-headed) and semi-quantitative measures (such

as the incidence of hypoglycaemia), but did not refer to their HbA_{1c} level or other objective measurements. These subjective outcomes were sought by all respondents.

By far the most common reason for using, or wanting to use, animal insulin either by injection or via an insulin pump, was improved warning of impending hypoglycaemia (9/17, 53%). These nine participants reported either loss of hypoglycaemia awareness, or severe and frequent hypoglycaemia that impaired their ability to undertake daily activities, when using human insulin or insulin analogues. Two people cited psychological factors as the main reasons for using animal insulin, listing mood swings, aggression and an inability to function cognitively as the reasons why they preferred to use animal insulin.

Three of the respondents considered that they had more stable blood glucose levels when using animal insulin compared with other types of insulin they had tried. Respondents also attached a high level of importance to their adverse experiences: two explicitly stated that they were prepared to forego the benefits of alternative insulins to avoid the problems they had personally experienced with them. The majority of respondents had been able to negotiate with healthcare providers to use their chosen type of insulin; however, three reported reluctance, and one described outright refusal, from healthcare professionals to support their desire to use animal insulin in a pump.

Within the limitations of the small sample, this survey suggests that people who chose to use animal insulin were making an informed choice, having researched the options available. In the

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3. By far the most common reason for using, or wanting to use, animal insulin either by injection or via an insulin pump, was improved warning of impending hypoglycaemia.

Table 1. Questions put to participants regarding their insulin use.

- What different types of insulin have you used?
- For each insulin:
- How long did you use it?
 - Did you inject it or use it with a pump, or both?
 - How good was your blood glucose control with this insulin?
 - What were the advantages of this insulin?
 - Did you have any problems with this insulin?

“Anecdotal evidence suggests that the lack of experience on the part of clinical staff, combined with a lack of published evidence to inform a decision, deterred healthcare professionals from considering animal insulin in a pump as a possible option.”

most extreme case, one person, who had been denied the insulin of their choice in a pump, had privately obtained a pump and the related consumables. The respondent had subsequently started to use the pump without medical support.

Choice of treatment

Eight of the nine respondents combining animal insulin with pump use had used animal insulin at some point prior to receiving a pump, and saw returning to it as a way of having “the best of both worlds”. Only one respondent had not used animal insulin by injection prior to receiving a pump. One possible implication of this is that still fewer people may choose this combination in the future as the population who have used animal insulin previously declines in number.

Four respondents reported that they felt reassured by having a range of insulins from which to choose, one describing this as providing a “backstop” for her. The enthusiasm with which respondents communicated their experiences was generally explained in terms of wanting to share their experiences to facilitate further options being available to fellow people with diabetes.

Three respondents were not using animal insulin in a pump, having been deterred by clinical staff, but wished to do so. Their anecdotal evidence suggests that the lack of experience on the part of clinical staff, combined with a lack of published evidence to inform a decision, deterred healthcare professionals from considering animal insulin in a pump as a possible option.

Conclusion

On the basis of this small sample, no absolute reasons for avoiding animal insulin in a pump were identified. However, effective pump use relied on patient knowledge of the absorption and activity profile of animal insulin, and on the availability of a pump that could be programmed to be compatible with the action of the animal insulin chosen. ■

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