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Continuous subcutaneous insulin infusion therapy and children with type 1 diabetes mellitus: the 2008 updated NICE guidelines

DAVID KERR

Abstract

Approximately 25,000 children and young people live with type 1 diabetes in the UK. Their high risk of long-term complications is compounded by the problematic management of diabetes in children. CSII (continuous subcutaneous insulin infusion), or 'insulin pump', therapy has the potential to improve glycaemic control, reduce the frequency of severe hypoglycaemia and improve quality of life, but is presently underused. NICE (National Institute for Health and Clinical Excellence) now recommends CSII as a treatment option for adults and children aged 12 years or older with type 1 diabetes, when MDI (multiple daily injection) insulin therapy results in disabling hypoglycaemia or fails to reduce HbA_{1c} levels below 8.5%, and for children aged under 12 years whenever MDI therapy is impractical or inappropriate. These new recommendations are likely to increase the use of CSII across the UK. Accordingly, healthcare providers will need to integrate this modality routinely within a cohesive service for adults and children with diabetes. As CSII therapy should be initiated only by a specialist team (normally comprising a physician with a special interest in CSII, a diabetes specialist nurse and a dietician), improving access to accredited staff training is a priority.

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Key words: continuous insulin infusion, diabetes mellitus, insulin, paediatrics, pump

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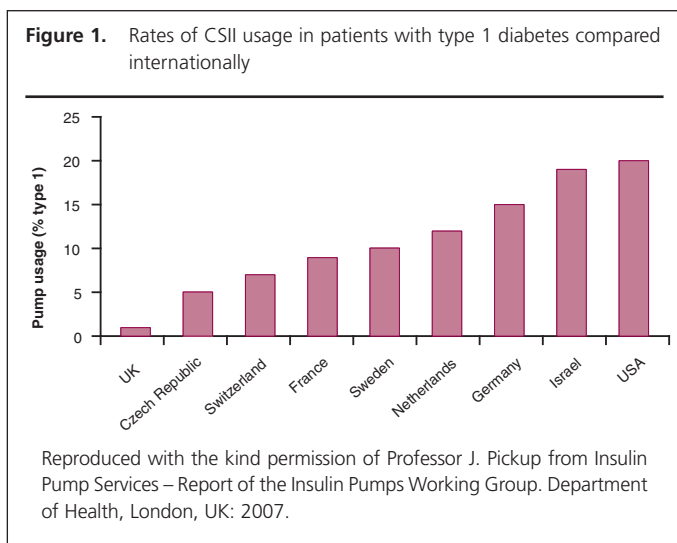
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Abbreviations and acronyms

CSII	continuous subcutaneous insulin infusion
HbA _{1c}	glycated haemoglobin
MDI	multiple daily injection
NICE	National Institute for Health and Clinical Excellence
QOL	Quality of Life

Introduction

In the UK, approximately 25,000 children and young people are living with type 1 diabetes.¹ Each year approximately 20 in every 100,000 children develop the condition² and, as the incidence of type 1 diabetes is rising, the age of presentation is decreasing.³ The early onset of childhood diabetes confers a high life-time risk of developing diabetes-related complications, and this risk is compounded by the specific problems associated with a childhood complicated by a chronic incurable condition and its treatment. Only 17% of children and young people with type 1 diabetes in England and Wales surveyed in the UK National Diabetes Audit in 2005–2006 achieved the recommended HbA_{1c} target of less than 7.5%. In addition, 30% had HbA_{1c} levels above 9.5%.¹ Similar data have also been reported in Scotland.⁴ At the same time, hypoglycaemic episodes remain common among insulin-treated children.^{5,6} At present CSII is used by 10–20% of patients with diabetes in the USA and many European



countries (figure 1).⁷ However, it is unclear how many UK patients use CSII because there is no central pump registry. While it is estimated that CSII is used by 1% or fewer of all patients with diabetes and only 0.1% of children,⁷ many diabetes centres with CSII expertise use the technology in a far higher proportion of their patients with type 1 diabetes.

The factors contributing to the underuse of CSII in the UK include a lack of understanding of its benefits, particularly among healthcare professionals, but also among patients and parents; insufficient specialist expertise; and limits on financial reimbursement. Variations across the UK in these factors and in local policies have resulted in considerable geographic disparities in CSII access.⁷ Importantly, recommendations issued by NICE in 2003 suggested that the technology would be appropriate for 1–2% of patients with type 1 diabetes.⁸ This figure may have been used by some healthcare providers to cap the funding of CSII. In situations when CSII is not funded, the resulting cost of the CSII pump (>£2,500 per annum) and consumables is an important barrier for many patients.

NICE has recently updated its guidance concerning the use of CSII and provided specific, revised recommendations for its use in children.⁹ This paper overviews these latest recommendations and discusses their likely impact.

NICE guidelines 2008

NICE now recommends CSII as a treatment option for adults and children aged 12 years or older with type 1 diabetes when MDI insulin therapy has resulted in disabling hypoglycaemia when achievement of target when HbA_{1c} levels has been attempted; or HbA_{1c} levels remain high (≥8.5%) during MDI therapy, despite a high level of care (table 1).⁹ NICE considers that children aged 12 years or older are normally able to self-administer a mid-day insulin dose (e.g. at school) and hence that they should undergo a trial of MDI therapy before CSII is considered. However, as younger children are generally unable to self-inject competently, NICE now recommends CSII for use in children aged under 12 years with type 1 diabetes whenever the use of MDI is impractical or inappropriate, i.e. without the need for an MDI trial.

The NICE committee recognised the potential disruption that switching to MDI at the age of 12 years could cause in children stabilised on CSII, but advised that an MDI trial should normally be undertaken at some point before the child reaches 18 years. The nature of the MDI trial is unspecified.

The NICE guidelines were based on a review of four randomised controlled trials of CSII versus MDI in patients with type 1 diabetes (including one in children and adolescents) and 48 observational studies of CSII initiation. The randomised trial performed in children and adolescents reported a 1% reduction in HbA_{1c} over 16 weeks with CSII, compared with MDI using an insulin analogue (glargine), together with a lower incidence of severe hypoglycaemia.¹⁰ Generally, the observational studies have shown a greater benefit of CSII over MDI than have the randomised clinical trials, including reduced HbA_{1c} in children and adolescents (0.2–1.2%) and lower rates of hypoglycaemia (rate ratios of 0.12–0.80).⁹ Other recent meta-analyses support a significant benefit of CSII over MDI on HbA_{1c} rates.^{11,12}

Table 1. Criteria for suitability for CSII in patients with type 1 diabetes: a comparison of the 2003 and 2008 NICE recommendations^{8, 9, a}

Patient group	NICE 2003	NICE 2008
Adults	Where MDI has failed to achieve an HbA _{1c} of ≤7.5% ^b during MDI without disabling hypoglycaemia	Where MDI resulted in disabling hypoglycaemia when targets attempted When HbA _{1c} levels have remained ≥8.5% during MDI therapy
Children ≥12 years	As for adults	As for adults
Children <12 years	As for adults	When MDI is impractical or inappropriate

Key: MDI=multiple daily (insulin) injections
^aCSII is not recommended for use in patients with type 2 diabetes
^bOr ≥6.5% in presence of microalbuminuria or adverse features of the metabolic syndrome

Nevertheless, CSII is associated with greater direct costs than MDI, resulting from the pumps and consumables. These costs are expected to be partly offset by reduced costs of managing hypoglycaemic episodes and, in the long-term, by reduced costs of diabetic complications, especially in those with very poor baseline control. Furthermore, the additional value of CSII in patients with moderate baseline HbA_{1c} is believed to come from improvement in patients' QOL, in particular by reducing the fear of hypoglycaemic episodes.⁹ Health economic data are available only in adults, but are also considered to apply to children.

In order that CSII is used cost-effectively, NICE recommends that CSII should be continued only if it reduces the HbA_{1c} level or the frequency of hypoglycaemic episodes and the associated anxiety. Individualised targets and timeframes should be agreed with the patient and carer and, if these are not met, further education and support should be provided before CSII is withdrawn.⁹

What impact will the guidelines have?

The updated NICE recommendations are likely to increase CSII use in adults and children and to promote greater equity of access for several reasons:

- The 2008 recommendations are supported by a larger clinical evidence base than the preceding 2003 guidance and hence have greater robustness
- The HbA_{1c} threshold defining MDI failure has been increased from 7.5 to 8.5%. Importantly, this does not represent the target for HbA_{1c} control, but rather the level at which NICE considered CSII to be cost-effective (in the absence of disabling hypoglycaemia). The target remains an HbA_{1c} level $\leq 7.5\%$ without frequent disabling hypoglycaemia^{9,13}
- The definition of disabling hypoglycaemia has been widened slightly and is now given as the repeated and unpredictable occurrence of hypoglycaemia that results in persistent anxiety about recurrence and is associated with significant adverse effects on QOL. The former requirement 'for third-party assistance' has been omitted to focus on the recurrence (rather than the severity) of episodes. This change should cover a larger number of patients with some degree of hypoglycaemia
- The current guidelines offer specific recommendations for paediatric patients with diabetes and thereby should improve the profile of CSII among all stakeholders responsible for this patient population
- The recommendation that CSII can be initiated without a trial of MDI where this is inappropriate or impractical removes an important barrier to CSII use
- The ongoing monitoring of CSII patients should help to maintain the cost-effectiveness of the service.

Unlike the 2003 NICE recommendations, the updated guidance does not include an anticipated percentage of patients in

whom CSII is likely to be appropriate. Anecdotally, some paediatric diabetologists already recommend CSII for all newly diagnosed children with type 1 diabetes, with 80–90% of patients aged under 12 years and 40–50% of those aged under 18 years accepting the treatment. These figures illustrate the potential demand for CSII under the updated NICE recommendations (F Campbell, personal communication).

Generally, the effective and safe use of CSII in children requires a considerable level of competence and motivation among patients and their carers, with regard to the operation of the technology as well as carbohydrate counting and self-monitoring of blood glucose. Many of these aspects are also common to MDI therapy, which children aged 12 years or older are expected to have trialled before CSII is begun. Indeed, all children with type 1 diabetes should already have access to a multidisciplinary paediatrics diabetes care team.¹³ Yet CSII providers often find low levels of knowledge about these fundamental aspects of diabetes management among referred patients.

CSII therapy should be initiated only by a specialist CSII team, normally including a physician with a special interest in this modality, a diabetes specialist nurse and a dietician.⁹ According to Diabetes UK, patients should undertake a quality-assured, structured education programme in conjunction with CSII commencement.⁷ For children, an average of approximately 55 h of healthcare professional time is required to initiate new CSII users during their first year (F Campbell, personal communication). Ongoing education is important to maintain and extend patients' expertise so that they gain maximal benefit from their pump. Patient organisations can provide helpful support to CSII users, for example through the regional 'Pump Clubs' run throughout the UK. Schools also have an important role to play.

Ensuring that adequate numbers of staff undertake accredited training programmes to achieve defined competencies for CSII (www.skillsforhealth.org.uk) will be difficult given the lack of a national curriculum and of standardised, validated programmes directed toward children, as well as oversubscription to the few courses that do exist.⁷ Patient organisations and professional associations could assist in the improvement and expansion of CSII education. CSII training should also be included within regional training programmes for junior doctors. The new NICE recommendations are likely to lessen the barriers to CSII use due to local policy and funding restrictions. In terms of the delivery of care, Diabetes UK has already recommended that specialist CSII services must be integrated within cohesive care pathways for children and adults with diabetes. For example, paediatric–adult transitional services should include a CSII service to allow continuity of care. Other components of appropriate CSII care include monitoring and audit protocols (e.g. glycaemic control, well-being/QOL, hypoglycaemic episodes).⁷ The management of CSII therapy in patients who are admitted to hospital also warrants consideration: nursing and junior medical staff will need to understand the technology and issues around the appropriate level of patient self-care in the hospital setting.

CSII pumps will normally be provided by healthcare trusts from a stock that balances a degree of choice for the patient

with the need for standardisation and expertise among the staff. While the pump is owned by the healthcare provider, it is recommended that it stays with the patient should he or she move to another area of the country. The purchasing, storage, upgrades and distribution of CSII equipment and consumables could be simplified by the NHS Home Delivery service,⁷ although any national scheme for the distribution of CSII equipment must not be financed by any diversion of funds away from the equipment itself. Alternatively, in some places, patients order consumables directly from the supplier and the invoice goes to the diabetes centre for monitoring and payment (via the healthcare trust). Factors, such as the warranty on pump units, replacement costs (upon expiry) and tendering agreements with manufacturers, are important determinants of the direct costs of CSII.

Conclusions

CSII offers a means to improve the management of type 1 diabetes for many paediatric patients with diabetes. CSII is presently underused in the UK, but there are clear signs that this will change. After specialist centres have championed the technology for years, CSII now appears to be entering mainstream clinical practice. As uptake increases, primary care trusts may take on a greater role and existing CSII centres may be invited to help develop this expertise among other providers locally.

Controversies will persist, despite the new NICE recommendations. For example, is it right that children aged 12 years and older should have to undergo a trial of MDI therapy first and should they be subjected to the same selection criteria as adults? Nevertheless, this welcome guidance from NICE should increase funding and access to CSII therapy, especially in children and, as such, the recommendations are certain to accelerate uptake of the technology.

Remaining constraints on the expansion of CSII use in the UK include the level of motivation among healthcare staff and the existing infrastructure. Healthcare providers face the challenge of integrating this specialist care routinely within an improved service for adults and children with diabetes. It will be important to ensure that the quality of CSII usage is maintained, and even improved, as the quantity of use rises. Access to accredited staff training is perhaps the most pressing need in this regard.

The NICE recommendations contain no implementation programme and, while criteria for auditing the implementation of the guidelines are provided, these do not consider patient outcomes.¹⁴ Ideally, the development of CSII services will be overseen by a dedicated, central CSII pump authority. Moreover, it is hoped that a national pump registry scheme will be established to monitor the uptake in pump use, to facilitate outcomes research and to inform future recommendations and policy.

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