# Technology

## Supporting inpatient diabetes care with CSII

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This section focuses on the latest developments in technology and their impact on clinical practice. For example, the article by O'Connell et al (summarised overpage) gives a valuable insight into the impact on glycaemic control of sensor-augmented insulin pump therapy. The authors demonstrate that even without specific instructions to the user as to how to adjust their insulin doses based on data from the continuous glucose monitor (CGM), the addition of CGM over and above standard insulin pump therapy results in a further mean reduction in $HbA_{1c}$ level of 0.43 percentage points (4.7 mmol/mol). Comparable with a number of recent studies, O'Connell et al confirm that this benefit is greatest in those who use the sensor for more than 70% of the time, with an averge reduction in $HbA_{1c}$ level of 0.51 percentage points (5.6 mmol/mol) compared with those using the sensor for lesser duration.

While these technological developments are clearly beneficial, we need to ensure that we also deploy existing technologies to maximum benefit. We have a long-established insulin pump service and have worked hard to ensure that people are able to continue using their insulin pumps while they are staying in hospital, even during operative procedures and labour (if they are under general anaesthetic then a trained healthcare professional should adjust their insulin dose). A considerable effort is required to educate all the healthcare professionals who may come into contact with insulin pump users in a variety of inpatient settings.

The article by Noschese et al (summarised alongside) describes the implementation of a protocol for managing insulin pump therapy in an inpatient setting, and the impact on parameters of glycaemic control and patient satisfaction. The authors report that the Hospital Patient Safety Committee at their medical centre identified inpatient insulin pump therapy as a safety issue and invited the Diabetes Inpatient Safety Committee to develop a strategy to guide the treatment of these people in hospital.

While the authors do not suggest that there are huge benefits in glcyaemic control – although there was certainly a trend to higher blood glucose levels in the small number of people who did not continue to use insulin pump therapy while in hospital – those who did continue to use their insulin pumps were not disadvantaged in terms of blood glucose parameters, and they reported a high level of satisfaction with their insulin pump management in hospital. It appears that outcomes were further improved when the insulin pump protocol was supplemented by input from the inpatient diabetes service. Interestingly, despite continuing to use their pump, almost 50% still did not feel personally in control of their management while in hospital.

It is interesting to note the variety of conditions that had necessitated the stay in hospital: both medical (particularly cardiac) and surgical, including pancreatitis and small bowel obstruction. Almost 20% of participants were undergoing solid organ transplantation. Helpfully, in the appendix the authors detail the paperwork used in implementing their protocol. Hopefully, evidence of this kind will help to encourage widespread acceptance of the feasibility and benefits of continuing insulin pump therapy in hospital in people with diabetes and support the value of the inpatient diabetes service.

**ENDOCRINE PRACTICE**

## Development of a protocol to care for inpatients using CSII

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| Readability | ✓✓✓✓ |
| Applicability to practice | ✓✓✓✓✓ |
| WOW! factor | ✓✓✓ |

1 This study describes the development of an inpatient insulin pump protocol (IIPP) for people using continuous subcutaneous insulin infusion (CSII) who wished to continue self-management of their diabetes during their hospital stay, and their experience of the protocol.

2 The medical records of bedside capillary blood glucose (CBG) levels and pump-related adverse events were reviewed for 50 consecutive people admitted to hospital using CSII.

3 Those using CSII during their hospital stay were invited to fill out a satisfaction questionnaire.

4 Participants were categorised into three groups: those who received care using the IIPP as well as inpatient diabetes service consultation (group 1; *n*=34), those who were cared for using the IIPP alone (group 2; *n*=12), or those who received usual care (group 3; *n*=4).

5 All three groups had similar CBG levels (group 1: 173±43 mg/dL [9.61±2.38 mmol/L]; group 2: 187±62 mg/dL [10.38±3.45 mmol/L]; group 3: 218±46 mg/dL [12.12±2.56 mmol/L]). The frequency of hypoglycaemia (CBG <70 mg/dL [3.89 mmol/L]) was not significantly different across the three groups, and no serious CSII-related adverse events occured.

6 Most participants (86%) reported satisfaction with their ability to use CSII therapy in hospital.

7 The IIPP provided a standardised and safe approach to the use of CSII in hospital.

Noschese ML, DiNardo MM, Donihi AC et al (2009) Patient outcomes after implementation of a protocol for inpatient insulin pump therapy. *Endocr Pract* **15**: 415–24

DIABETOLOGIA

## Patient-led sensor-augmented CSII reduced $HbA_{1c}$ levels

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|---|---|
| Readability | ✓✓✓ |
| Applicability to practice | ✓✓✓✓ |
| WOW! factor | ✓✓✓✓ |

1 Sensor-augmented insulin pump therapy was compared with standard pump therapy in this open, multi-centre, parallel, randomised controlled trial.

2 Participants in the sensor-augmented group were not provided with instructions on interpreting the continuous glucose monitoring (CGM) data ("patient-led"; *n*=31). Participants in the control group continued with their original insulin pump regimen (*n*=31).

3 The primary outcome was the between-group difference in time spent within the target glycaemic range (4–10 mmol/L) over the 3-month study.

4 Secondary outcomes were difference in $HbA_{1c}$ level, amount of time spent within hypoglycaemic (≤3.9 mmol/L) and hyperglycaemic (≥10.1 mmol/L) ranges and glycaemic variability.

5 There was no difference between groups in time spent in the target range (measured using CGM) or in hyperglycaemic and hypoglycaemic ranges, or in glycaemic variability. $HbA_{1c}$ was 0.43 percentage points (4.7 mmol/mol) lower in the intervention group compared with the control group (*P*=0.009).

6 Those who used the sensor ≥70% of the time had a reduction in $HbA_{1c}$ level of 0.51 percentage points (5.6 mmol/mol) lower than people using the sensor <70% (*P*=0.04).

7 People already using insulin pump therapy can further improve their glycaemic control by additionally using CGM. More time spent using the sensor correlated with improved glycaemic control.

O'Connell MA, Donath S, O'Neal DN et al (2009) Glycaemic impact of patient-led use of sensor-guided pump therapy in type 1 diabetes: a randomised controlled trial. *Diabetologia* **52**: 1250–7

DIABETES CARE

## Intraperitoneal vs. subcutaneous insulin infusion

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| Readability | ✓✓✓✓ |
| Applicability to practice | ✓✓✓ |
| WOW! factor | ✓✓✓✓ |

1 This 16-month prospective trial compared the effect of continuous intraperitoneal insulin infusion (CIPII) with subcutaneous insulin. The incidence of hypoglycaemia (the primary outcome) was lower with CIPII than with subcutaneous insulin (3.5±2.3 versus 4.0±2.6 per week; *P*=0.13).

2 There was a significant improvement in $HbA_{1c}$ level in the CIPII group (absolute mean difference –0.76% [–8.3 mmol/mol]).

3 Although the incidence of hypoglycaemia did not improve significantly, improved glycaemic control was achieved with CIPII.

Logtenberg SJ, Kleefstra N, Houweling ST et al (2009) Improved glycaemic control with intraperitoneal versus subcutaneous insulin in type 1 diabetes. *Diabetes Care* **32**: 1372–7

DIABETIC MEDICINE

## CSII may prevent deterioration in kidney function

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|---|---|
| Readability | ✓✓✓✓ |
| Applicability to practice | ✓✓✓✓ |
| WOW! factor | ✓✓✓ |

1 In this multicentre, retrospective, observational study, 110 people with type 1 diabetes treated with continuous subcutaneous insulin infusion (CSII) were compared with 110 controls treated with multiple daily injections (MDI) to assess the effect of CSII on albumin excretion rate (AER).

2 After 3 years, $HbA_{1c}$ was lower in those using CSII than MDI (8.1±0.9% [65±9.8 mmol/mol] versus 8.4±1.3% [68±14.2 mmol/mol]; *P*<0.005).

3 AER was similar at baseline and significantly lower in the CSII group (4.7 versus 6.4 µg/min; *P*<0.002). Nine people in the MDI group developed microalbuminuria versus only one using CSII.

4 As well as improving glycaemic control, CSII may also help to reduce the progressive increase in AER in people with type 1 diabetes.

Lepore G, Bruttomesso D, Bonomo M et al (2009) Continuous subcutaneous insulin infusion is more effective than multiple daily injections in preventing albumin excretion rate increase in type 1 diabetic patients. *Diabet Med* **26**: 602–8

DIABETES TECHNOLOGY & THERAPEUTICS

## CSII reduces $HbA_{1c}$ in an Indian population with T2D

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| Readability | ✓✓✓✓ |
| Applicability to practice | ✓✓✓✓ |
| WOW! factor | ✓✓✓✓ |

1 This study investigated the use of continous subcutaneous insulin infusion (CSII) in an Asian Indian population with type 2 diabetes.

2 A total of 46 participants who were using a multiple daily injection regimen switched to CSII. $HbA_{1c}$ level, body weight and total daily insulin dose were measured before initiation of CSII and after 6 months.

3 Participants were asked to complete a questionnaire and rate their satisfaction with CSII and whether or not it interfered with their daily activities.

4 After using CSII for 6 months, a statistically significant reduction in mean $HbA_{1c}$ level (0.5% [5.5 mmol/mol]) was observed (*P*<0.0063).

5 Body weight and total daily insulin dose did not change significantly. A high treatment satisfaction and low interference with daily activities was reported.

6 This group of people experienced a reduction in $HbA_{1c}$ after 6 months of treatment with CSII.

Kesavadev J, Balakrishnan S, Ahammed S, Jothydev S (2009) Reduction of glycosylated hemoglobin following 6 months of continuous subcutaneous insulin infusion in an Indian population with type 2 diabetes. *Diabetes Technol Ther* **11**:517–21

***"As well as improving glycaemic control, CSII may also help to reduce the progressive increase in albumin excretion rate in people with type 1 diabetes."***