

Technology

Could pump therapy offer advantages over conventional insulin delivery during the peri-operative period?



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The increasing use of insulin pumps in the UK means that there is a need to consider their optimal use in wider hospital settings, such as during obstetric care and surgery. Recent consensus guidelines from the Joint British Diabetes Societies reflect this.

The inpatient self-management guideline (Joint British Diabetes Societies for Inpatient Care Group, 2012) has a section on self-management of insulin pumps during hospital admission, which advises that pump users undergoing a procedure requiring them to be nil by mouth for a limited period (no more than one missed meal) should be able to continue using the pump during the procedure. The guideline on management of diabetes during surgery (Joint British Diabetes Societies for Inpatient Care Group, 2011) goes into greater detail in the section on special circumstances, advising that the basal rate be continued as normal during such procedures, and bolus dosing recommenced with the first post-operative meal. However, the authors of these guidelines observe that there are limited data on the use of pump therapy in people with diabetes undergoing surgery. Our experience is that blood glucose levels are well controlled by the pump in these circumstances, but could pump therapy offer advantages over conventional insulin delivery during the peri-operative period? The paper by Ma et al summarised alongside addresses this possibility.

The authors have been continuing insulin pump therapy peri-operatively since 2006, and thus compared glycaemic control and peri-operative outcomes in 281 pump users and 256 people on non-pump insulin regimens, matched for pre-operative status and surgical procedure. They found that the pump users had a lower fasting glucose on post-operative day 1 (9.06 versus 11.05 mmol/L; $P=0.003$), and more stable glycaemic control than those on non-pump insulin regimens (glucose fluctuation index, 2.35 versus 2.94 mmol/L; $P=0.01$). There was a low number of

all and severe hypoglycaemic episodes but, whilst non-significant, these were fewer in the pump users. Encouragingly, there were some potential gains in terms of recovery from surgery associated with pump usage, with a lower frequency of post-operative fever, a shorter hospital stay (12.7 versus 14.4 days; $P=0.03$) and decreased time to suture removal (14.0 versus 16.0 days; $P=0.02$).

Apart from the obvious caveat that this was not a prospective study, there are some other important considerations as to the implications of these findings: 90% of the study subjects had type 2 diabetes; the details for the non-pump users' peri-operative insulin regimen is not clear, although there is nothing to suggest they were managed with intravenous insulin; and only 27.8% of the non-pump users were on multiple daily injection regimens. When the latter cohort was compared to their matched pump users there were no significant differences between the two groups – but this may well have reflected the small numbers concerned, as there was a trend towards all the differences seen between the pump users and the larger cohort. Intriguingly, the authors mention short-term pump use for surgery, suggesting that some individuals only use pumps in the pre- and peri-operative periods. If there were a benefit in terms of reduced peri-operative morbidity and hospital stay with such an intervention, this may well be cost-effective in a selected group of patients.

This study encourages the continued use of pump therapy in the surgical patient during the peri-operative period. There is increasing evidence that this can achieve better glycaemic control than switching to intravenous insulin during this time, and there is the intriguing possibility that there may be benefits to be realised in terms of recovery from surgery.

Joint British Diabetes Societies for Inpatient Care Group (2011) *Management of adults with diabetes undergoing surgery and elective procedures: improving standards*. NHS Diabetes, Leicester

Joint British Diabetes Societies for Inpatient Care Group (2012) *Self-management of diabetes in hospital*. NHS Diabetes, Leicester

DIABETES TECHNOLOGY AND THERAPEUTICS



Evaluating CSII therapy peri-operatively

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

1 This retrospective study from China evaluated all the surgical procedures of people with diabetes in one centre over 6 years. The authors studied the efficacy and safety of continuous subcutaneous insulin infusion (CSII) during the peri-operative care of these patients.

2 Participants were well matched for characteristics such as age and diabetes duration, and 90% had T2D and 10% had T1D or an uncertain type.

3 The authors compared the CSII group ($n=281$) and the control/non-CSII group ($n=256$), which included patients receiving conventional (72.2%) and multiple daily injection insulin (27.8%) treatment.

4 Compared with the control, the CSII group had lower blood glucose fluctuation ($P=0.01$), lower fasting glucose on the first and second post-operative days ($P<0.05$), a lower incidence of fever ($P=0.005$), fewer post-operative days to suture removal ($P=0.02$) and fewer days to discharge ($P=0.03$). There was no significant difference in the number of hypoglycaemic events between the two groups.

5 Although CSII therapy is more costly, there was no difference in the cost compared with the control therapy ($P=0.47$). This was put down to a reduction in other medical expenditure.

6 The article suggests that CSII is effective and safe for short-term use peri-operatively, and more research is needed to evaluate its long-term effects.

Ma D, Chen C, Lu Y et al (2013) Short-term effects of continuous subcutaneous insulin infusion therapy in perioperative patients with Diabetes Mellitus. *Diabetes Technol Ther* 24 Aug [Epub ahead of print]

“Both partners in marriage saw continuous glucose monitoring as giving ‘peace of mind’ from anxiety, allowing more collaborative management and better understanding of people’s lives with diabetes.”

THE NEW ENGLAND JOURNAL OF MEDICINE

Threshold-suspended feature analysed

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

1 The authors of this open-label study tested the threshold-suspended feature with sensor-augmented insulin pump therapy in people with T1D and a documented history of nocturnal hypoglycaemia.

2 Participants were randomly assigned to groups with ($n=121$) or without ($n=126$) the addition of the threshold-suspended feature and

monitored for a 3-month period.

3 The primary safety end point was a HbA_{1c} change from randomisation to study end. The primary efficacy end point was the mean area under the curve (AUC) for nocturnal hypoglycaemia.

4 The change in HbA_{1c} for both groups was negligible from randomisation to study end. In the threshold-suspended feature group, the mean AUC for nocturnal hypoglycaemic events was 37.5% lower ($P<0.001$) and nocturnal hypoglycaemic events occurred 31.8% less frequently than in the “without” group ($P<0.001$).

5 Automatic pump suspension did not result in hyperglycaemia after 2 and 4 hours.

Bergental RM, Klonoff DC, Garg SK et al (2013) Threshold-based insulin-pump interruption for reduction of hypoglycemia. *N Engl J Med* **369**: 224–32

ADVANCES IN MEDICAL SCIENCES

RT-CGM in adolescents with poorly controlled T1D

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

1 The authors tested real-time continuous glucose monitoring (RT-CGM) for a month in 40 adolescents with poorly controlled T1D (baseline HbA_{1c} , 67 ± 16.4 mmol/mol

[$9.3 \pm 1.5\%$]) to examine its potential long-term benefits. Participants received family support throughout.

2 After the 3-month follow-up, HbA_{1c} levels were reduced significantly across the whole cohort ($P<0.001$). However, the group with a baseline HbA_{1c} above 75 mmol/mol (10%) did not significantly improve their HbA_{1c} ($P=0.06$).

3 More research is needed to see if RT-CGM could be suitable for long-term use in adolescents with moderately poorly controlled T1D.

Głowska-Olszewska B, Tobiaszewska M, Luczynski W, Bossowski A (2013) Monthly use of a real-time continuous glucose monitoring system as an educational and motivational tool for poorly controlled type 1 diabetes adolescents. *Adv Med Sci* **3**: 1–9

DIABETIC MEDICINE

Effect of CGM on marital relations

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

1 Twenty individuals with T1D (termed patients) and 14 spouses attended focus groups examining the impact of continuous glucose monitoring (CGM) on diabetes management and marital relationships.

2 Inclusion criteria included cohabitation for at least 5 years (to ensure a range of experiences around CGM) and well-managed glycaemia.

3 Conflict occurred when patients did not share management, and when the patient and spouse did not fully understand the technology.

4 Both partners saw CGM as giving “peace of mind” from anxiety, allowing more collaborative management and better understanding of the patients’ lives with diabetes.

Ritholz MD, Beste M, Edwards SS et al (2013) Impact of continuous glucose monitoring on diabetes management and marital relationships of adults with type 1 diabetes and their spouses: a qualitative study. *Diabet Med* **2** Jul [Epub ahead of print]

DIABETES CARE

Bolus advisor use for individuals using MDI therapy

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

1 These are the first results from ABACUS (the Automated Bolus Advisor Control and Usability Study), which is a multinational, prospective randomised controlled study.

2 The study examined the glycaemic control of those using multiple daily insulin injection (MDI) therapy with the addition of either an automated bolus advisor (Accu-Chek Aviva Expert meter [Roche, Burgess Hill]; [EXP] cohort; $n=100$) or a standard blood glucose (BG) meter and manual bolus calculator (control [CNL] cohort; $n=93$).

3 People with T1D and T2D were both included, and the primary clinical outcome was to achieve a $>0.5\%$ (5.46 mmol/mol) decrease in HbA_{1c} in 26 weeks. The authors’ main focus was the number of people who would achieve this, rather than the percentage decrease in HbA_{1c} .

4 Compared to the CNL group, more of the EXP group achieved a $>0.5\%$ HbA_{1c} decrease ($P<0.01$) and treatment satisfaction was also higher ($P<0.01$).

5 As the study progressed, participants consulted the bolus advisor less often ($P<0.01$), and young people consulted it even less. Those that achieved a $>0.5\%$ decrease showed a significant reduction in daily use of the bolus advisor, compared to those that did not reach the target.

6 The use of an automated bolus advisor improved glycaemic control and reduced glycaemic variability without increasing severe hypoglycaemia.

Ziegler R, Cavan DA, Cranston I et al (2013) Use of an insulin bolus advisor improves glycaemic control in multiple daily insulin injection (MDI) therapy patients with suboptimal glycaemic control: First results from the ABACUS trial. *Diabetes Care* **30** Jul [Epub ahead of print]