

Technology

Targeted pump use in people with type 1 diabetes



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The place of continuous glucose monitoring (CGM) in the management of people with type 1 diabetes using intensive insulin therapy remains controversial. Most studies appear to indicate that there is little benefit derived from real-time CGM unless it is used almost constantly (Juvenile Diabetes Research Foundation [JDRF] CGM Study Group, 2008), which is not acceptable to many potential users. Furthermore, the benefits appear confined to improvement in HbA_{1c}; although duration of hypoglycaemia may be reduced, the frequency of hypoglycaemic events does not seem to be affected (JDRF CGM Study Group, 2009). Paradoxically, in practice, real-time CGM is often used to protect those with recurrent severe hypoglycaemia or hypoglycaemia unawareness against these events.

What do two recently published meta-analyses add to our understanding of the current evidence base? Pickup et al (2011; summarised alongside) used strict inclusion criteria: randomised controlled trials (RCTs) with at least 2 months of real-time CGM or self-monitoring of blood glucose (SMBG) in people with type 1 diabetes on intensive insulin therapy reporting on glycaemic control and hypoglycaemia frequency. Only six studies (including two separate reports from the JDRF study [JDRF CGM Study Group, 2008; 2009]) were eligible for inclusion. What makes their analysis particularly robust is that it is based on individual data from 892 people studied in these trials.

Gandhi et al (2011; summarised overleaf) similarly analysed only RCTs with at least 2 months of CGM or SMBG and the same mode of insulin delivery in each study arm, but included studies of retrospective or real-time CGM in type 1 or type 2 diabetes. In total, there were 19 studies with 1801 people enrolled.

Gandhi et al found that, compared with SMBG, CGM resulted in a mean reduction in HbA_{1c} level of 0.27% (3.0 mmol/mol; 95% confidence interval [CI], 0.1–0.44) but

concluded it was only effective in adults. Pickup et al found a similar mean HbA_{1c} reduction with CGM (0.30% [3.3 mmol/mol]; 95% CI, 0.17–0.43) but drilling down to the individual patients found that this benefit was seen in all age groups. They found age had only a minor effect on the benefit, with an additional 0.05% (0.5 mmol/mol) of HbA_{1c} lowering for every 25 years advancement in age. The authors conclude that older people are probably better able to use the data from CGM to adjust therapy and diet to optimise control.

Neither study found a difference in hypoglycaemia frequency, and none of the studies were powered to identify any such benefit. Gandhi et al noted that, where reported, participants felt confident about the CGM device and were more positive about glycaemic management when using it.

None of these findings give us any more information to place CGM in therapy, but Pickup et al reached two other significant conclusions. First, there is increased benefit for greater frequency of usage, each 1 day per week of additional usage contributing a reduction in HbA_{1c} level of 0.15% (1.6 mmol/mol), but significant benefit may be seen when CGM is used for only 5 days per week or perhaps less. Second, the higher the baseline HbA_{1c} level the greater the reduction in HbA_{1c} with CGM, each 1% (10.9 mmol/mol) increase in baseline HbA_{1c} level being associated with a further reduction in final HbA_{1c} level of 0.13% (1.4 mmol/mol).

These observations should allow more cost-effective use of real-time CGM, targeting either those with higher HbA_{1c} levels at baseline or those with lower HbA_{1c} level who are prepared to use it 7 days per week. Evidence of benefit for those with problematic hypoglycaemia is awaited from ongoing trials powered to address this question.

Juvenile Diabetes Research Foundation Continuous Glucose Monitoring Study Group (2008) Continuous glucose monitoring and intensive treatment of type 1 diabetes. *N Engl J Med* **359**: 1464–76

Juvenile Diabetes Research Foundation Continuous Glucose Monitoring Study Group (2009) The effect of continuous glucose monitoring in well-controlled type 1 diabetes. *Diabetes Care* **32**: 1378–83

BMJ

Real-time CGM versus SMBG in T1D

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

1 This meta-analysis of randomised controlled trials (RCTs) aimed to assess the clinical effectiveness of real-time continuous glucose monitoring (CGM) compared with self-monitoring of blood glucose (SMBG) in people with T1D.

2 Inclusion criteria comprised RCTs of at least 2 months' duration in men and non-pregnant women. The studies compared real-time CGM with SMBG, and insulin delivery was the same in both arms.

3 Six RCTs were identified (449 people randomised to CGM; 443 to SMBG).

4 The overall mean difference in HbA_{1c} level for CGM versus SMBG was –0.30% (–3.3 mmol/mol; 95% confidence interval [CI], –0.43 to –0.17).

5 Best fit regression determinants of final HbA_{1c} level showed that for every 1 day increase in sensor use per week, the effect of CGM versus SMBG increased by 0.15% (1.6 mmol/mol; 95% credibility interval, –0.194% to –0.106%); every 1% (10.9 mmol/mol) increase in baseline HbA_{1c} level increased the effect by 0.126% (1.4 mmol/mol; –0.257% to 0.0007%).

6 The overall area under the curve reduction in hypoglycaemia was –2.8 (–0.46 to –0.09), which equates to a reduction in median hypoglycaemia exposure of 23% for CGM versus SMBG.

7 CGM was found to be associated with a significant reduction in HbA_{1c} level that was greatest in people with the highest baseline HbA_{1c} levels and who used sensors most frequently.

Pickup JC, Freeman SC, Sutton AJ (2011) Glycaemic control in type 1 diabetes during real time continuous glucose monitoring compared with self monitoring of blood glucose: meta-analysis of randomised controlled trials using individual patient data. *BMJ* **343**: d3805

JOURNAL OF DIABETES SCIENCE AND TECHNOLOGY

CGM effective in improving glycaemia in T1D and T2D

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

1 The authors conducted a systematic review and meta-analysis to determine the efficacy of continuous glucose monitoring (CGM) versus self-monitoring of blood glucose (SMBG) in managing glycaemic control and reducing hypoglycaemia.

2 The following databases were searched for randomised trials of adults and children with T1D or T2D: MEDLINE, EMBASE, Cochrane Central, Scopus and Web of Science. Nineteen eligible trials were identified.

3 A random-effects model was used to generate meta-analytic estimates of treatment effects.

4 CGM was associated with a significant overall reduction in HbA_{1c} level (weighted mean difference [WMD], -0.27% [3.0 mmol/mol]; 95% confidence interval [CI], -0.44 to -0.10). This was observed in adults with T1D (WMD, -0.50% [5.5 mmol/mol]; 95% CI, -0.69 to -0.30) as well as T2D (WMD, -0.70% [7.7 mmol/mol]; 95% CI, -1.14 to -0.27); no significant effect was observed in children and adolescents.

5 No significant difference in HbA_{1c} reduction was observed between studies of real-time CGM (WMD, -0.22% [2.4 mmol/mol]; 95% CI, -0.59 to 0.15) versus non-real-time CGM (WMD, -0.30% [3.3 mmol/mol]; 95% CI, -0.49 to -0.10).

6 The authors concluded that CGM appears to improve glycaemic control in adults with T1D or T2D, but the effect on hypoglycaemia is imprecise and unclear.

Gandhi GY, Kovalaske M, Kudva Y et al (2011) Efficacy of continuous glucose monitoring in improving glycaemic control and reducing hypoglycaemia: a systematic review and meta-analysis of randomized trials. *J Diabetes Sci Technol* **5**: 952-65

DIABETES TECHNOLOGY & THERAPEUTICS

Implanted insulin pumps effective in poorly controlled T1D

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

1 This 5-year, retrospective study was undertaken to assess the efficacy and safety of implanted insulin pumps in 181 people with poorly controlled T1D.

2 Mean age of participants at implantation was 43 years, mean diabetes duration was 22.2 years, and mean body weight was 68.6 kg.

3 Retinopathy was present in 62% of participants, neuropathy in

34.6%, nephropathy in 26% and cardiovascular disease in 14%.

4 Participants' previous insulin regimens were multiple daily injection (17.1%) or continuous subcutaneous insulin injection (82.9%).

5 A significant reduction in mean HbA_{1c} level was observed between baseline and at 1 year (7.9 vs 7.6% [63 vs 60 mmol/mol]; *P*<0.01); this was maintained at 7.5-7.6% (58-60 mmol/mol) for up to 5 years, with no significant change in body weight on complications status.

6 The authors concluded that implanted insulin pump therapy confers long-term benefits for people with poorly controlled T1D.

Schaepelynck P, Renard E, Jeandidier N et al (2011) A recent survey confirms the efficacy and the safety of implanted insulin pumps during long-term use in poorly controlled type 1 diabetes patients. *Diabetes Technol Ther* **13**: 657-60

DIABETES TECHNOLOGY & THERAPEUTICS

CGM/CSII improves T1D pregnancy and glycaemic outcomes

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

1 Twenty-five pregnant women with T1D were treated with insulin pump therapy for at least 1 year; CSII and CGM were initiated at least 3 months before conception.

2 Participants were randomised to either constant CGM (*n*=12)

or intermittent CGM (*n*=12). From baseline to study end, mean HbA_{1c} level reduced in both groups; 6.78 versus 6.14% (50.6 vs 43.6 mmol/mol) in the continuous CGM group and 6.92 versus 6.23% (52.1 vs 44.6 mmol/mol) in the intermittent CGM group.

3 No significant decrease in HbA_{1c} level was observed between the two groups.

4 The authors concluded that pump therapy plus constant or intermittent CGM can improve glycaemic control and pregnancy outcomes in T1D.

Petrovski G, Dimitrovski C, Bogoev M et al (2011) Is there a difference in pregnancy and glycaemic outcome in patients with type 1 diabetes on insulin pump with constant or intermittent glucose monitoring? A pilot study. *Diabetes Technol Ther* **13**: 1109-13

ENDOCRINE PRACTICE

Perioperative pump use inconsistently documented

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

1 The aim of this study was to assess perioperative management of 35 people with T1D who were being treated with continuous subcutaneous insulin infusion (CSII) therapy.

2 Between January 2006 and December 2010, 50 procedures were performed; status of pump use was documented in 32 cases in the preoperative area, 14 intraoperatively, and 30 in the postanesthesia unit.

3 Glycaemic values were recorded in 47 cases preoperatively, 30 intraoperatively, and 48 in the postanesthesia unit.

4 It was concluded that documentation of pump use and glycaemic monitoring was inconsistent.

Nassar AA, Boyle ME, Seifert KM et al (2011) Insulin pump therapy in patients with diabetes undergoing surgery. *Endocr Pract* [Epub ahead of print]

“Continuous glucose monitoring appears to improve glycaemic control in adults with T1D or T2D, but the effect on hypoglycaemia is imprecise and unclear.”