

Review: Intensive insulin pump therapy slightly improves glycemic control in type 1 diabetes

Pickup J, Mattock M, Kerry S. Glycaemic control with continuous subcutaneous insulin infusion compared with intensive insulin injections in patients with type 1 diabetes: meta-analysis of randomised controlled trials. *BMJ*. 2002 Mar 23;324:705-8.

QUESTION

In patients with type 1 diabetes mellitus, is continuous subcutaneous insulin infusion (pump therapy) as effective as multiple insulin injections for glycemic control?

DATA SOURCES

Studies were identified by searching MEDLINE (1975 to 2000), EMBASE/Excerpta Medica (1980 to 2000), the Cochrane Controlled Trials Register, and a personal collection of peer-reviewed articles and by reviewing bibliographies of retrieved studies, references provided by a support group for patients using pumps, and lists of reports supplied by 2 manufacturers of pumps.

STUDY SELECTION

Studies were selected if they were randomized controlled trials (RCTs) that compared pump therapy with multiple-dose insulin injection therapy (i.e., multiple injections and adjustment of injection dosage or timing, or both, according to hospital and home-monitored blood glucose levels). Studies were excluded if they were short term (2-wk duration of therapy), included patients with newly diagnosed type 1 diabetes, or used conventional insulin injection therapy.

DATA EXTRACTION

Data were extracted on the characteristics of patients (age and duration of diabetes) and treatment (duration, type of pump, type of insulin, and injection regimen). Main outcomes were glycemic control (mean blood glucose level and percentage of glycated hemoglobin) and total daily insulin dosage.

MAIN RESULTS

12 trials ($n = 350$) met the selection criteria. Duration of treatment ranged from 2.5 to 24 months. Meta-analysis using a random-effects model showed that patients who received pump therapy had lower blood glucose levels and lower glycated hemoglobin than did patients who received multiple

insulin injections (Table). Pump therapy was associated with less variability in blood glucose levels than was multiple injection therapy. The total daily insulin dosage was 14% lower with pump therapy than with multiple injection therapy (Table).

CONCLUSION

In patients with type 1 diabetes, continuous subcutaneous insulin infusion resulted in slightly better glycemic control than did multiple insulin injections.

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Intensive insulin therapy with continuous subcutaneous infusion vs multiple injections (duration 2.5 to 24 mo) for type 1 diabetes*

| Outcomes | Weighted mean difference (95% CI)† |
|--------------------------------------|------------------------------------|
| Blood glucose level (mmol/L) | -1.06 (-1.46 to -0.66) |
| Glycated hemoglobin (%) | -0.51 (-0.80 to -0.23) |
| Total daily insulin dosage (units/d) | -7.58 (-10.8 to -4.44) |

*Abbreviations defined in Glossary; CI calculated from data in article.

†Converted to usual units.

COMMENTARY

Since the Diabetes Control and Complications Trial was published (1), clinicians caring for patients with type 1 diabetes have faced several challenges, including choosing the right type of intensive insulin therapy, implementing intensive insulin therapy in all eligible patients, achieving optimal glycemic control for extended periods, and developing effective and safe islet transplantation and the "artificial pancreas" to limit hypoglycemia. The meta-analysis by Pickup and colleagues addresses the first challenge by comparing multiple insulin injections with the external insulin pump.

The meta-analysis does not account for the crossover design used in 11 of the 12 included RCTs and did not report on differences in quality of life or cost between the 2 approaches. Furthermore, the results may not apply to current pump technology (11 of 12 RCTs were done before 1990) and to newer insulin analogues that were equivalent or superior to regular insulin in pumps and multiple daily injections in recent RCTs (2-4). Comparisons of standard multiple insulin injections and insulin pumps with regimens including long-acting insulin analogues and inhaled insulin are not yet available.

For most patients, first-line intensive insulin therapy continues to consist of multiple insulin injections. Usually, clinicians offer the pump to patients receiving multiple injections who are unable to reach glycemic goals and have wide glycemic excursions and frequent hypoglycemia. In our clinic, patients who use a pump have adequate

problem-solving skills and can adhere to glucose self-monitoring, accept the subcutaneous infusion cannula, and prefer the dosing flexibility of the pump. The limited evidence available suggests that both forms of intensive insulin therapy are safe and efficacious. Therefore, patients and clinicians should embrace intensive insulin therapy and work together to determine which approach—multiple injections or external pump—is most likely to achieve glycemic goals while preserving or improving quality of life.

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References

1. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med*. 1993;329:977-86.
2. Zinman B, Tildesley H, Chiasson JL, Tsui E, Strack T. Insulin lispro in CSII: results of a double-blind crossover study. *Diabetes*. 1997;46:440-3.
3. Bode BW, Strange P. Efficacy, safety, and pump compatibility of insulin aspart used in continuous subcutaneous insulin infusion therapy in patients with type 1 diabetes. *Diabetes Care*. 2001;24:69-72.
4. Heller SR, Amiel SA, Mansell P. Effect of the fast-acting insulin analog lispro on the risk of nocturnal hypoglycemia during intensified insulin therapy. U.K. Lispro Study Group. *Diabetes Care*. 1999;22:1607-11.