DAFNE (Dose Adjustment for Normal Eating): structured education in insulin replacement therapy for type 1 diabetes

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This European approach to insulin management is now being introduced in Australia

Since the publication of the Diabetes Control and Complications Trial (DCCT) in 1993,[1] improved glycaemic control in type 1 diabetes has been acknowledged as a desirable goal in theory, but frustratingly difficult to achieve in practice. Although bodies such as the American Diabetes Association recommend a glycated haemoglobin (HbA_{1c}) target of < 7%,[2] only around 20% of adults with type 1 diabetes under specialist supervision in Australian centres achieve this goal (data from the Australian National Diabetes Information Audit and Benchmarking Survey; Associate Professor Jeff Flack, Director, Diabetes Centre, Bankstown–Lidcombe Hospital, NSW, personal communication).

Intensive insulin treatment in the North American-based DCCT involved an initial inpatient stay of 2–4 days. Patients received formalised dietary and insulin prescriptions, emphasising consistent distribution of carbohydrate across the day and intensive glucose monitoring. The program was medically directed and labour intensive, with patients maintaining weekly telephone contact and attending monthly clinic visits. No Australian diabetes centre has been able to routinely offer this level of support to patients.

The reduction in microvascular complications seen with intensive treatment in the DCCT was accompanied by a threefold increase in severe hypoglycaemia and a 33% increase in the risk of becoming overweight.[1] Overall quality of life did not improve.[1] These adverse effects have been seen by many as inevitable consequences of tight glycaemic control and may have discouraged many clinicians and patients from pursuing a "DCCT-style" approach to intensive insulin treatment.

As in other endeavours, the Europeans took a different approach from that used in North America. The Dose Adjustment for Normal Eating (DAFNE) program[3] is a UK-based adaptation of the German Diabetes Training and Treatment Programme (DTTP).[4] DTTP has been progressively developed in Germany since the late 1970s, under the leadership of the late Michael Berger (former President of the European Association for the Study of Diabetes). It is a 5-day structured inpatient education program facilitated by diabetes educators and dietitians. It aims to encourage and equip people who have type 1 diabetes to manage their insulin regimens actively and independently. DTTP has also been adopted in Romania,[5] Austria[6] and Russia,[7] with positive results reported by all groups.

In DTTP, patients follow a normal diet and receive intensive training in precise, but not restrictive, estimation of dietary carbohydrate in terms of 10 g carbohydrate portions. Prandial short-acting insulin doses are calculated as a ratio to intake of carbohydrate portions at each meal and major snack (eg, 1 unit per carbohydrate portion). Basal insulin generally comprises twice daily isophane (NPH) insulin or once or twice daily long-acting insulin analogues. Insulin ratios and basal insulin doses are adjusted to meet defined preprandial and bedtime glycaemic targets, with corrective insulin or carbohydrate given as required. General care of diabetes, adaptations of insulin for exercise and alcohol intake, and management of "sick days" are also addressed in the 35-hour program.

The 5-day inpatient DTTP course has become part of standard care for type 1 diabetes in Germany. Active clinical audits involving a network of 96 diabetes clinics across Germany continue to demonstrate clinically meaningful improvements in HbA_{1c} (especially for those with poor baseline control) and reduced hypoglycaemic episodes (especially for those with good baseline control) after DTTP training.[8,9] Reduced rates of ketoacidosis and hospital admissions have also been noted.[9] In Austria and the UK, DTTP has been adapted to a 5-day outpatient program with eight patients per group. Content remains very similar to the German program.

The UK DTTP (DAFNE) approach was evaluated in a formal randomised controlled trial.[3] Reported benefits in a cohort of 169 patients with poorly controlled type 1 diabetes included a fall of 1% in HbA_{1c} without increased hypoglycaemia or mean weight gain. Quality of life was also improved.[3] However, DAFNE is a complex intervention, and it remains unclear which element of the program is most important in improving diabetes control. Aside from the efficacy of the insulin algorithms per se, the effect may be in part due to increased contact with health care professionals and peer group support. Further, there are some weaknesses in the DTTP–DAFNE approach. Only two randomised controlled trials have been conducted,[3,5] and, by current standards, the first[3] would not be considered of high quality. Also, DAFNE is more expensive than current "routine" diabetes education. To benefit from DAFNE, patients need to perform regular glucose testing and self-adjustment of insulin doses, so it is unlikely to benefit those who struggle with the day-to-day demands of basic diabetes self-care. DAFNE insulin adjustment requires reasonable English literacy and numeracy, which may exclude some patients. Developed in the 1980s, DAFNE was designed around soluble and isophane insulin, rather than more recent insulin analogues. It does not include glycaemic index concepts. The standard glucose targets used in DAFNE (eg, fasting glucose 5.5–7.7 mmol/L) are higher than those recommended for pregnancy[10] and will require revision in patients planning to become pregnant.

Participation in a DAFNE course is clearly not the only possible pathway to improved glycaemic control in type 1 diabetes. Some people with this condition have been able to achieve excellent glycaemic control over many years without such a program, generally using either multiple-dose insulin regimens or continuous subcutaneous insulin infusion (or insulin pump) therapy. A recent randomised controlled crossover trial reported HbA_{1c} values 0.25 percentage points lower with subcutaneous insulin infusion than with multiple dose insulin therapy,[11] but this must be weighed against the increased cost.

DAFNE has been costed in the UK at $A1300 per patient,[12] and a published health cost modelling analysis suggested mean savings of $A5500 per patient over 10 years, arising primarily from a reduction in microvascular complications.[12] Even the most con-

servative analyses have suggested that DAFNE is cost-saving rather than simply cost-effective.[12]

The use of DAFNE as one means of improving care for people with type 1 diabetes has been supported by reviews conducted by the UK National Institute for Clinical Excellence[13] and the UK Department of Health.[14] In January 2006, provision of structured patient education for people with type 1 diabetes became a requirement of the National Service Framework for diabetes in the UK, with DAFNE recognised as the one program which currently meets all the Framework's requirements for type 1 diabetes.[15] DAFNE courses are now provided in 39 centres across the UK, with 3537 DAFNE "graduate" patients reported in January 2006.[16]

In November 2004, clinicians from four centres in Australia completed DAFNE course observation and post-course training in the UK. The UK DAFNE course materials were then adapted to the Australian health care context. These four centres have now conducted around 12 DAFNE courses in Australia, with positive patient feedback. All centres have committed to the collection of baseline and follow-up data.

An "OzDAFNE" collaborative, with strong links to the UK, has been established to ensure consistent standards of course resources and delivery across Australia, and to facilitate training and accreditation of further DAFNE centres within Australia. The processes of accreditation, peer review and quality assurance are seen as essential by all groups involved in the DTTP–DAFNE collaboratives and represent a great strength of the program.

The capacity of current OzDAFNE centres to make DAFNE available to people with type 1 diabetes is limited. We hope that other diabetes services will undertake DAFNE training and join the OzDAFNE collaborative. This requires a doctor, diabetes educator and dietitian to observe a 5-day DAFNE course, attend further training and participate in peer review and quality assurance. Two further centres in Queensland have recently completed training and plan to provide courses, while further training is planned in Victoria in the near future.

The study reported by Davis and colleagues in this issue of the Journal clearly demonstrates that poor glycaemic control affects people with type 2 as well as type 1 diabetes in Australia.[17] The authors also note distinct therapeutic procrastination in proceeding from diet to oral agents to insulin in patients with type 2 diabetes. Previous studies have described "provider frustration" in dealing with diabetes care,[18] and this may represent a further barrier to effective implementation of published guidelines.

DAFNE was designed with type 1 diabetes in mind, but type 2 patients with marked insulin deficiency, requiring intensive insulin treatment, might also benefit. However, the DAFNE insulin algorithms have not been formally evaluated in patients with type 2 diabetes. The "dietary freedom" of DAFNE may be less appropriate in type 2 diabetes, in which obesity is a common comorbidity. DESMOND (Diabetes Education and Self-Management for Ongoing and Newly Diagnosed) is a 1-day structured education program for type 2 diabetes developed in the UK, primarily targeted at the earlier stages of this condition.[14]

Currently, most people with type 1 and type 2 diabetes in Australia have suboptimal glycaemic control and remain at risk of the devastating long-term complications of diabetes. Active strategies to improve glycaemic control and meet other therapeutic targets, including the expansion of DAFNE programs for patients with type 1 diabetes, should be developed across Australia.

Competing interests

I am Director of the Queensland Diabetes Centre, which runs regular DAFNE courses and President of the DAFNE Association of Australia, a not-for-profit association which promotes and disseminates the DAFNE method and has received funding from Novo Nordisk (Australia) and Abbott Australasia. I have also received speaker fees and assistance in attending meetings from Novo Nordisk and Eli Lilly Australia, manufacturers of insulin products.

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