Global Guideline

for Type 2 Diabetes

Chapter 6: Glucose control levels

International Diabetes Federation

Glucose control levels

06

Recommendations

■ Standard care

TT1 Advise people with diabetes that maintaining a DCCT-aligned HbA_{1c} below 6.5 % should minimize their risk of developing complications.

TT2 Provide lifestyle and education support, and titrate therapies, to enable people with diabetes to achieve a DCCT-aligned HbA_{1c} below 6.5 % (where feasible and desired), or lower if easily attained.

TT3 Advise those in whom target HbA_{1c} levels cannot be reached that any improvement is beneficial.

TT4 Sometimes raise targets for people on insulin or sulfonylurea therapy in whom attainment of tighter targets may increase the risk of hypoglycaemic episodes, which may present particular problems for people with other physical or mental impairment.

TT5 Equivalent target levels for capillary plasma glucose levels are <6.0 mmol/l (<110 mg/dl) before meals, and <8.0 mmol/l (<145 mg/dl) 1-2 h after meals.

■ Comprehensive care

TT_C1 The intervention levels are as for *Standard care*, but it may be possible to devote more resources to achieving lower target levels without adverse impact on health.

■ Minimal care

TT_M1 The intervention levels are as for *Standard care*, but may need to be based on measurement of plasma glucose levels alone.

Plasma glucose is the preferred measure of most modern laboratories. Whole blood gives lower readings due to the volume occupied by haemoglobin. Capillary blood glucose strips measure the glucose in the plasma of the capillary blood sample, but may be calibrated to give results either as plasma or whole blood glucose (check meter instructions).

Rationale

The UKPDS established the importance of glucose control in prevention of vascular complications in people with Type 2 diabetes. The issue then arises as to the desirable level of glucose control to be achieved. In an ideal world this would be 'normal', but if the available lifestyle and pharmaceutical therapies are less than optimal in terms of efficacy and adverse effects on quality of life, or if these therapies are expensive, then some compromise (varying between individuals and health-care systems) will be needed. The chosen measures of glucose control (HbA_{1c} and self-monitoring) are discussed elsewhere (see *Clinical monitoring, Self-monitoring*) – this section deals with target levels.

The concept of targets is open to criticism – they may be unattainable, they may limit what could be attained, and they may be uneconomic to attain. However, without some form of targeted control of an asymptomatic condition it becomes difficult to promote care at all. Targets are often better thought of as 'assessment levels' and 'intervention levels'.

Evidence-base

The evidence for a target level of control is rarely the subject of an RCT. However, the epidemiological analyses of the UKPDS [1] can be informative in setting targets. Other evidence will usually come from cohort and cross-sectional epidemiological studies [2,3]. While target levels have been set by a number of organizations (including the ADA [4,5] and IDF (Europe) [6]) and in the NICE Type 2 diabetes [7] and Canadian guidelines [8], they are rarely supported by any kind of formal discussion of literature. There is however a high degree of conformity of the recommendations. The NICE Type 1 diabetes guideline does attempt to derive its recommendations with more rigour, and while this is largely directed to microvascular prevention, the argument relating to prevention of arterial disease in people with Type 1 diabetes can be usefully extrapolated to people with Type 2 diabetes in general [9].

The UKPDS shows that good glucose control is attainable at least in the early years; this is consistent with many other intervention studies of different therapies. The issue of whether a microvascular control threshold might or might not exist for glucose control seems not to be relevant to most people with Type 2 diabetes, as the targets for glucose control for prevention of arterial disease are lower when set separately (by NICE [9] and the European Policy Group [6]); thus the issue is primarily that of arterial risk prevention.

Epidemiological evidence shows a relationship between HbA_{1c} and development of cardiovascular disease even within the normal range of HbA_{1c} [10]. This suggests that normal or even low normal is to be preferred, if attainable at reasonable cost and effort. However, this is virtually never attained in clinical studies of therapies. What is clear is that arterial risk in a population with diabetes (UKPDS) decreases down to a DCCT-aligned HbA_{1c} of 5.5 % (compared with normal range of <6.1 %), the lowest level achieved over time for a significant group of people in that study. Use of glucose-lowering therapies was highly cost-effective in UKPDS [11], and accordingly 6.5 % is the target/intervention level recommended in the NICE Type 1 [9] and Type 2 guidelines [7].

Translation of this into self-monitored capillary (whole blood or plasma calibrated) levels is not simple. The upper level of fasting plasma glucose is usually taken as 5.5 mmol/l (100 mg/dl), which might then equate with a DCCT-aligned HbA_{1c} of 6.1 %. Studies with newer insulins achieving pre-breakfast glucose levels of ~6.0 mmol/l (~110 mg/dl) typically return DCCT-aligned HbA_{1c} results of ~7.0 % [12], but glucose profiles in these studies show rising glucose levels through the day, explaining the inconsistency. Regression equations between capillary measured whole blood glucose or plasma glucose and HbA_{1c} referable to the DCCT assay have been published for Type 1 diabetes [13,14], but these combine pre-prandial and post-prandial tests through the day, and reflect the different profiles of glucose control seen in that type of diabetes.

The case for targeting post-prandial blood glucose control can be made on many grounds, none of them RCT-based. Overall the case is compelling, not least by the simple logical observation that the outcome trials have established the utility of lowering blood glucose levels overall, while the highest levels of the day are generally after meals. That post-prandial levels may be particularly pathophysiological for the endothelium is generally based around arguments surrounding 2-h OGTT post-challenge glucose concentrations rather than post-prandial levels. As post-challenge levels seem closely related to the features of the metabolic syndrome the argument for a special relationship to vascular damage is still limited, and the approach adopted in this document is simply to use the average relationship to basal glucose levels in people in good blood glucose control.

Consideration

The intervention level/assessment level has been taken as a DCCT-aligned HbA_{1c} of 6.5 %, with a target level less than that if easily achieved. This is taken as translating to basal self-

monitored plasma glucose levels <6.0 mmol/l (<110 mg/dl), with post-prandial target levels of <8.0 mmol/l (<145 mg/dl).

Implementation

These targets should be incorporated in local protocols and guidelines detailing methods for evaluating and advising on lifestyle and pharmaceutical therapies as the natural history of the condition evolves.

Evaluation

Glucose targets (as given above) should be present in local guidelines and protocols. Audit is of attained glucose control on different types of therapy.

References

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