DIABETES DATASET DOMAIN DESCRIPTION

A Non-technical Description of Key Concepts in Outpatient Monitoring

and Management of Insulin Dependent Diabetes Mellitus (IDDM) for the

AAAI Spring Symposium on Intepreting Clinical Data.

The following text is provided to orient you to the diabetes data

set. It is meant as a quick introduction to the pertinent issues in

this domain for potential participants of the AAAI Spring Symposium on

Interpreting Clinical Data. However, it is not meant to be a rigorous

or comprehensive review of the subject.

Isaac Kohane, AIM-94 Co-Chair

8/27/1993

aim-94@camis.stanford.edu

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Patients with IDDM are insulin deficient. This can either be due to a)

low or absent production of insulin by the beta islet cells of the

pancreas subsequent to an auto-immune attack or b) insulin-resistance,

typically associated with older age and obesity, which leads to a

relative insulin-deficiency even though the insulin levels might be

normal.

Regardless of cause, the lack of adequate insulin effect has multiple

metabolic effects. However, once a patient is diagnosed and is

receiving regularly scheduled exogenous (externally administered)

insulin, the principal metabolic effect of concern is the potential

for hyperglycemia (high blood glucose). Chronic hyperglycemia over a

period of several years puts a patient at risk for several kinds of

micro and macrovascular problems (e.g. retinopathy). Consequently, the

goal of therapy for IDDM is to bring the average blood glucose as close

to the normal range as possible. As explained below, current therapy

makes this goal a very challenging (and often frustrating) one for

most patients. One important consideration is that due to the

inevitable variation of blood glucose (BG) around the mean, a lower mean

will result in a higher frequency of unpleasant and sometimes

dangerous low BG levels.

Outpatient management.

Outpatient management of IDDM relies principally on three

interventions: diet, excercise and exogenous insulin. Proper treatment

requires careful consideration of all three interventions.

INSULIN

One of insulin's principal effects is to increase the uptake of

glucose in many of the tissues (e.g. in adipose/fat tissue) and

thereby reduce the concentration glucose in blood. Patients

with IDDM administer insulin to themselves by subcutaneous injection.

Insulin doses are given one or more times a day, typically before

meals and sometimes also at bedtime. Many insulin regimens are devised

to have the peak insulin action coincide with the peak rise in BG

during meals. In order to achieve this, a combination of several

preparations of insulin may be administered. Each insulin formulation

has its own characteristic time of onset of effect (O), time of peak

action (P) and effective duration (D). These times can be significantly

affected by many factors such as the site of injection (e.g. much more

rapid absorption in the abdomen than in the thigh) or whether the

insulin is a human insulin or an animal extract. The times I have

listed below are rough approximations and I am sure that I could find

an endocrinologist with different estimates.

Regular Insulin: O 15-45 minutes P 1-3 hours D 4-6 hours

NPH Insulin: O 1-3 hours P 4-6 hours D: 10-14 hours

Ultralente: O: 2-5 hours. P (not much of a peak) D 24-30 hours.

EXERCISE

Exercise appears to have multiple effects on BG control. Two important

effects are: increased caloric expenditure and a possibly independent

increase in the sensitivity of tissues to insulin action. BG can fall

during exercise but also quite a few hours afterwards. For instance,

strenuous exercise in the mid-afternoon can be associated with low BG

after dinner. Also, too strenuous exercise with associated mild

dehydration can lead to a transient increase in BG.

DIET

Another vast subject but (suffice it to say for the purposes of users

of the data set) in brief: a larger meal will lead to a longer and

possibly higher elevation of blood glucose. The actual effect depends on

a host of variables, notably the kind of food ingested. For instance,

fat causes delayed emptying of the stomach and therefore a slower rise in BG

than a starchy meal without fat. Missing a meal or eating a meal of smaller

than usual size will put the patient at risk for low BG in the hours that follow

the meal.

GLUCOSE CONCENTRATIONS

BG concentration will vary even in individuals with normal pancreatic

hormonal function. A normal pre-meal BG ranges approximately 80-120 mg/dl.

A normal post-meal BG ranges 80-140 mg/dl. The target range for an individual

with diabetes mellitus is very controversial. I will cut the Gordian knot on

this issue by noting that it would be very desirable to keep 90% of all BG

measurements < 200 mg/dl and that the average BG should be 150 mg/dl or less.

Note that it takes a lot of work, attention and (painful) BG checks to reach

this target range. Conversely, an average BG > 200 (over several years) is

associated with a poor long-term outcome. That is, the risk of vascular

complications of the high BG is significantly elevated.

Hypoglycemic (low BG) symptoms fall into two classes. Between 40-80 mg/dl,

the patient feels the effect of the adrenal hormone epinephrine as the BG

regulation systems attempt to reverse the low BG. These so-called

adrenergic symptoms (headache, abdominal pain, sweating) are useful, if

unpleasant, cues to the patient that their BG is falling dangerously. Below

40 mg/dl, the patient's brain is inadequately supplied with glucose and

the symptoms become those of poor brain function (neuroglycopenic

symptoms). These include: lethargy, weakness, disorientation, seizures and

passing out.

OTHER SOURCES OF INFORMATION

If you want to learn more about the outpatient treatment of IDDM, most

of the standard medical or endocrinological textbooks have large

sections on this subject. Alternatively, the local chapters of the

Juvenile Diabetes Foundation and American Diabetes Association may be

able to provide you with some helpful practical information. Finally,

feel free to send e-mail to aim-94@camis.stanford.edu. One of the program

committee members is an endocrinologist and will be pleased to answer

technical/medical questions.