

Steroid Therapy and Management of Hyperglycaemia

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Rationale

Diabetes is common, affecting up to 20% of hospitalised patients. Intercurrent illness and the use of glucocorticoid steroids are associated with worsening hyperglycaemia in patients with a known diagnosis of diabetes as well as those previously undiagnosed. Treatment for the hyperglycaemia should be instituted in tandem with the presenting medical condition. Glucocorticoids are an essential part of the management of inflammatory disease processes, allergic reactions, haematological malignancies and shock. However, they have profound effects on glucose metabolism, particularly on post-prandial hyperglycaemia. This guidance

document describes early identification of hyperglycaemia and management strategies in patients on steroids.

Scope of guidelines

This guidance is intended for use in the clinical management of people who are being treated with glucocorticoids and with a known diagnosis of diabetes or new presentation of hyperglycaemia. It is aimed at medical staff and nursing staff who prescribe and administer steroid therapy.

Outcome statement

The aim of co-ordinated management, with input from the Diabetes Team, is to ensure that hyperglycaemia is identified in a timely and appropriate manner. Diabetes treatment should be implemented to achieve and maintain reasonable glycaemic control.

Aims of management

1. To prevent hyperglycaemia during steroid therapy which may predispose the patient to a hyperglycaemic hyperosmolar crisis
2. To treat hyperglycaemia as quickly as possible whilst avoiding hypoglycaemia
3. To ensure that the correct anti-hyperglycaemic agents, oral or insulin, are prescribed with appropriate adjustments to existing diabetes treatment
4. To maintain stable glycaemic control and avoid symptomatic hyperglycaemia
5. To ensure that the patient has appropriate treatment consistent with changes in and cessation of steroid therapy

Effects of glucocorticoids

In pharmacological doses glucocorticoids cause increased insulin resistance, exacerbating diabetes control in people with diabetes and precipitating or 'unmasking' diabetes in patients at risk. The hyperglycaemic effects are usually temporary and dose-related. Diabetes treatments should be tailored in line with steroid dosing in patients known to have diabetes.

Types of steroids commonly used

Steroid	Potency (equivalent doses)	Duration of Action (Half-life in hours)
Hydrocortisone	25mg	8
Prednisolone	5mg	16 - 36
Methylprednisolone	4mg	18 - 40
Dexamethasone	0.75mg	36 - 54
Betamethasone	0.75mg	36 - 54

Monitoring blood glucose levels

Target blood glucose levels: 6-10 mmol/L

Blood glucose levels should be monitored 6 hourly once steroid therapy is commenced in patients with known diabetes. In patients without diabetes, random daily capillary blood glucose monitoring is recommended and diabetes treatment should be considered if blood glucose levels are persistently elevated to greater than 11.0mmol/L. Contact the diabetes team for advice.

Principles of the treatment of hyperglycaemia

Treatment of steroid-induced or steroid-exacerbated hyperglycaemia should be individualised to the patient's needs; this guidance will focus on principles of management.

The clinical approach should reflect the following considerations:

1. the pharmacologic properties of the steroid agent used
2. the duration of action
3. the timing
4. the frequency of doses
5. the anticipated duration of therapy
6. the severity of the hyperglycemia

Mild hyperglycemia in an immuno-competent patient may not require treatment if the steroids will be discontinued in a week or two. Moderate hyperglycemia carries an increased risk of infection, especially in people with other risk factors such as immuno-compromise or central intravenous lines and should be treated.

Management adjustments required in hyperglycaemia secondary to steroids are not well defined and will vary from patient to patient depending on several factors. It is possible that a patient with well controlled diabetes will experience a 50-100% increase in insulin requirement when the dose of steroids is above 20 mg a day of prednisone or equivalent.

Insulin Treated Diabetes (Type 1 or Type 2 Diabetes)

Twice daily regimen (e.g. Mixtard 30, Novomix 30)

1. Patients on a twice daily regimen need insulin dose adjustment based on the steroid regime. For example, when a short-acting glucocorticoid such as prednisone is given once a day, the hyperglycemic effect is most pronounced during the first 8 to 12 hours after the dose, and may not be evident later at night. It is therefore appropriate to increase the dose of insulin before breakfast to prevent elevated glucose before lunch and dinner.
2. The evening dose of insulin needs to be adjusted until fasting blood glucose levels of 6-10mmol/L are achieved, whilst also considering the risk of nocturnal hypoglycemia.
3. Dose adjustment to continue until target glucose levels are achieved – adjustments may be daily or every 48 hours depending on glycaemic profile.
4. Doses of insulin to be reviewed if steroid doses are increased or tapered.
5. Capillary blood glucose monitoring 6 hourly.
6. Refer to the Diabetes Team for advice or if hyperglycaemia remains unresolved.

Four times a day (basal-bolus) regimen

1. Glucocorticoids increase insulin resistance and particularly exacerbate postprandial hyperglycemia in patients with type 1 and type 2 diabetes. Therefore it is usually necessary to increase the doses of mealtime rapid acting insulin (e.g. Actrapid, insulin lispro, insulin aspart, insulin glulisine) in patients treated on a four times a day (basal-bolus) insulin regime.
2. Due to variability of the effect of glucocorticoids on the insulin dose, dose increments should be cautious, with an initial increment of about 20%. It may be necessary to make adjustments each day for several days until glycaemic stability is achieved. Thereafter, fine-tuning and modification of the insulin regime can be made every few days as required.

3. Doses of insulin to be reviewed if steroid doses are increased or tapered.
4. Capillary blood glucose monitoring 6 hourly.
5. Refer to the Diabetes Team for advice or if hyperglycaemia remains unresolved.

Intravenous insulin

An intravenous (IV) sliding scale insulin infusion can be used in any steroid-treated patient in whom the glucose values are persistently uncontrolled (eg. >10mmol/L) and are not responsive to initial increments in the insulin dose. The use of intravenous insulin facilitates control of hyperglycemia and can provide an estimate of the patient's 24-hour insulin requirement. Intravenous insulin should only be used as a short-term measure. Review its use after 24-48 hours.

Tablet-treated Type 2 Diabetes

Once steroid treatment is instituted hyperglycaemia may arise requiring an increase in oral therapy dosing or insulin therapy if only on oral hypoglycaemic agents (OHAs). Oral hypoglycaemic agents such as metformin may take some time (days or weeks) to exert their effect on glycaemia which may not cover the steroid-induced hyperglycaemia. Sulphonylureas (e.g. gliclazide and glibenclamide) have a rapid effect of glycaemia and may be effective in managing steroid-induced hyperglycaemia. Consider switching to once daily insulin therapy if blood glucose levels are persistently > 10.0mmol/L or patient is on maximal OHAs. If patients need to be treated with insulin for the first time due to steroid treatment, once daily Human Mixtard 30 or Insulatard should be used.

Previously undiagnosed diabetes

In patients previously undiagnosed with diabetes, anti-hyperglycaemic agents should be commenced to improve glycaemic control. Initial treatment may be with sulphonylurea or, in the case of severe, symptomatic hyperglycaemia, once daily insulin.

Steroid-induced hyperglycaemia is usually a transient condition, and may 'unmask' type 2 diabetes with those people who have other risk factors or predisposition. Diabetes status should be confirmed with an oral glucose tolerance test a minimum of 8 weeks following cessation of steroid therapy.

Discharge Planning

Patients will need to continue to monitor or be monitored if they are discharged on steroids. This is essential as diabetes treatment will need to be adjusted as steroids are tapered or increased. The discharge plan needs to include strategies to intercept downward or upwards trends in glycaemic control. Patients with in-hospital hyperglycaemia and previously undiagnosed diabetes should be referred to the diabetes team for follow-up and evaluation of diabetes status with initiation of therapeutic measures if appropriate.

Glucocorticoid-induced Hyperglycaemia

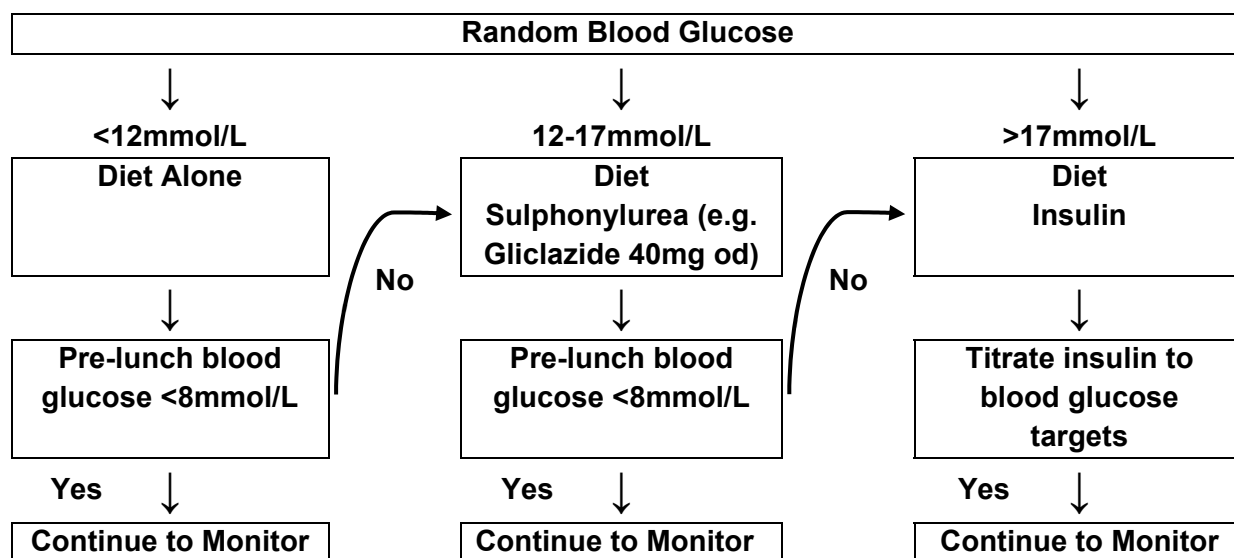


Table 1. Summary of steroid-induced hyperglycaemia management. Pre-lunch blood glucose should be used as Prednisolone, the most commonly prescribed steroid in hospital, has its peak action on glycaemia during the day and little effect on pre-breakfast fasting glucose.

Admin Info

6) IMPLEMENTATION

Training required for staff	No
If yes, who will provide training	
When will training be provided?	
Date for implementation of guideline	

7) MONITORING / AUDIT

When will this guideline be audited?	1/1/2011
Who will be responsible for auditing this guideline?	Dr. Jonathan Valabhji, Clinical Lead, Diabetes
Are there any other specific recommendations for audit?	

8) REVIEW

When will this guideline be reviewed?	June 2012 Nick Oliver
Please indicate frequency of review: As a guide: <ul style="list-style-type: none"> • Drug related guidance should be reviewed every 2 years • Therapy related guidance should be reviewed every 5 years • Clinical treatment guidance should be reviewed every 3 – 5 years 	2 yearly
Date of next review	June 2012

10) GUIDELINE DETAIL

Start Date: (date of final approval by CPG)		
Dates approved by:	Divisional Guidelines Group (if applicable)	
	CPG1 Guidelines Committee	

Have all relevant stakeholders (Trust sites, CPGs and departments) been included in the development of this guideline?	Imperial College Healthcare NHS Trust Diabetes Team Professor D Johnston Dr A Dornhorst Dr J Valabhji Dr E Hatfield Dr N Martin Dr T Tan Dr D Gable Dr M Yee Dr N Oliver Sarah Allen Carol Jairam Mary Joyce Barbara Muzenda Clare Poulter Jo Reed Carmel Ryan Anna Sackey Inez Walkes Sarah Menezes Nicola Bandaranayake Louisa Fearnley
Who will you be notifying of the existence of this guidance?	Please give names/depts
Related documents:	If applicable
Author/further information:	Nick Oliver / Carol Jairam Diabetes Dept CPG1 – Medicine St. Mary's Hospital 0203 312 1073
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Next review due	2012
THIS GUIDELINE REPLACES:	New

11) INTRANET HOUSEKEEPING

Key words	Diabetes Hyperglycaemia Steroids Glucocorticoids
Which CPG does this belong to?	Medicine
Which subdivision of the guidelines spine should this belong to?	Diabetes and Endocrinology
Title for the intranet if different from the document (<i>please note that documents sit alphabetically so should not start with "guideline for..."</i>)	Diabetes: Steroid therapy and management of hyperglycaemia