

Further learning

# Complications of therapy

SUPPORTING DOCUMENTATION

# COncise adVice on Inpatient Diabetes (COVID:Diabetes): DEXAMETHASONE/GLUCOCORTICOSTEROID THERAPY IN COVID-19 PATIENTS: IMPLICATIONS AND GUIDANCE FOR THE MANAGEMENT OF BLOOD GLUCOSE IN PEOPLE WITH AND WITHOUT DIABETES

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**JBDS** Joint British Diabetes Societies  
for Inpatient care



## NATIONAL INPATIENT DIABETES COVID-19 RESPONSE GROUP\*

**i** This guidance is for use in ALL patients with COVID-19 who are treated with dexamethasone or other high doses of glucocorticosteroid therapies (subsequently to be collectively referred to as glucocorticoids) in a ward setting  
This guidance may be adapted for use in Critical Care Units  
In contrast to the COVID:Diabetes GUIDANCE FOR MANAGING INPATIENT HYPERGLYCAEMIA this group previously published, this guidance recommends larger insulin doses to overcome the greater insulin resistance which may be encountered in many patients treated with high doses of glucocorticoids and should ONLY be used in this context

### ✓ Key Facts

- > High dose glucocorticoids reduce mortality in people with COVID-19 who require ventilation or oxygen therapy
- > Glucocorticoid therapy impairs glucose metabolism and is the commonest cause of life threatening inpatient Hyperosmolar Hyperglycaemic State (HHS)
- > COVID-19 increases insulin resistance and impairs insulin production from the pancreatic beta cells; this can precipitate hyperglycaemia and life threatening Diabetic Ketoacidosis (DKA) in people with diabetes and even in people not known to have diabetes
- > Glucose levels above 10.0 mmol/L have been linked to increased mortality in people with COVID-19
- > High dose glucocorticoid regimens such as the recommended dexamethasone dose of 6 mg/d (oral or IV) used in the *recovery trial*, equivalent to 40mg of prednisolone/day will undoubtedly affect glucose metabolism
- > Thus, the **triple insult** of high dose glucocorticoid therapy induced impaired glucose metabolism, COVID-19 induced insulin resistance and COVID-19 related impaired insulin production could result in significant hyperglycaemia, HHS and DKA in people with and without diabetes, increasing both morbidity and mortality
- > Sulphonylureas are NOT recommended in this context as beta cell function may be impaired and insulin resistance is likely to be severe. For this reason, these recommendations differ from those in the JBDS guideline on the Management of Hyperglycaemia and Steroid (Glucocorticoid) Therapy

## AIMS

**i** To ensure ALL patients on high dose glucocorticoid regimens receive appropriate glucose surveillance and appropriate management of hyperglycaemia

## GLUCOSE MONITORING

**i** NOTE- Check HbA1c as this may 1) help differentiate stress hyperglycaemia from previously undiagnosed diabetes and 2) give an indication of the preceding glycaemic control and degree of insulin resistance

Target glucose 6.0 -10.0 mmol/L (up to 12.0 mmol/L is acceptable)

### Frequency of monitoring

#### > People not known to have diabetes

Check the glucose at least 6 hourly ideally at fasting periods (e.g. before meals and at bedtime). If after 48 hours all fasting glucose results are <10.0 mmol/L reduce frequency to once daily at 17.00-18.00 hrs. Continue until dexamethasone is stopped

If any fasting glucose is above 10.0 mmol/L continue 6 hourly monitoring and follow the guidance below to correct hyperglycaemia i.e. glucose above 12.0 mmol/L

#### > People with diabetes

Throughout the admission, check fasting glucose at least 6 hourly e.g ideally before meals, or more frequently if the glucose is outside the 6.0 -10.0 mmol/L range

## MANAGING DEXAMETHASONE RELATED HYPERGLYCAEMIA

First, exclude Diabetic Ketoacidosis and Hyperosmolar Hyperglycaemic State by checking blood glucose, ketones, venous pH, bicarbonate and U&Es and if DKA/HHS diagnosed follow specific guidelines for their management

**⚠ If DKA/HHS have been excluded, follow the guidance below but note, this advice is CONSERVATIVE. If after initial treatment hyperglycaemia persists, do not hesitate to escalate to the next treatment step and involve the diabetes team as early as possible**

### ADVICE FOR CORRECTING INITIAL HYPERGLYCAEMIA - GLUCOSE ABOVE 12.0 MMOL/L

Use **subcutaneous** rapid acting insulin analogues (Novorapid®/Humalog®/Apridra®) as described below. Note these are conservative doses and depending on response in individual patients, as previously stated, may need to be increased rapidly (or where more insulin sensitive, decreased)

Recheck glucose at 4 hrs to determine response and whether a further correction dose is needed

#### > Insulin naïve

Follow the weight-based tables below in those people:

- » not known to have diabetes
- » with type 2 diabetes treated with diet alone or with oral hypoglycaemic agents

#### > Insulin treated

Where the total daily dose (TDD) of insulin is known follow the guidance in the table based on TDD. If the TDD is unknown, follow guidance according to the person's weight

### CORRECTION DOSES OF RAPID ACTING INSULIN

**i** If after a second correction dose the glucose level remains >12 mmol/L either move to the next column or increase the algorithm by 1-3 units for each of the rows and enter the new doses in the blank dose escalation column striking out the other columns.

**i** If after repeated correction doses the glucose level remains >12.0 mmol/L commence Variable Rate Intravenous Insulin Infusion

GLUCOSE (MMOL/L)	TDD = <50 UNITS PER DAY OR WEIGHT < 50 KG	TDD = 50 - 100 UNITS PER DAY OR WEIGHT 50-100 KG	TDD = >100 UNITS PER DAY OR WEIGHT >100 KG	DOSE ESCALATION Enter number of units for each glucose level (see above)	←
12.0-14.9	2 units	3 units	4 units	units	<ul style="list-style-type: none"> <li>• Please check <b>KETONES</b> if glucose &gt;12.0mmol/L</li> <li>⚠ If <b>KETONE &gt;1.5mmol/L, for doctor review</b></li> <li>⚠ If <b>KETONE &gt;3.0mmol/L</b> Exclude DKA-Venous pH, bicarbonate, lab glucose, U&amp;E. Refer to diabetes team</li> </ul>
15.0-16.9	2 units	3 units	5 units	units	
17.0-18.9	3 units	4 units	5 units	units	
19.0-20.9	3 units	5 units	6 units	units	
21.0-22.9	4 units	6 units	7 units	units	
23.0-24.9	4 units	7 units	8 units	units	
25.0-27.0	5 units	8 units	9 units	units	
Over 27	6 units	9 units	10 units	units	

### MAINTAINING GLYCAEMIC CONTROL

Most people with hyperglycaemia will need a basal insulin to maintain glycaemic even if they respond to the correction dose. The following are suggested basal insulin regimes.

#### > People NOT on an intermediate acting (NPH) or long acting insulin:

Where glucose has risen above 12.0 mmol/l due to glucocorticoid treatment, start NPH insulin which has an intermediate duration of action (e.g. Humulin I®, Insulatard®) - a starting total dose of 0.3 units/kg/day is conservative but experience suggests that a dose of 0.5 units/kg/day or more may be required depending on severity of illness, BMI and pre-existing diabetes control as indicated by HbA1c. Give 2/3 of the total daily dose in the morning (07.00 – 08.00) and the remaining 1/3 in the early evening (17.00-18.00). e.g. 0.3 x 80kg = 24 units/d i.e. 16 units a.m. and 8 units p.m. ). NOTE- there should be a low threshold for dose escalation (see table below) and referral to the diabetes team

NPH insulin twice daily is recommended as this gives more flexibility with dose adjustment. However, the metabolic effects of dexamethasone can persist for up to 36 hours, thus a longer acting basal analogue insulin may also be considered. The choice should be based on the individual patient, for example if there is considerable postprandial hyperglycaemia with NPH and the patient is eating and drinking a premixed insulin (see examples below) may be more appropriate.

#### ⚠ ALERT NOTE - if:

- > Older (>70 yrs) or frail
- > Serum creatinine >175 umol/l (eGFR <30 ml/min)

**Use a reduced NPH insulin dose of 0.15 units/kg (e.g. 0.15 x 80kg = 12 units i.e. 8 units a.m. and 4 units p.m.) NOTE- there should be a low threshold for dose escalation and referral to the diabetes team**

› **People already using once or twice daily long-acting insulin or twice daily NPH including those on basal-bolus regimens**

Increase the long acting basal or NPH insulin by 20% but this may need rapid escalation by as much as 40% depending on response. Titrate the dose using the tables below. Patients on basal-bolus regimens may not require 'mealtime' insulin boluses if not eating, however, if hyperglycaemia persists during adjustment of basal insulin then use corrective rapid acting insulin doses according to total daily insulin dose (TDD) or weight given in the table for correction doses of rapid acting insulin

› **People on twice-daily pre-mix insulin**

e.g. NovoMix 30®/Humulin M3®/Humalog Mix 25®/Humalog Mix 50®

Continue mixed insulin and adjust dose (follow dose adjustment for long-acting insulin table below). Consider increasing the morning dose by 20% but this may need rapid escalation by as much as 40% each day depending on the response. There should be a low threshold for referral to the diabetes team

## DOSE ADJUSTMENT FOR LONG-ACTING INSULIN

Doses can be titrated daily, although longer-acting insulins may take 48-72 hours to reach steady state. Dose adjustments will affect blood glucose throughout the day

### ONCE daily long-acting insulin

GLUCOSE LEVEL JUST BEFORE INSULIN DOSE	
<4mmol/L	Reduce insulin by 20%
4.1-6mmol/L	Reduce insulin by 10%
6.1-12mmol/L	No change
12.1-18mmol/L	Increase insulin by 10%
>18mmol/L	Increase insulin by 20%

### TWICE daily NPH or long-acting insulin

GLUCOSE LEVEL	JUST BEFORE MORNING INSULIN DOSE	JUST BEFORE EVENING INSULIN DOSE
<4mmol/L	Reduce <b>evening</b> insulin by 20%	Reduce <b>morning</b> insulin by 20%
4.1-6mmol/L	Reduce <b>evening</b> insulin by 10%	Reduce <b>morning</b> insulin by 10%
6.1-12mmol/L	No change	No change
12.1-18mmol/L	Increase <b>evening</b> insulin 10%	Increase <b>morning</b> insulin by 10%
>18mmol/L	Increase <b>evening</b> insulin by 20%	Increase <b>morning</b> insulin by 20%

› **People using a personal insulin infusion pump**

If the person is too unwell to manage their pump, transfer to a Variable Rate Intravenous Insulin Infusion (VRIII) with a basal insulin given alongside - seek the advice of the diabetes team. If the pump is removed, give the pump to a relative for safekeeping or label with the patients details and safely store

Those people well enough to manage their subcutaneous insulin infusion pump should be recommended to initially increase the basal rates by 20% and be made aware that this may need to be increased further on a daily basis. Refer all people using a personal insulin pump to the diabetes team

## END OF GLUCOCORTICOID THERAPY

After glucocorticoid therapy is stopped insulin resistance and consequently insulin requirements usually fall gradually requiring a gradual reduction in insulin requirements. However in COVID-19 patients a faster and a more aggressive reduction in insulin dose may be necessary. From day one, the total insulin dose may need to be reduced by as much as 50% guided by 'pre-steroid' insulin requirements. Subsequent insulin dose changes should be guided by 6 hourly glucose monitoring and input from the diabetes specialist team.

## DISCHARGE AND FOLLOW-UP

› **Diabetes precipitated by COVID-19 infection and dexamethasone treatment**

Normoglycaemia may be established after stopping dexamethasone without the need for ongoing diabetes therapy. However, up to a third of people may later develop diabetes therefore alert the GP that the patient will need a yearly HbA1c measurement

› **People with known diabetes**

These patients will require close support following discharge. The discharge guidelines and patient information leaflet produced by this group are available to facilitate this. The leaflet can be accessed here: <https://www.diabetes.org.uk/professionals/resources/shared-practice/inpatient-and-hospital-care#patients>

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Designed by: [Leicester Diabetes Centre](#)

# COncise adVice on Inpatient Diabetes (COVID:Diabetes): SAFE AND SUPPORTED DISCHARGE TO REDUCE READMISSIONS AND IMPROVE PATIENT FLOW

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## NATIONAL INPATIENT DIABETES COVID-19 RESPONSE GROUP\*

### ✓ Key Facts

COVID-19 disease can:

- ⚠ Cause severe insulin resistance and insulin deficiency precipitating DKA in people with type 1 diabetes and unusually also in those with type 2 diabetes
- ⚠ Precipitate new onset diabetes
- ⚠ Result in the need for new or increased insulin therapy and often at very high doses

On recovery, insulin requirements can **fall rapidly with the risk of hypoglycaemia**. The insulin dose must be carefully adjusted and factored in to discharge planning.

**Insulin – actions for safe discharge of people using insulin:** this should be supplemented by local guidance on insulin dose adjustment and how to obtain advice.

**When planning a discharge** it is essential that there is liaison between the person with diabetes, the discharging team, diabetes and community teams to agree an individualised discharge care plan with the aim to ensure that systems are in place to:

- > Monitor blood glucose at least before each insulin injection
- > Adjust insulin dose to prevent hypoglycaemia, recurrence of hyperglycaemia and DKA
- > Alert appropriate teams to people with specific care requirements (see table below)
- > Facilitate a follow-up plan by the specialist team or those in the community experienced in insulin dose adjustment

**i** The following clinical scenarios are provided to assist teams when planning a safe discharge for a person using insulin:

CLINICAL SCENARIO	DISCHARGE CARE PLAN
<p><b>Person is <u>unable</u> to self-administer insulin safely as they:</b></p> <ul style="list-style-type: none"> <li>&gt; Have a cognitive impairment e.g. learning disability, dementia</li> <li>&gt; Have a risk issue e.g. recent self-harm, suicidal intent, severe mental health issues</li> <li>&gt; Have visual impairment or dexterity issues</li> </ul>	<p><b>LEVEL 1 – NURSE ADMINISTRATION OF INSULIN</b></p> <ul style="list-style-type: none"> <li>⚠ <b>Insulin doses to be clearly documented on discharge summary</b></li> <li>&gt; Refer to district nursing service for insulin administration and glucose/ketone monitoring. (N.B. if risk issue is indicated, risk assessment information must be shared)</li> <li>&gt; District nurses to liaise with GP/Diabetes teams for insulin titration as per local guidance</li> <li>&gt; <b>Refer to checklist for safe discharge below</b></li> </ul>
<p><b>Person/carer is <u>able</u> to administer insulin but needs <u>temporary supervision/support</u> as they:</b></p> <ul style="list-style-type: none"> <li>&gt; Are new to insulin treatment</li> <li>&gt; Require insulin adjustment from a high dose (see above)</li> <li>&gt; Need support with glucose +/- ketone monitoring or insulin titration</li> <li>&gt; Need additional key education</li> </ul>	<p><b>LEVEL 2 – SUPERVISED ADMINISTRATION OF INSULIN REQUIRED (temporary until competent)</b></p> <ul style="list-style-type: none"> <li>⚠ <b>Insulin doses to be clearly documented on discharge summary</b></li> <li>&gt; Refer to district nursing service for support with insulin administration to include glucose/ketone monitoring; education and advice</li> <li>&gt; District nurses to liaise with GP/Diabetes teams for insulin titration as per local guidance</li> <li>&gt; <b>Refer to checklist for safe discharge below</b></li> </ul>
<p><b>Person is <u>able</u> to safely self-administer insulin and they:</b></p> <ul style="list-style-type: none"> <li>&gt; Can monitor glucose +/- ketones</li> <li>&gt; Can dispose of sharps safely</li> </ul>	<p><b>LEVEL 3 – SELF ADMINISTRATION OF INSULIN</b></p> <ul style="list-style-type: none"> <li>⚠ <b>Insulin doses to be clearly documented on discharge summary and in the person's discharge information</b></li> <li>&gt; Ensure person understands signs &amp; symptoms of hypoglycaemia &amp; hyperglycaemia, and how to treat</li> <li>&gt; Check person has contact details of diabetes team to get advice, support or follow up appointments if needed</li> <li>&gt; <b>Refer to checklist for safe discharge below</b></li> </ul>

## COVID-19 and Diabetes – Safe and supported discharge to reduce readmissions and improve patient flow

DISCHARGE CHECKLIST FOR PEOPLE USING INSULIN (Please ensure this is completed)			
Insulin therapy (2 week supply) - and starter pack if new to insulin	<input type="checkbox"/>	Blood ketone test strips*	<input type="checkbox"/>
Standard pen injection needles	<input type="checkbox"/>	Urine ketone strips (if ketone meter unavailable)*	<input type="checkbox"/>
Safety pen injection needles 5mm (Level 1 patients)	<input type="checkbox"/>	Sharps box	<input type="checkbox"/>
Lancets for finger pricking (safety lancets for Level 1 patients)	<input type="checkbox"/>	Discharge letter	<input type="checkbox"/>
Glucose meter	<input type="checkbox"/>	Referral to District Nurses (if needed)	<input type="checkbox"/>
Glucose test strips	<input type="checkbox"/>	Contact details for diabetes team (if needed)	<input type="checkbox"/>
Ketone meter*	<input type="checkbox"/>	Follow up appointment (if needed)	<input type="checkbox"/>
*all people with type 1 diabetes; people with type 2 diabetes and history of DKA			

### PEOPLE USING A PERSONAL INSULIN PUMP AND/OR WEARABLE DIABETES TECHNOLOGY

- > Always RETURN the insulin pump to the person with diabetes.
- > Check that they have sufficient pump consumables at home.

For people using continuous glucose monitoring or 'flash' (Libre) monitors – check they have sensors at home along with lancets and strips for blood glucose and ketone monitoring to confirm when blood glucose is out of range.

**NOTE:** Pump users may need a supply of subcutaneous insulin and/or pen devices at discharge to use until they restart their pump and to keep at home in case the pump fails. Check with the person before discharge.

### OTHER DIABETES MEDICATIONS – ACTIONS FOR SAFE DISCHARGE OF PEOPLE USING OTHER DIABETES MEDICATIONS

- > **Metformin** – can be reintroduced when person is clinically well, eGFR >30ml/min and lactate normal.
- > **SGLT2 inhibitors** - drugs ending in “-flozin” – do **NOT** use if person has had DKA. Ensure person is eating and drinking before restarting and remind the person of ‘Sick day rules’ as SGLT2 inhibitors should be temporarily stopped during any illness causing dehydration. Be cautious when eGFR is persistently below 45ml/min, and seek specialist advice when unsure.
- > **Sulphonylureas** e.g. Gliclazide, Glimpiride – may have been stopped temporarily during acute illness because of risk of hypoglycaemia. If continuing risk e.g. elderly; impaired cognition; renal impairment; reduced oral intake; recent HbA1c <53mmol/mol - consider alternatives if appropriate.
- > **Other diabetes medications, including DPP-4 inhibitors, GLP-1 agonists and pioglitazone** should be reviewed prior to discharge (where possible discuss with the diabetes team) or as soon as possible following discharge (by GP or usual care provider).

### PEOPLE WITH ACTIVE FOOT DISEASE

- > Confirm diabetic foot team are aware of discharge and a follow-up plan is in place
- > Confirm the person has been informed of duration of any antibiotic treatment and if antibiotics need to be re-prescribed
- > Confirm a referral to practice nurse / community team for dressings has been made
- > Confirm supply of dressings has been given
- > Confirm the person has appropriate footwear and protection

#### Education and support

The key aim is to ensure that the person is safe at the point of discharge and that an individualised discharge care plan is in place, to include ongoing further education. People who have been newly diagnosed with diabetes are likely to be feeling extremely anxious, they may require additional reassurance (see below for conversation guidance).

#### Conversation guidance for supporting anxious patients

Your words will have a significant impact on how your patients feel, and their ongoing confidence to manage their condition. Consider the following suggestions:

- > Normalise, but don't minimise anxieties. These are stressful times and a degree of worry is entirely appropriate.
- > Discuss risk sensitively rather than employing 'scare tactics'. It is much more effective to build a person's self-efficacy; e.g. 'what's one thing you could work on to get your blood glucose more stable?' rather than use a phrase such as 'your control is poor and will lead to complications'
- > Signpost to sources of support e.g. GP surgery, local diabetes team, Diabetes UK helpline, Diabetes UK online resources

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