

University of Dundee

New Guidance on Managing Inpatient Hyperglycaemia during the COVID-19 Pandemic

Rayman, G.; Lumb, A.; Kennon, B.; Cottrell, C.; Nagi, D.; Page, E.

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DR GERRY RAYMAN (Orcid ID : 0000-0003-3331-7015)

DR ALISTAIR NATHAN LUMB (Orcid ID : 0000-0001-7041-9534)

MRS EMMA PAGE (Orcid ID : 0000-0002-6998-7064)

PROFESSOR KETAN DHATARIYA (Orcid ID : 0000-0003-3619-9579)

DR PARTH NARENDRAN (Orcid ID : 0000-0002-4583-8793)

DR ROSE STEWART (Orcid ID : 0000-0003-1985-1406)

DR MAYANK PATEL (Orcid ID : 0000-0002-6609-5394)

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Corresponding Author Email ID: gerry.rayman@ipswichhospital.nhs.uk

New Guidance on Managing Inpatient Hyperglycaemia during the COVID-19 Pandemic

Rayman G, Lumb A, Kennon B, Cottrell C, Nagi D, Page E, Voigt D, Courtney H, Atkins H, Platts J, Higgins K, Dhatariya K, Patel M, Narendran P, Kar P, Newland-Jones P, Stewart R, Burr O, Thomas S.

The COVID-19 pandemic has had a dramatic impact on the provision of acute inpatient care with specialists from all disciplines having to manage patients outside of their usual speciality areas. In many UK hospitals diabetes consultants and diabetes inpatient specialist nurses have been redeployed to the wards to care for COVID-19 positive or suspected cases. Consequently, clinicians relatively unfamiliar with managing hyperglycaemia have been required to do so as the usual input from diabetes specialist teams has not been possible in many areas.

The National Diabetes Inpatient COVID-19 Response Group was formed to provide guidance to those involved in the care of inpatients with diabetes during this crisis. We have published in a previous issue of

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this journal guidance on care at the 'front door' aimed at emergency departments and admitting teams¹. We now present guidance on the management of inpatient hyperglycaemia (Figure 1). We recognise that most hospitals will already have established local guidance in place. The current guidance is intended to help supplement and update existing guidance with a particular reference to supporting those less experienced in insulin use. In this respect, it is tailored to manage hyperglycaemia but as much as possible reducing the risk of overcorrection resulting in hypoglycaemia. It thus sets more liberal glycaemic targets than have been suggested in previous UK guidelines². The COVID specific diabetes algorithms aim to achieve a 'lower' target of 6.0 mmol/L (higher than the previous of 4.0mmol/L) yet to keep blood glucose levels less than 10.0 mmol/L with up to 12.0 mmol/L being acceptable.

Uniquely, it provides 3 different correction regimes for rapid acting analogue insulin based on the information available to the clinician. Firstly, if the person with diabetes knows their own 'correction dose' this should be used (e.g. for people with type 1 diabetes who are DAFNE trained, 1 unit reduces the blood glucose by 3.0 mmol/L). Secondly, if the total daily dose is known the correction is based on intervals of less than 50 units/day, 50-100 units/day and over 100 units/day. Finally, where none of the previous are known, the correction is based on weight with intervals of less than 50 kg, 50-100 kg and > 100 kg (for insulin naïve people or those newly presenting).

The guidance recommends commencement of a basal insulin if hyperglycaemia persists after several correction doses of rapid acting insulin within a 24 hr period. The algorithm recommends a starting dose related to the person's weight and specific issues such as age, fragility and renal function. There are then dosing regimens related to the particular basal insulin available in individual hospitals. There is also a dose adjustment regimen for the basal regimen based on the blood glucose levels immediately prior to the timing of the basal insulin.

Finally, the guidance recognises that the insulin dose may need adjustment, particularly the basal insulin dose when there is a change in insulin sensitivity such as can occur with improving infection, reduction in corticosteroid treatment and in those recovering from COVID-19 related insulin resistance.

Although, this guidance has been introduced for use during the present pandemic it is possible that this more judicious glucose target that has been previously advocated by some³ and the early intervention with basal insulin may become the established guidance for the future.

1. Guidelines for the management of diabetes services and patients during the COVID-19 Pandemic. Rayman G, Lumb A, Kennon B, Cottrell C, Nagi D, Page E *et al* DOI:10.1111/dme.14316
2. A good inpatient diabetes service. Joint British Diabetes Societies. https://abcd.care/sites/abcd.care/files/resources/A_good_Inpatient%20Service_FINAL_Aug19.pdf. Accessed 12/05/2020
3. Levy N, Hall G. M. National guidance contributes to the high incidence of inpatient hypoglycaemia. *Diabet. Med.* 36: 120–121 (2019)

COncise adVice on Inpatient Diabetes (COVID:Diabetes):

DiABETES UK
KNOW DIABETES. FIGHT DIABETES.

GUIDANCE FOR MANAGING INPATIENT HYPERGLYCAEMIA



NATIONAL INPATIENT DIABETES COVID-19 RESPONSE GROUP*

Use when:

- ✓ **Glucose above 12 mmol/l and a correction dose is appropriate for the individual patient**
- ✓ **DKA/HHS not present**

Can be used in place of variable rate intravenous insulin when infusion pumps not available

- ⚠ **DO NOT use for people with COVID-19 causing severe insulin resistance in the ICU. Contact your local diabetes team for advice in this circumstance.**
- ⚠ **After 9pm consider risk of hypoglycaemia overnight when thinking about the use of a corrective dose**

IF GLUCOSE > 12 MMOL/L AND NO INSULIN ADMINISTERED IN PREVIOUS 4 HRS CONSIDER A CORRECTIVE DOSE OF RAPID-ACTING ANALOGUE INSULIN (NOVORAPID®/HUMALOG®/APIDRA®)

- > Re-check glucose after 4 hours OR before next meal - further action may be required
- > Target glucose 6-10 mmol/l – aiming for higher end of range (up to 12 mmol/l acceptable)
- > Dose decided using one of the following 3 factors and the table below. Factors are listed in order of importance:
 1. If person uses pre-existing correction ratio (**CR**) (e.g. 1 unit insulin lowers glucose by 3 mmol/l) this should be used
 2. If person using insulin but doesn't have correction ratio, use their usual total daily insulin dose (**TDD**)
 3. If person not previously using insulin, or dose is unknown, use their **weight**
- > If the person has rapid-acting insulin with each meal the corrective dose can be added to their mealtime dose if appropriate.

GLUCOSE (MMOL/L)	CR* = 1UNIT ↓ 4 MMOL/L OR TDD** LESS THAN 50 UNITS OR WEIGHT LESS THAN 50KG	CR* = 1UNIT ↓ 3 MMOL/L OR TDD** = 50-100 UNITS OR WEIGHT BETWEEN 50-100 KG	CR* = 1UNIT ↓ 2 MMOL/L OR TDD** OVER 100 UNITS OR WEIGHT OVER 100 KG
12.0-14.9	1	1	2
15.0-16.9	2	2	3
17.0-18.9	2	3	4
19.0-20.9	3	3	5
21.0-22.9	3	4	6
23.0-24.9	4	5	7
25.0-27.0	4	5	8
Over 27	5	6	9

*CR = Correction ratio, **TDD = total daily insulin dose

- ⚠ **It is recommended that glucose is checked at least 4 times per day in people treated with insulin**

LONG-ACTING INSULIN (LEVEMIR®/ ABASAGLAR®/LANTUS®/SEMGLEE®/ HUMULIN I®/ INSULATARD®/INSUMAN BASAL®)

- > **Already using long-acting insulin:** Continue and titrate dose (see tables below)
 - > **NOT already using long-acting insulin:** If 2 or more glucose readings in 24 hrs are > 12 mmol/l (eg, 2 or more corrective doses in previous 24 hrs)
 - » ADD long-acting insulin - total dose 0.25 units/kg/day (eg, 0.25 x 80kg = 20 units OD OR 10 units BD depending on the choice of basal insulin - see below).
 - » NOTE if:
 - Older (>70 yrs) or frail
 - Serum creatinine >175 umol/l
- Use a reduced long-acting insulin dose of 0.15 units/kg (eg 0.15 x 80kg = 12 units OD OR 6 units BD)

Recommended options (all acceptable – refer to local protocols):

Levemir® Insulin detemir 100 units/ml (U100)	<ul style="list-style-type: none"> > Two equal doses of 0.125 units/kg, 12 hrs apart > Not available in vials so insulin pen needles must be available to use with a pen device* > Can adjust either dose
Abasaglar®/Lantus®/Semglee® Insulin glargine 100 units/ml (U100)	<ul style="list-style-type: none"> > Single dose of 0.25 units/kg/24 hrs (minimises patient contact) or > Split above into 2 equal doses, 12 hrs apart > Abasaglar®/Semglee® not available in vials so insulin pen needles must be available to use with an insulin pen device**
Humulin I®/Insulatard®/Insuman Basal® Isophane insulin 100 units/ml (U100)	<ul style="list-style-type: none"> > Two equal doses of 0.125 units/kg/10-14 hrs apart > Particularly suited to steroid treatment – dose given as 2/3 total long-acting insulin dose am : 1/3 total long-acting insulin dose pm

- * Only specific insulin syringes/needles should be used to administer insulin from vials

- ** DO NOT WITHDRAW INSULIN FROM A 3ML INSULIN PEN CARTRIDGE OR 3ML PREFILLED



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 long-acting insulin

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

Dose reduction should also be considered in the following circumstances:

- > Improving infection (as measured by falling CRP)
- > Enteral feed reducing or stopping
- > Corticosteroid treatment reducing or stopping
- > End of life care

⚠ In people recovering from COVID-19-related insulin resistance, doses may need to be reduced RAPIDLY to avoid hypoglycaemia.

As noted above, severe insulin resistance has been noted in some people with COVID-19 in the ICU. In this circumstance, suggested alternative treatment strategies include four times daily doses of Levemir[®] or twice daily doses of Lantus[®].

Contact your local diabetes team for advice.

*NATIONAL INPATIENT DIABETES COVID-19 RESPONSE GROUP:

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