NHS Greater Glasgow and Clyde

CLINICAL GUIDELINE

Diabetes, Variable Rate Intravenous Insulin Infusion (VRIII): Frequently Asked Questions

A guideline is intended to assist healthcare professionals in the choice of disease-specific treatments.

Clinical judgement should be exercised on the applicability of any guideline, influenced by individual patient characteristics. Clinicians should be mindful of the potential for harmful polypharmacy and increased susceptibility to adverse drug reactions in patients with multiple morbidities or frailty.

If, after discussion with the patient or carer, there are good reasons for not following a guideline, it is good practice to record these and communicate them to others involved in the care of the patient.

Version Number:	2
Does this version include changes to clinical advice:	No
Date Approved:	5th May 2023
Date of Next Review:	31st May 2025
Lead Author:	Urmila Ratnasabapathy
Approval Group:	Medicines Utilisation Subcommittee of ADTC

Important Note:

The Intranet version of this document is the only version that is maintained.
Any printed copies should therefore be viewed as 'Uncontrolled' and as such, may not necessarily contain the latest updates and amendments.

Diabetes: Variable Rate Intravenous Insulin Infusion (VRIII) for ADULT patients

NHS Greater Glasgow and Clyde

Frequently Asked Questions

Contents	Page

Produced by: VRIII Implementation Group* May 2021
Review date: May 2023 Next review May 2026

*Acknowledgement to the GG&C Clinical Nutrition Group for their contributions to questions 4.4 - 4.6

1. INTRODUCTION

In April 2019, a Variable Rate Intravenous Insulin Infusion (VRIII) chart and guideline were rolled out to improve safety concerning the prescribing, administration and monitoring of intravenous insulin in adult patients. The guideline was developed in line with the most recent Joint British Diabetes Societies and Association of Anaesthetists of Great Britain and Ireland guidelines. It should be used in medical and surgical ADULT patients (excluding obstetrics, paediatrics, DKA and HHS) and replaces existing 'sliding scale' insulin guidelines.

The VRIII chart (click here) is an 8-page coloured booklet to record all information relating to VRIII prescribing, administration and monitoring. The chart includes:

- Prescribing sections for both IV insulin and VRIII fluids
- Integrated VRIII guideline (by-passing the need to view the guideline on StaffNet)
- Guidance on preparation and administration of IV insulin
- Section to record all monitoring

The following additional educational material is also available:

1. Notes for Prescribers on how to use the chart
2. Notes for Nursing Staff on how to use the chart
3. 9-min video (if this hyperlink does not work please, copy and paste this link into a Google Chrome browser: https://www.youtube.com/watch?v=7OWRkZmb6D4).

This FAQ provides **additional** information – it is therefore important that clinical staff have read all instructions on both the VRIII chart and Notes for Prescribers / Notes for Nursing Staff prior to reading this FAQ. All educational material can be accessed via the Prescription Chart Homepage on StaffNet (via 'Clinical Info' tab).

2. PRESCRIBING - insulin

Q2.1: Is there a CBG threshold value for starting VRIII and, if so, what is it?

The clinical team responsible for the patient should make a decision on what the appropriate CBG level should be for commencing VRIII, taking in to account the individual patient's circumstances.

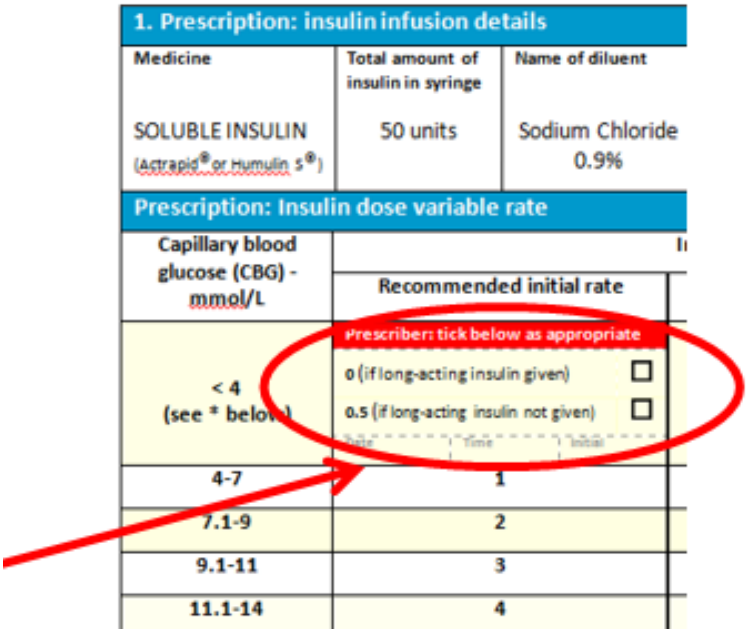
Circumstances that lower the target CBG (i.e. reduce the threshold) for commencing VRIII include an unwell patient, high NEWS scores, sepsis, decreased conscious level, fasting, insulin deficient patients, pregnancy and mild/moderate ketosis. If unsure, please seek support or advice from the diabetes specialist team.

Q2.2: Why must VRIII be prescribed on *both* the Medicine Prescription Chart (Kardex) and the VRIII chart?

All charts supplementary to the Kardex must also be prescribed on the Kardex, with 'as per chart' endorsed in the dose section. This safety feature ensures that all prescribers and nursing staff, when reviewing the Kardex, are aware that a separate prescribing chart is in use. This is also applicable for wards using the electronic prescription chart on HEPMA.

Q2.3: Should sub-cutaneous long acting (basal) insulin be given at a specific time in relation to the fasting period?

No, long acting insulin should be administered at the patient's usual time, regardless of the fasting start time and the expected fasting finish time. Clearly document the administration time of the patient's long acting sub-cutaneous insulin and inform nursing staff that it is important to administer during VRIII. Complete the red prescribing box to indicate that long acting insulin is being continued – see below.



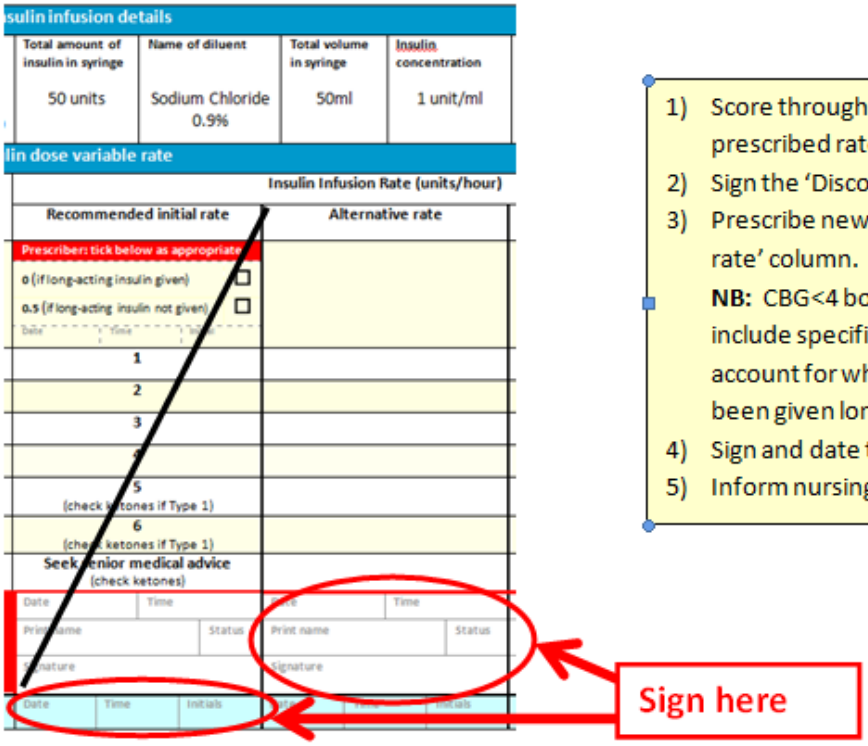
1. Prescription: insulin infusion details		
Medicine	Total amount of insulin in syringe	Name of diluent
SOLUBLE INSULIN (Actrapid® or Humulin S®)	50 units	Sodium Chloride 0.9%

Prescription: Insulin dose variable rate	
Capillary blood glucose (CBG) - mmol/L	Recommended initial rate
< 4 (see * below)	Prescriber: tick below as appropriate 0 (if long-acting insulin given) ☐ 0.5 (if long-acting insulin not given) ☐
4-7	1
7.1-9	2
9.1-11	3
11.1-14	4

Q2.4: Why would an alternative insulin scale be required?

An alternative insulin scale would be required for patients who are either very sensitive or very resistant to insulin. For example, a patient who is prescribed high doses of sub-cutaneous insulin may require high IV doses; the standard scale may not provide adequate CBG control for such patients.

Unless advised otherwise by a Diabetes Specialist, all patients (regardless of their normal sub-cutaneous dose) should be started on VRIII using the 'Recommended initial rate' (pre-populated on the VRIII chart). Patients with uncontrolled CBGs on VRIII should be prescribed an alternative scale, following the steps outlined below. If you are unsure of how to prescribe an alternative scale, seek advice from a Diabetes Specialist.



1) Score through the previously prescribed rate
2) Sign the 'Discontinuation' box
3) Prescribe new rate in the 'alternative rate' column.
   NB: CBG<4 box - remember to include specific instructions to account for whether the patient has been given long-acting insulin or not.
4) Sign and date the prescription
5) Inform nursing staff of the change

Q2.5: Should Xultophy® (containing insulin degludec and liraglutide) sub-cutaneous injection be continued if the patient is on VRIII?

All in-patients on Xultophy® should already have been temporarily switched over to insulin degludec (Tresiba® 100 units/ml) on its own, regardless of whether VRIII is required.

3. PRESCRIBING – VRIII fluids

Q3.1: Why are IV fluids required for patients on VRIII?

IV fluids are required to:

- Maintain fluid balance and electrolytes (including sodium and potassium) in the normal range; the majority of patients on VRIII are unable to eat or drink.
- Facilitate the administration of glucose at a steady rate.

Q3.2: Why must the VRIII fluid contain glucose?

To avoid hypoglycaemia by providing glucose at a steady rate for the insulin infusion.

Q3.3: Is it necessary to continue glucose-containing fluids even if the CBGs are high?

Yes, this is essential. Once the rate of VRIII glucose-containing infusion has been decided, the rate should NOT be altered unless there are concerns about fluid overload. Changing the type

of substrate fluid frequently, according to the CBG values, is discouraged since it leads to highly variable CBG readings. If the blood glucose is outside the target range, this should be corrected by altering the rate of insulin infusion, not the VRIII glucose-containing IV fluid.

Q3.4: What are 'background fluids' and when are these prescribed?

If the patient is *euvolaemic* then the VRIII fluid regimen is an appropriate 'maintenance' fluid regimen for the majority of patients i.e. only VRIII IV fluids will be required (see VRIII guideline for advice on special patient groups).

Patients who are *hypovolaemic* (e.g. due to sepsis, dehydration, increased GI losses) may require either resuscitation fluids or replacement fluids in addition to VRIII fluids. Such fluids generally do not contain glucose, must be prescribed on a separate fluid prescription chart and administered via a separate intravenous cannula.

Q3.5: Why is the fluid recommended in my clinical area not the default 0.45% sodium chloride + 5% glucose + 0.15% potassium chloride mixture?

0.45% sodium chloride + 5% glucose + 0.15% potassium chloride mixture is the VRIII fluid recommended by JBDS (Joint British Diabetes Societies) and is consequently the first line fluid in the NHSGGC VRIII guideline. It is considered an ideal fluid for administration with VRIII because it is near to 'physiological' and contains glucose. A fluid bag containing 0.45% sodium chloride (rather than 0.18% sodium chloride) is preferred, as unwell diabetic patients on VRIII often have higher sodium requirements.

Prior to rollout of VRIII, 0.18% sodium chloride + 4% glucose + 0.15% potassium chloride infusion bags were already being used for patients requiring general maintenance fluids in some surgical wards in NHSGGC. To minimise confusion in these clinical areas (and avoid storage problems), it was agreed locally that these bags would also be used for VRIII patients. Although not the preferred VRIII fluid bags, they contain a mixture of sodium chloride, glucose and potassium, which is essential for the VRIII regimen.

Please note the following:

1) Such wards may stock 1000ml bags of 0.18% sodium chloride + 4% glucose + 0.15% potassium chloride (containing 20mmol of potassium per 1000ml). The VRIII guideline provides guidance on using 500ml bags of 0.18% sodium chloride + 4% glucose + 0.15% potassium chloride (containing 10mmol of potassium per 500ml), therefore, extra vigilance is required.

2) The potassium supplementation table on page 8 of the VRIII chart currently states that a 500ml bag of 0.18% sodium chloride + 4% glucose + 0.3% potassium chloride is available to prescribe for patients requiring 20mmol of potassium. This 500ml bag (containing 20mmol of potassium per 500ml) is no longer available and local decisions have been made on alternative treatment options, which are either:

    a. Prescribe 0.45% sodium chloride + 5% glucose + 0.3% potassium chloride 500ml bag (containing 20mmol of potassium per 500ml)

    OR

b. Prescribe 0.18% sodium chloride + 4% glucose + 0.3% potassium chloride **1000ml** bag (containing 40mmol of potassium per 1000ml) and advise nursing staff to **set the infusion pump to only run in 500ml** i.e. discard the remaining 500ml. Alternatively the 1000ml bag can be run over 10 hours provided the serum potassium remains within the target range.

4. PRESCRIBING – special patient groups

Q4.1: Can VRIII be used in critical care?

Critical Care patients with Diabetes
The VRIII guideline can be used for patients with Diabetes in Critical Care Units, however, the standard VRIII fluid regimen may not be appropriate if on enteral feeding or TPN. See questions 4.4 – 4.6 for guidance on this.

Critical Care areas that have decided not to follow the new VRIII guideline should have a process in place to manage patients for transfer to a downstream ward who still require IV insulin; a switch to the new VRIII guideline and chart is considered the safest approach. Critical Care areas should be **encouraged to adopt the VRIII guideline** to ensure there is consistency in management and charting.

Critical Care patients with hyperglycaemia (without Diabetes)
ICUs may have local protocols for managing non-diabetic patients with hyperglycaemia; VRIII can also still be used for this patient group (akin to steroid-induced hyperglycaemia i.e. 'non diabetic').

Q4.2: Can VRIII be prescribed for renal patients?

The guideline does not exclude renal patients, however, it is important to note that renal impairment may alter a patient's insulin requirements. It is acceptable to start on the insulin rate as recommended on the guideline and alter the rate, if required, based on the patient's CBG response. The total volume of VRIII fluid infused is also important; seek specialist diabetes/renal advice on rate to run VRIII fluids and exact fluid selection.

Q4.3: How do I manage patients with or without pre-existing diabetes who are hyperglycaemic when on steroids?

Most of these cases can be managed by addition of glicazide and/or intermediate/long-acting subcutaneous insulin, without the need to progress to VRIII. You can find further details on how to manage this in the NHSGGC In-patient Prescribing FAQs for Junior Doctors (Q17-19) on StaffNet

Q4.4: Do I need to run VRIII fluids with the insulin infusion if a patient is receiving Parenteral Nutrition?

- VRIII fluids are RARELY required in patients who are receiving Parenteral Nutrition as they are usually already prescribed large volumes of fluid and glucose (substrate) within Parenteral Nutrition.
- If it is felt that additional fluid volume is required, then seek urgent advice directly from the local Nutrition Support Team. This team may have the option to adjust the Parenteral Nutrition prescription accordingly (and on a daily basis if indicated) rather than commence VRIII fluid, as there is a real risk of fluid overloading these patients with dual intravenous fluid modalities.
- The aim is to get patients off VRIII as soon as is safely and practicably possible. Once blood glucose is stabilised and feeding established, the patient should be converted to subcutaneous insulin injections or oral hypoglycaemics. This can be extremely challenging and if there are problems with glycaemic control then seek timely input from the Diabetes Team.

Q4.5: Do I need to run VRIII IV fluids with the insulin infusion if a patient is on fully established, and consistently delivered, enteral feeding?

- Ward areas should NEVER run IV insulin infusions without accompanying VRIII IV fluids. However, due to the risk of fluid overload and electrolyte imbalance, patients fully established (and meeting their nutritional and/or fluid requirements) on enteral feeding should be assessed on an individual basis and VRIII fluids tailored to needs. Check electrolytes on a regular basis as per the VRIII guideline. If unsure, seek advice from the Diabetes Specialist Team.
- Be alert for prolonged (more than 8 hours) or interrupted periods of feeding (whether deliberate, including overnight-only feeding, or unplanned) as VRIII fluids will need to be given during this time, along with the IV insulin infusion. Do not stop insulin infusions during rest periods unless the patient is hypoglycaemic. Be aware of daily fluid balance goals when calculating volume of VRIII fluids. If the patient is hyperglycaemic, increase the dose of insulin rather than reduce the rate of feeding or withhold VRIII IV fluids.
- The aim is to get patients off VRIII as soon as practicably possible. Once blood glucose is stabilised and feeding established, the patient should be converted to subcutaneous insulin injections or oral hypoglycaemics.

Q4.6: Do I need to run VRIII IV fluids with the insulin infusion if a patient is partially established on enteral feeding

If enteral feeding has not yet reached target levels of nutritional and/or fluid requirements, the additional volume should be supplemented with VRIII IV fluids to ensure that the patient is administered sufficient glucose-containing fluid to accompany the insulin infusion. Adjust the VRIII fluid rate accordingly to reflect and complement the volume of enteral feed administered.

Once the enteral feeding has been fully established and the nutritional requirements are being met with this, then refer to the guidance notes in Q4.5.

5. MONITORING

Q5.1: On page 8 of the chart, the potassium supplementation table advises that U&Es are rechecked at 4 hours but the 'Prescriber Review' section on page 8 suggests at least twice daily review. Is this a discrepancy?

No. The 'Prescriber Review' section states at least twice daily highlighting that the frequency of review depends on the clinical scenario. In the initial stages when insulin is just started, it will be unclear as to how quickly the serum potassium level is going to change; hence a 4 hourly U&Es check to provide information for the VRIII fluid bag choice is required. U&Es checks can then drop down to 12 hourly once the patient is stable.

6. ADMINISTRATION

Q6.1: Why is there a need to replace the VRIII fluid bag immediately when the volumetric pump starts alarming, indicating that the VRIII fluid bag has reached empty?

It is unsafe to continue to administer IV insulin without concomitant VRIII IV fluids. Anticipate when the fluid bag is due to be changed and switch over to the new bag seamlessly (avoiding the need to stop the insulin infusion). It is poor practice to interrupt the insulin infusion unnecessarily.

Q6.2: What should I do if my ward does not stock the recommended VRIII fluids?

The majority of wards will not stock VRIII IV fluids. Designated wards with stock have been identified on each hospital site - click here for the 'Stock Locations of VRIII Fluids' document (or access it via StaffNet/Clinical Info/Medicine Prescribing Charts).

If stock cannot be sourced, contact your local pharmacy department or page the on-call pharmacist via Switchboard if out of hours.

Q6.3: Why is the Octopus brand not a suitable administration set?

Use of an administration set with both an anti-syphon valve and an anti-reflux valve is essential for VRIII administration.

An anti-syphon valve is important as it connects directly to the insulin syringe and prevents accidental syphoning of the insulin syringe. Syphoning is when the entire contents of a syringe empties within a few minutes and inadvertently administers an overdose to the patient. Syphoning is a risk if the insulin syringe is positioned higher than the patient and/or if the syringe is not connected correctly; use of an administration set with an anti-syphon valve will prevent this occurring.

In the event of the VRIII fluid being inadvertently stopped, an anti-reflux valve prevents the insulin solution flowing into the VRIII fluid line.

As the Octopus administration set does not contain an anti-syphon valve it is NOT recommended for use with VRIII. Protect-a-line 2 has both an anti-syphon and an anti-reflux valve and is therefore the recommended administration set.