Worcestershire NHS
Acute Hospitals NHS Trust

GUIDELINE FOR THE MANAGEMENT OF HYPERGLYCAEMIA IN ACUTE CORONARY SYNDROMES (ACS)

This guidance does not override the individual responsibility of health professionals to make appropriate decisions according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

Introduction

This guideline outlines the role of intensive insulin therapy in managing hyperglycaemia within the first 48 hours (and subsequent management) of patients admitted with acute coronary syndromes (ACS). Intensive insulin therapy is defined as an intravenous infusion of insulin and glucose with or without potassium. Hyperglycaemia is defined as a capillary blood glucose level (CBG) above 11.0mmol/l.

The patients covered by this guideline are *all* patients admitted to hospital with ACS and a CBG above 11.0mmol/l, irrespective of whether they are known to have diabetes mellitus or not.

This guideline is for use by the following staff groups :

All qualified health care professionals involved in the management of hyperglycaemia in patients admitted to hospital with ACS.

Lead Clinician(s)

Dr Irfan Babar	Consultant Diabetologist
Approved by Medicines Safety Committee on:	November 2012
Guideline reviewed and Approved by Accountable Director on:	19th September 2018
Review Date: This is the most current document and is to be used until a revised version is available	19th September 2020

Key amendments to this guideline

Date	Amendment	Approved by:
September 2012	Major review of guideline	Countywide Diabetes Group
22/01/2014	Minor updates and changes to CBG readings to reflect WAHT-END-011 guideline	Krishna Kukadia
26/08/2016	Document extended for 12 months as per TMC paper approved on 22nd July 2015	TMC
19/09/2018	Document Reviewed and Minor updates to include new basal insulins and update advice regarding SGLT-2 Inhibitors	Diabetes Countywide Team

Guideline for the Management of Hyperglycaemia in Acute Coronary Syndromes (ACS)

Introduction

Acute Coronary Syndromes (ACS) encompasses a spectrum of unstable coronary artery disease, ranging from unstable angina to transmural myocardial infarction. The principles behind the presentation, investigation and management of these syndromes are similar, but there are important distinctions depending on the category of ACS.

Hyperglycaemia is common in people admitted to hospital with ACS. Recent studies found that approximately 65% of patients with acute myocardial infarction who were not known to have diabetes had impaired glucose regulation when given a glucose tolerance test.

Hyperglycaemia in patient's admitted into hospital with ACS is a powerful predictor of poorer survival and increased risk of complications while in hospital, regardless of whether or not the patient has diabetes. Despite this, hyperglycaemia remains underappreciated as a risk factor in ACS and is frequently untreated. Persistently elevated blood glucose levels in patients during acute myocardial infarction are also associated with increased in-hospital mortality and currently is a better predictor of outcome than admission blood glucose. Management of hyperglycaemia after ACS therefore must not be overlooked and remains an important clinical issue.

Guideline

1. Management for *all* inpatients within 48-hours of presenting with ACS

1.1. All patients presenting to A&E, Medical Admissions Unit or CCU with ACS should have a random blood glucose checked *immediately* with their other baseline tests.

1.2. Manage hyperglycaemia in patients admitted to hospital for ACS by keeping blood glucose levels **11.0 mmol/l or below** while avoiding hypoglycaemia (blood glucose <4.0mmol/l) ***irrespective of whether they have a previous diagnosis of diabetes or not.***

1.3. Consider a ***continuous variable rate intravenous insulin infusion*** (CVRIII) with hourly monitoring of blood glucose levels as per local trust protocol (*see section 2 below*) for any patient with ACS and a CBG above 11.0mmol/l. This needs to be continued for at least 24 hours or longer if the patient is not eating or drinking.

1.4. Patients who are put onto CVRIII, who are usually prescribed subcutaneous insulin injections should have these temporarily stopped with the exception of their basal insulin administered once or twice daily. Basal insulins are: Glargine (Lantus®, Abasaglar®, Toujeo®), Determir (Levemir®), Degludec (Tresiba®), Insulatard®, Humulin I®, Insuman® Basal, Hypurin® Isophane, Hypurin® Lente, Hypurin® Protamine Zinc. Basal insulin should be continued at the usual dose for patients with Type 1 Diabetes. Basal insulin should be continued at **half the usual dose** for patients with Type 2 Diabetes.

1.5. Patients previously taking oral hypoglycaemic agent(s) or injectable GLP-1 analogues e.g. exenatide, dulaglutide, liraglutide should have these discontinued whilst CVRIII is prescribed.

1.6. For the diagnosis and management of ACS refer to WAHT-CAR-043 *'Acute Coronary Syndrome Guideline'.*

2. Preparation of continuous variable rate intravenous insulin infusion

Intravenous insulin infusion is prescribed once only on page 2 of the CVRIII prescription (WR2170). It is prepared as follows:

2.1. Insulin Actrapid 50 units must be measured using an insulin syringe and made up to 50mls with 0.9% sodium chloride, administered via a syringe pump. This should be administered via a syringe pump. The patient should be commenced on the correct point of variable rate regimen 1 according to their baseline CBG **(see point 2.4, insulin infusion rate table)**. Each syringe preparation and rate change must be documented by two members of nursing staff on the relevant section of page 2 of the CVRIII prescription (WR2170)

2.2. Intravenous fluids should not routinely be initiated unless clinically indicated for an additional reason e.g. the patient is dehydrated due to vomiting.

2.3. If intravenous fluids are initiated the insulin syringe pump should be connected to an intravenous access separate from the intravenous fluids. However, if venous access is difficult, use a 2 or 3 tailed device with **non-return valves**.

2.4. Adjust the insulin infusion according to the following variable rate:

CBG (mmol/l)	***Insulin Infusion Rate*** **(units/hour - 1 unit=1ml)**		
	Regimen 1	**Regimen 2**	**Regimen 3**
Below 7.0	0.5	1	2
7.0 – 11.0 (Target range)	2	4	8
11.1 – 17.0	4	8	16
Above 17.0	6	12	24

2.5. Blood glucose levels should be maintained **between 7.0-11.0mmol/l** whilst taking care to avoid hypoglycaemia in the patient (blood glucose <4.0mmol/l). Commence the insulin infusion rate on the appropriate point of variable rate regimen 1 according to the baseline CBG **(see point 2.4).** Monitor CBG **every hour** and adjust the insulin infusion rate according to variable rate regimen 1. Once the patient's treatment is stable i.e. 4 consecutive CBG readings between 7.0 – 11.0mmol/l monitoring may be reduced to **every 2 hours.** Return to hourly monitoring if CBG falls outside this range.

2.6. If CBG is not optimised between 7.0 – 11.0mmol/l after 4 hours consider changing to variable rate regimen 2. Continue monitoring CBG **every hour** and adjust the insulin infusion rate according to variable rate regimen 2. Once the patient's treatment is stable i.e. 4 consecutive CBG readings between 7.0 – 11.0mmol/l monitoring may be reduced to **every 2 hours**. Return to hourly monitoring if CBG falls outside this range. If CBG remains above 11.0mmol/l on a further 4 readings then consideration should be taken to change patients onto regimen 3. Continue monitoring CBG **every hour** and adjust the insulin infusion rate according to variable rate regimen 3. Once the patient's treatment is stable i.e. 4 consecutive CBG readings between 7.0 – 11.0mmol/l monitoring may be reduced to **every 2 hours**. Return to hourly monitoring if CBG falls outside this range

2.7. Further information on continuous variable rate intravenous insulin infusions can be located at WAHT-END-011 '*Guideline for the use of Continuous Variable Intravenous Insulin Infusion (CVRIII)'* and the trust's continuous variable rate intravenous insulin infusion prescription chart (WR2170).

3. Subsequent management of inpatients with ACS following initial treatment of hyperglycaemia

3.1. Patients with a previous diagnosis of Diabetes (Type 1 or 2) on subcutaneous insulin

3.1.1. If the patient is a known diabetic already on subcutaneous insulin injections then their usual regime (see point 1.4 regarding basal insulin) can be restarted as soon as he/she is able to eat and drink (*see WAHT-END-011 for further guidance on discontinuing continuous variable rate intravenous insulin infusions*).

3.1.2. Adjust individual insulin doses if appropriate to keep readings between 7.0-11.0mmol/l whilst avoiding hypoglycaemia (blood glucose <4.0mmol/l). If recent or current HbA1c is found to be high (above 57mmol/mol) then consider a change in insulin regime (or dose) after discussion with the patient.

3.1.3. These patients should be referred to the Diabetes Specialist Nurses prior to discharge and a follow-up appointment organised with the GP (if under primary care previously) or in the hospital based Diabetes Clinic within 3 months of discharge.

3.2. Patients with a previous diagnosis of Diabetes (Type 2) taking oral hypoglycaemic agents and/or injectable GLP-1 analogues

3.2.1. Patients diagnosed with Type 2 Diabetes who were previously taking oral therapy and/or injectable GLP-1 analogues e.g. exenatide should have these agents discontinued and subcutaneous insulin injections initiated. This is even more important if recent diabetes control in this patient has been suboptimal. HbA1c levels over the previous 12 months should be reviewed.

3.2.2. After 24-48 hours at the first breakfast or evening meal, the patient should be commenced on premixed biphasic insulin (**suggested insulin Novomix® 30**) administered subcutaneously twice daily. The starting dose is 8 units twice daily unless the patient required more than 30 units over the previous 24 hours in which case the initial dose should be increased appropriately. Other insulin types and regimes (e.g. once daily Insulatard®) can be considered in any individual patient at the discretion of the Physician or Consultant Diabetologist. Refer the patient to the Diabetes Specialist Nurses and commence the patient on the initiation of insulin care pathway (*See 'Guideline for the Management of the Initiation of Insulin' WAHT-END-006)*

3.2.3. If recent diabetes control has been good (HbA1c <52mmol/mol) and/or hypoglycaemia is a significant concern. The Diabetes team may advise that this subset of patients be switched back to and maintained on oral therapy prior to discharge.

3.2.4. Patients should be seen at the hospital based Diabetes Clinic to review his/her glycaemic profile and HbA1c. If insulin requirements are very low (e.g. less than 10 units a day) or there is a tendency of hypoglycaemia on insulin and/or HbA1c is less than <52mmol/mol then consideration should be given to withdraw insulin therapy and oral therapy adjusted/restarted.

3.2.5. It will be important to stop Pioglitazone (permanently) and Metformin therapy (at least temporarily). Sulphonylureas or DPP4 inhibitors could be restarted if no tendency towards hypoglycaemia is observed. SGLT-2 Inhibitors should be stopped before planned/emergency surgery and/or during periods of acute illness.

3.2.6. Refer these patients to the Diabetes Specialist Nurse prior to discharge. Seek advice from the Diabetes Specialist team on the appropriate management of these patients.

3.3. Patients previously *unknown* to have diabetes

3.3.1. If the patient is not known to be diabetic then either the patient has previously undiagnosed Type 2 Diabetes or may have stress hyperglycaemia.

3.3.2. They should have a Fasting Blood Glucose (FBG) level conducted no earlier than 4 days after the onset of ACS and an HbA1c recorded. These tests should not delay discharge of the patient and can be carried out in primary care.

3.3.3. If the FBG is less than 6.0mmol/l and HbA1c is less than <48mmol/mol then diabetes is *excluded* but these patients are still at a higher risk of it. They should be offered advice about healthy eating, weight management, smoking cessation, alcohol consumption and physical exercise in line with NICE guidance. Advise patients without known diabetes that if they have had hyperglycaemia after an ACS they are at increased risk of developing Type 2 Diabetes and should consult their GP if they experience the following symptoms: frequent urination, excessive thirst, weight loss or fatigue.

3.3.4. GPs should be informed to offer at least annual monitoring of HbA_{1c} and FBG in these patients even if asymptomatic.

3.3.5. If the FBG is >7.0mmol/l and/or HbA1c is more than >48 mmol/mol then it is likely that these patients have previously undiagnosed diabetes and need to be treated following NICE guidance for Type 2 Diabetes

3.3.6. These patients should all receive an inpatient referral to a Diabetic Specialist Nurse. Treatment options need to be decided by the Diabetes team or the patient's GP following appropriate referral.

Monitoring Tool

This should include realistic goals, timeframes and measurable outcomes.

How will monitoring be carried out? Clinical Audit

Who will monitor compliance with the guideline? Countywide Diabetes Specialist Group

STANDARDS	%	CLINICAL EXCEPTIONS
All patients presenting with ACS have a random blood glucose checked within 48 hours of admission	100	None
Hyperglycaemia in patients admitted to hospital with ACS is managed appropriately to keep blood glucose levels below 11.0 mmol/l (which may or may not require the use of a continuous variable rate intravenous insulin infusion) while avoiding hypoglycaemia (blood glucose <4.0mmol/l) irrespective of whether they have a previous diagnosis of diabetes	100	None
Subsequent diabetes management is individualised as outlined in this guideline	100	None

References

1. NICE Clinical Guideline 130 (2011). Hyperglycaemia in Acute Coronary Syndromes. London. National Institute of Clinical Excellence. Accessed via: www.nice.org.uk.

2. WAHT-END-011. Guideline For The Use Of Continuous Variable Rate Intravenous Insulin Infusion (CVRIII) (2013). Worcestershire Acute Hospitals NHS Trust.

3. WAHT-END-002. Guideline for Management of Patients with Diabetes Mellitus in the Immediate Post-MI (Myocardial Infarction) Period. (2009). Worcestershire Acute Hospitals NHS Trust

CONTRIBUTION LIST

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Supporting Document 1 - Equality Impact Assessment Tool

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

		Yes/No	Comments
1.	**Does the policy/guidance affect one group less or more favourably than another on the basis of:**		
	• Race	No	
	• Ethnic origins (including gypsies and travellers)	No	
	• Nationality	No	
	• Gender	No	
	• Culture	No	
	• Religion or belief	No	
	• Sexual orientation including lesbian, gay and bisexual people	No	
	• Age	No	
2.	**Is there any evidence that some groups are affected differently?**	No	
3.	**If you have identified potential discrimination, are any exceptions valid, legal and/or justifiable?**	No	
4.	**Is the impact of the policy/guidance likely to be negative?**	No	
5.	**If so can the impact be avoided?**	N/A	
6.	**What alternatives are there to achieving the policy/guidance without the impact?**	N/A	
7.	**Can we reduce the impact by taking different action?**	N/A	

If you have identified a potential discriminatory impact of this key document, please refer it to Human Resources, together with any suggestions as to the action required to avoid/reduce this impact.

For advice in respect of answering the above questions, please contact Human Resources.

Supporting Document 2 – Financial Impact Assessment

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

	Title of document:	**Yes/No**
1.	Does the implementation of this document require any additional Capital resources	No
2.	Does the implementation of this document require additional revenue	No
3.	Does the implementation of this document require additional manpower	No
4.	Does the implementation of this document release any manpower costs through a change in practice	No
5.	Are there additional staff training costs associated with implementing this document which cannot be delivered through current training programmes or allocated training times for staff	No
	Other comments:	N/A

If the response to any of the above is yes, please complete a business case and which is signed by your Finance Manager and Directorate Manager for consideration by the Accountable Director before progressing to the relevant committee for approval