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Highlights

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Newly diagnosed abnormal glucose tolerance determines post-MI prognosis in patients with hospital related hyperglycaemia but without known diabetes

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- In patients without known diabetes, abnormal glucose tolerance (AGT), diagnosed on the 2 hour post load plasma glucose (2h-PG) and not admission plasma glucose (APG), determines post-MI prognosis.
- AGT, mainly newly diagnosed DM, determines prognosis in patients with and without hospital related hyperglycemia (HRH).
- AGT imposes an additional post-MI prognostic risk in patients without HRH.

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ABSTRACT

Aims: Investigate if abnormal glucose tolerance (AGT) affects post-myocardial infarction (MI) prognosis in patients with hospital-related hyperglycaemia (HRH) but without known diabetes mellitus (KDM).
Methods: Post-MI survivors without KDM underwent pre-discharge oral glucose tolerance test. Cardiovascular death and non-fatal re-infarction (MACE) were recorded. We compare the ability of admission (APG), fasting (FPG) and 2 h post-load (2 h-PG) plasma glucose to predict MACE in patients with (HRH) and without HRH (NoHRH).
Results: 50.2% and 73% of NoHRH and HRH had AGT respectively. MACE occurred in 19.5% and 18.1% in HRH and NoHRH groups. MACE-free survival was lower in patient with AGT in both groups (NoHRH: HR 1.82, 95% CI 1.19–2.78, $p = 0.005$; HRH: HR 2.48, 95% CI 1.24–4.96, $p = 0.010$). AGT predicted MACE-free survival (NoHRH: HR 1.60, 95% CI 1.02–2.51, $p = 0.042$; HRH: HR 3.09, 95% CI 1.07–8.94, $p = 0.037$). 2 h-PG, but not FPG or APG, independently predicted MACE free survival (NoHRH: HR 1.17, 95% CI 1.07–1.27, $p \leq 0.001$ and HRH: HR 1.18, 95% CI 1.03–1.37, $p = 0.020$). Addition of AGT and 2 h-PG, not FPG or APG, improved net reclassification of events in both groups.
Conclusion: Post-MI prognosis is worse with AGT irrespective of presence of HRH. 2 h-PG, predicts prognosis in HRH and NoHRH groups.

1. Introduction

Hospital-related hyperglycaemia (HRH) is common after acute myocardial infarction (MI) in patients without known diabetes mellitus (DM).[1–3] Several studies[1–3] using different thresholds of admission plasma glucose (APG) conclude that post-MI prognosis is worse in patients with newly diagnosed hyperglycaemia on APG (AH) than in those without. These studies label AH as "stress hyperglycaemia" without identifying pre-hospital hyperglycaemia using admission glycosylated haemoglobin (HbA1c)[4] or confirming normoglycaemia on follow up when the "stress" had been relieved.[5] Thus it is unclear whether the HRH, classified as stress hyperglycaemia, is hitherto undiagnosed hyperglycaemia or related to the stress of acute illness.

Several studies report adverse post-MI prognosis in patients with newly diagnosed abnormal glucose tolerance (AGT) but without known diabetes. Most studies reporting on the prognostic effect of newly diagnosed hyperglycaemia on APG do not report fasting plasma glucose (FPG) and/or 2 h post load glucose (2 h-PG). The effect of HRH and AGT on post-MI prognosis in the same population patients without known DM has not been studied. Thus it is thus unclear whether AGT has any effect on post-MI prognosis in patients without known DM found to have HRH on a single abnormal APG. This clarification has important clinical ramification as some guidelines recommend no further glycaemic testing after MI in patients without known DM in the absence of AH.[6]

In this study, we evaluate the effect of AGT on post-MI prognosis in patients without known DM, who have HRH diagnosed on APG.

2. Material and methods

We retrospectively analysed standard dataset collected locally for the Myocardial Infarction National Audit Project on consecutive post MI[7] survivors without known DM admitted between November 2005 and October 2008 who underwent pre-discharge OGTT as part of routine clinical care and were followed up.[8] This study includes patients for whom APG, FPG and 2 h-PG were available.

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Data on age, gender, risk factors for CAD, past medical history, pre-hospital and discharge medications, troponin I levels, heart rate, systolic blood pressure, creatinine level, presence of congestive heart failure, previous history of MI, revascularisation status and presence of ST-segment depression were recorded. Global Registry of Acute Coronary Events (GRACE) risk score (GRS) for risk of death or MI from discharge to 6 months was calculated for each patient. All post-MI survivors without known DM underwent pre-discharge OGTT on/after the third day of admission. APG, FPG (after overnight fast of ≥8 h) and 2-h PG (venous plasma glucose 2 h after administration of 75 g glucose in 200 ml water) were measured. Clinically unstable patients were tested later. Patients who died or were transferred to other centres before the OGTT or did not tolerate it were excluded. Plasma glucose was enzymatically determined using the glucose oxidase method. Intravenous glucose solutions were not allowed, but anti-adrenergic agents were used if clinically indicated. The patients with IGT and new DM (NDM) were advised lifestyle modification including diet, physical activity and referred to the diabetologists for appropriate out-patients management.

MI was diagnosed according to the universal definition.[7] "Known DM" was diagnosed from history i.e. the patient had been informed of the diagnosis by a physician before the admission or was on anti-diabetic treatment. HbA1c was not used in diagnosing pre-hospital diabetes as it was not recommended in the guidance at the time of data collection.[9–11] Hospital related hyperglycaemia (HRH) was defined as APG ≥7.8 mmol/l.[4] The patients were classified as normal glucose tolerance (NGT): FPG < 6.1 mmol/l and a 2-h PG < 7.8 mmol/l; impaired fasting glucose (IFG): FPG 6.1–6.9 mmol/l and 2-h PG < 7.8 mmol/l; IGT: FPG < 7 mmol/l and 2-h PG 7.8–11 mmol/l. NDM: FPG ≥ 7.0 and/or 2-h PG ≥ 11.1 mmol/l. Abnormal glucose tolerance (AGT) was defined as IGT and NDM groups together.

All participants were followed up for a median of 48 months for outcomes. Completeness of follow up was ensured by manual review of hospital and general practice records. The first occurrence of a major adverse cardiovascular event (MACE) defined as cardiovascular deaths and non-fatal re-infarction as was obtained from hospital and general practice records and confirmed by the office of public health intelligence. No other event was included as an end-point as these are the only ones predicted by the Global Registry of Acute Coronary Event risk score (GRS). Permission was sought from the East Yorkshire and North Lincolnshire Research Ethics Committee to analyse the data. As the study retrospectively analysed routinely collected anonymised data on standard clinical practice to contribute to a National Audit database, the Committee waived the need for formal ethical approval and patient consent.[8]

Continuous variables are presented as median (interquartile range, IR) and categorical variables as counts and proportions (%). The baseline characteristics of patients with (HRH group) and without HRH (NoHRH group) were compared using Mann-Whitney test for continuous variables and chi-squared test for categorical variables. Event-free survival was estimated by the Kaplan-Meier method compared using the Log-rank test. Cox proportional-hazards regression was used to analyse the effect of several variables on event free survival. Age, gender, smoking status, hypercholesterolemia, hypertension, history of previous MI, diagnosis at discharge, discharge prescription of aspirin, clopidogrel, beta-blockers, angiotensin-converting enzyme inhibitors and statins, revascularisation status, GRS and glucometabolic status were entered "stepwise" into the model along with APG, FPG and 2 h-PG as continuous variables. Hazard ratios (HRs) and 95% confidence intervals (CIs) are reported. Multicollinearity between all the variables included in the model was tested (MedCalc Statistical Software version 17.0.4, Ostend, Belgium) and variables with variance inflation factor < 4 were included in the same model.

APG, FPG and 2 h-PG were entered, individually and in combination, into logistic regression models along with the above covariates to compute the predicted probabilities of MACE. Hosmer-Lemeshow test was applied for goodness of fit for the logistic regression model.

The incremental predictive value of adding 2 h-PG to models with APG and FPG was analysed from these predicted probabilities using category-free continuous net reclassification improvement ($NRI^{>0}$) and integrated discrimination improvement (IDI). The event (NRIe) and non-event NRI (NRIne) were defined as net percentage of persons with and without the event of interest correctly assigned a higher and lower predicted risk, respectively. The overall NRI is the sum of NRIe and NRIne reported as a number. The IDI was defined as the mean difference in predicted risks between those with and without events.

3. Results

Of the 768 post-MI survivors without pre-existing diabetes mellitus who completed OGTT, 674 patients for whom APG, FPG and 2 h-PG were available were included in this analysis. HRH was diagnosed in 200 (29.7%) subjects. Amongst the patients with HRH 27.0% had NGT. AGT was present 50.2% of those without HRH. The HRH group was older with more frequent diagnosis of STEMI and new DM and lower use of dual anti-platelet therapy. They had higher GRACE risk score, FPG, 2 h-PG and APG (Table 1).

After a median follow up of 3.9 years, MACE occurred in 39(19.5%) (9 deaths, 30 MI) in HRH and 86(18.1%) (29 deaths, 57 MI) in noHRH groups. After adjusting for several covariates, MACE was similar in patients with and without HRH (OR 0.95, 95% CI 0.60 to 1.52, $p = 0.841$). This pattern was similar in patients with (OR 0.98, 95% CI 0.57 to 1.67, $p = 0.928$) and without (OR 0.51, 95% CI 0.15 to 1.65, $p = 0.258$) AGT. AGT independently predicted odds of MACE in the whole cohort (OR 1.88, 95% CI 1.20 to 2.94, $p = 0.006$) and in patients with (OR 3.60, 95% CI 1.13 to 11.32, $p = 0.029$) and without HRH (OR 1.71, 95% CI 1.02 to 2.86, $p = 0.041$).

MACE-free survival was similar in patients with and without HRH (Table 2). MACE-free survival was worse in patients with AGT than without in the entire cohort and both in the HRH and noHRH groups (Table 2, Fig. 1). MACE-free survival was worse in patients with IGT and NDM compared to the NGT in both groups

Table 1
Baseline characteristics of the groups.

	NoHRH ($n = 474$)	HRH ($n = 200$)	p-value
Age(years; median; IQR)	63.0 (73–56)	67.5 (78–58.5)	0.002
Male n (%)	346 (73.0)	136 (68.0)	0.189
Non-smoker n (%)	342 (72.2)	136 (68.0)	0.278
Hypertension n (%)	179 (37.8)	85 (42.5)	0.250
Hypercholesterolaemia n (%)	233 (49.2)	87 (43.5)	0.179
Previous MI n (%)	92 (19.4)	32 (16.0)	0.297
Known IHD n (%)	141 (29.8)	58 (29.0)	0.846
Diagnosis STEMI n (%)	187 (39.5)	102 (51.0)	0.006
Discharge medications			
Aspirin n (%)	441 (93.0)	177 (88.5)	0.051
Clopidogrel n (%)	394 (83.1)	158 (79.0)	0.204
Dual anti-platelet n (%)	376 (79.3)	143 (71.5)	0.027
Beta-blocker n (%)	363 (76.6)	157 (78.5)	0.588
ACEI/ARB n (%)	380 (80.2)	173 (86.5)	0.050
Statin n (%)	451 (95.2)	191 (95.5)	0.844
Revascularised n (%)	192 (40.5)	88 (44.0)	0.400
GRS (Discharge to 6 m)	113 (94–131)	113 (94–148)	0.002
NGT	229 (48.3)	54 (27.0)	<0.0001
IFG	7 (1.5)	0 (0)	
IGT	166 (35.0)	84 (42.0)	0.086
NDM	72 (15.2)	62 (31.0)	<0.0001
FPG (mmol/l; median; IQR)	5.0 (4.7–5.4)	5.4 (5.0–5.95)	<0.0001
APG (mmol/l; median; IQR)	6.1 (5.4–6.7)	9.0 (8.3–10.5)	<0.0001
2 h-PG (mmol/l; median; IQR)	7.75 (6.3–10.0)	9.7 (7.6–12.2)	<0.0001

HRH, hospital related hyperglycaemia; MI, myocardial infarction; IHD, ischaemic heart disease; STEMI, ST elevation myocardial infarction; ACEI/ARB, angiotensin converting enzyme inhibitor/angiotensin receptor blocker; NGT, normal glucose tolerance; IFG, impaired fasting glucose; IGT, impaired glucose tolerance; NDM, new diabetes mellitus; FPG, fasting plasma glucose; APG, admission plasma glucose; 2 h-PG, 2 h post load glucose; IQR, interquartile range.

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Table 2
Unadjusted and adjusted predictors of major adverse cardiac events.

	Unadjusted			Adjusted[a]		
	HR	95% CI	P	HR	95% CI	P
HRH	1.08	0.74–1.59	0.684	0.98	0.66–1.45	0.910
AGT						
All	1.93	1.36–2.75	0.0002	1.73	1.17–2.58	0.007
Without HRH	1.82	1.19–2.78	0.005	1.60	1.02–2.51	0.042
With HRH	2.48	1.24–4.96	0.010	3.09	1.07–8.94	0.037
IGT						
All	1.77	1.16–2.70	0.009	1.45	0.94–2.25	0.094
Without HRH	1.49	0.90–2.47	0.125	1.26	0.76–210	0.372
With HRH	2.75	1.22–6.20	0.015	2.84	0.94–8.57	0.065
NDM						
All	2.93	1.77–4.82	<0.001	2.37	1.48–3.81	<0.001
Without HRH	3.55	1.85–6.81	<0.001	2.58	1.45–4.57	0.001
With HRH	3.12	1.27–7.69	0.013	3.52	1.12–11.01	0.031

[a] Adjusted for GRACE Score, discharge medications (ACEI, aspirin, clopidogrel, beta-blocker, statin), discharge diagnosis of STEMI, gender, risk factors (hypercholesterolaemia, hypertension, smoking), previous history of MI and whether revascularised. Abbreviations same as in text.

(Fig. 1). AGT, adjusted for several co-variates, independently predicted MACE-free survival in the whole population (Table 2). AGT determined prognosis both in patients HRH and noHRH groups. NDM, but not IGT, predicted prognosis in both groups. In the whole group, 2 h-PG, but not FPG or APG, was an independent predictor of MACE free survival (Table 3). This pattern persisted in groups with and without HRH. Additionally, use of dual antiplatelets and beta-blockers predicted MACE in whole and group without HRH. HRH did not predict MACE (Table 3).

Adding 2 h-PG, but not FPG, improved the net reclassification and integrated discrimination of logistic regression of models that included APG as the only glucose matrix. This was maintained in the patients without HRH but not in patients with HRH. AGT significantly improved the ability of model containing GRACE score in predicting prognosis (Table 4). Using continuous NRI ($NRI^{>0}$) AGT improved reclassification by 42.4% for those with events in the overall cohort resulting in a significant overall improvement in net reclassification both in groups with ($NRI^{>0}$ 0.416, $p = 0.020$) and without HRH ($NRI^{>0}$ 0.307, $p = 0.010$). Addition of AGT to models including both GRACE score and HRH improved total net reclassification (NRI 0.333, $p = 0.001$) and integrated discrimination (IDI 0.012, $p = 0.014$).

4. Discussion

This study suggests that in subjects without known diabetes 1) OGTT determined glycaemic categories rather than presence of HRH adversely affects post-MI prognosis, 2) 2 h-PG, but not FPG or APG, predicts prognosis both in patients with and without HRH and 3) 2 h-PG is a more powerful predictor of post-MI prognosis than APG.

Hyperglycaemia in patients without known diabetes at admission with MI, labelled as "stress hyperglycaemia", has been extensively reported.[1–3] Capes et al.[1] and Hao et al.[3] reviewed several studies all of which used fasting or admission glucose at varied thresholds to define "stress hyperglycaemia". Until recently, there was neither a threshold of glucose nor a glucose matrix set for the definition of "stress

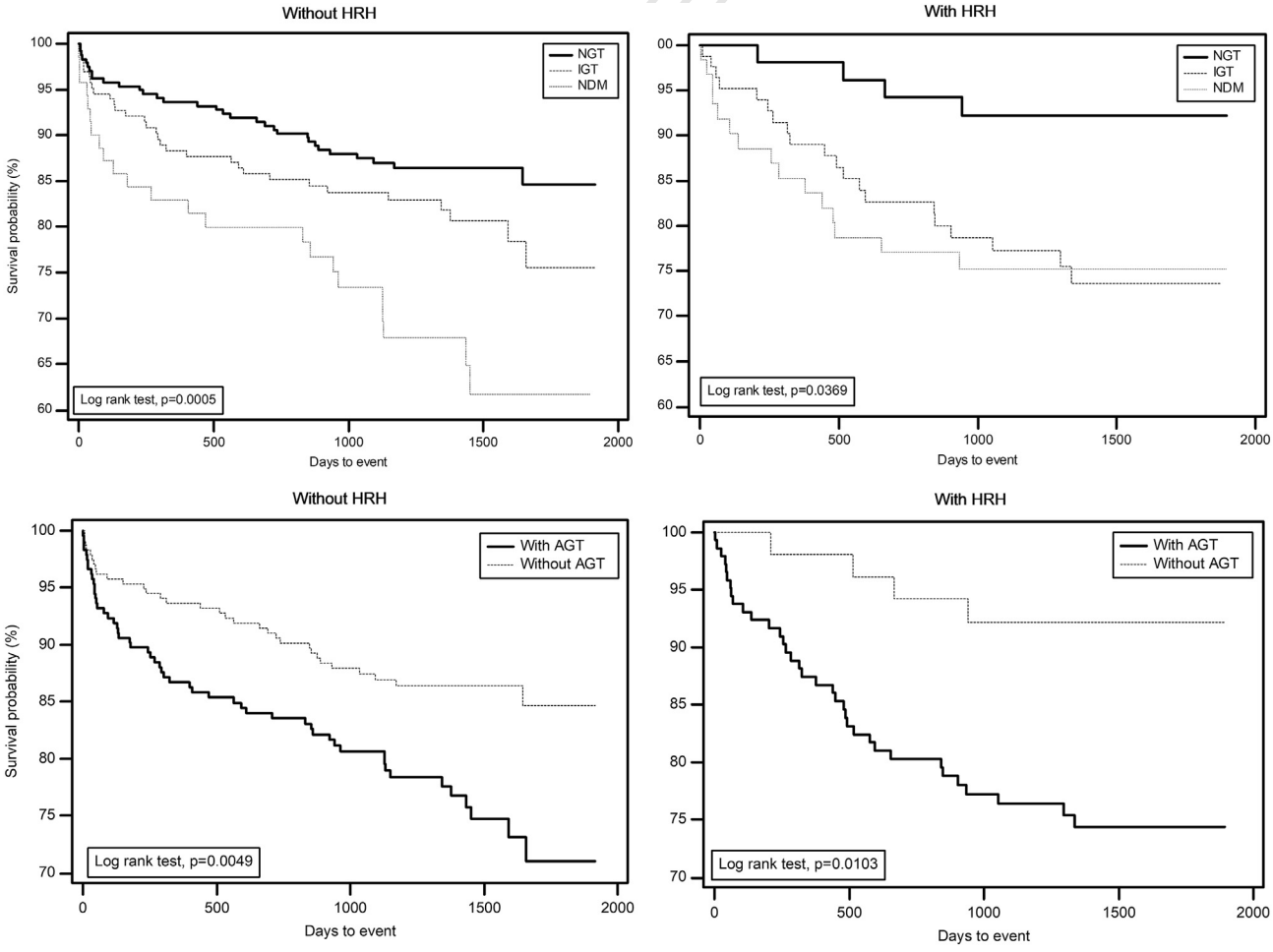

Fig. 1. Kaplan–Meier curves showing event-free survival in patients with and without hospital related hyperglycaemia.

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Table 3
Predictors of major adverse cardiac events.

Covariate	All ($n = 674$)			NoHRH (n = 474)			HRH (n = 200)		
	HR	95% CI	P	HR	95% CI	P	HR	95% CI	P
Previous MI	2.06	1.32–3.19	0.001	2.05	1.19–3.54	0.010	2.84	1.22–6.57	0.015
Revascularised	1.41	0.97–2.05	0.068	1.29	0.82–2.03	0.263	2.20	1.04–4.65	0.039
GRACE Score	1.01	1.00–1.01	0.007	1.01	1.00–1.01	0.002	1.01	1.00–1.02	0.009
Fasting glucose	0.87	0.67–1.14	0.311	0.87	0.58–1.30	0.492	0.76	0.50–1.14	0.184
Admission glucose	0.99	0.90–1.09	0.886	0.83	0.64–1.08	0.162	1.13	0.96–1.33	0.127
2 h post load glucose	1.14	1.06–1.22	<0.001	1.17	1.07–1.27	<0.001	1.18	1.03–1.37	0.020

Abbreviations same as in text.

hyperglycaemia". ADA had classified newly detected hyperglycaemia during hospitalisation on FPG or random blood glucose, as either "unrecognised diabetes" or "hospital-related hyperglycaemia" without using the term "stress hyperglycaemia".[5] More recently "stress hyperglycaemia" or "hospital-related hyperglycaemia" has been defined as any blood glucose concentration ≥ 7.8 mmol/l without evidence of previous DM detected on admission HbA1c.[4] Only 3 of the studies reviewed used[1,3] this threshold and none of them measured any other glucose matrix to detect pre-admission hyperglycaemia or exclude post-discharge hyperglycaemia. Thus it is impossible to infer from these studies whether the adverse post-MI prognosis seen resulted from "unrecognised" or "stress related" hyperglycaemia. This study challenges the notion that admission hyperglycaemia labelled as "stress hyperglycaemia" affects post-MI prognosis and suggests that the abnormal glucose tolerance, mainly undiagnosed DM, diagnosed on the 2 h post-load glucose and not admission plasma glucose that determines post-MI prognosis.

OGTT on/after the third day of admission was normal in 27% of our patients with HRH. OGTT is unlikely to miss glucose intolerance especially in the presence of the stress of acute illness. Thus this hyperglycaemia at admission is possibly "stress" induced. HRH in rest of the patients could either be "undetected" or "stress induced" hyperglycaemia. Whether pre-discharge OGTT identifies "true" glucometabolic status is debated. On the basis of a meta-analysis, Ye et al.[12] concluded that after adjusting for the interval between repeated tests and age, pre-discharge OGTT in acute coronary syndrome (ACS) patients had similar diagnostic accuracy as in non-ACS patients. Some studies report a decrease in the prevalence of hyperglycaemia on OGTT 3 months after the cardiac event suggesting that the pre-discharge OGTT identified stress hyperglycaemia rather than "true" glucometabolic abnormalities.[13,14] Others, however, indicate that pre-discharge OGTT predicts long term glucometabolic state.[15,16] Reproducibility of pre-discharge OGTT results at follow up is determined by the extent of myocardial injury and timing of the OGTT. The prevalence decreases in patients with STEMI undergoing primary PCI[13,14] especially when OGTT is done within 24 h of the event.[13] OGTT done at or after 5 days in patients with NSTEMI seems to reliably predict long term glucometabolic state.[15,16] This is likely related to the subsidence of the acute responses between 2 and 5 days with no further decrease thereafter.[16] Hage et al.[17] suggested better reproducibility of OGTT in patients with subendocardial than transmural infarction. As OGTT was done beyond 3 days and almost half of the HRH group had NSTEMI in this study, the timing of OGTT and the infarct size may not have adversely influenced the results of the OGTT. Thus it is highly likely that most patients with HRH in this study had hitherto "undetected" hyperglycaemia. More importantly, irrespective of its relation to long term glucometabolic status, pre-discharge OGTT based classification, rather than the admission hyperglycaemia independently predicted

Table 4
Continues Net Reclassification Improvement and Integrated Discrimination Improvement for major adverse cardiac events.

$NRI^{>0}$	All n = 674			HRH absent n = 474			HRH present n = 200		
	E	NE	Total	E	NE	Total	E	NE	Total
2 h-PG added to model with only APG									
UP	66	213	279	47	143	190	21	73	94
DWN	59	336	395	39	245	284	18	88	106
TOTAL	125	549	674	86	388	474	39	161	200
NRI	0.056	0.224	0.280	0.093	0.263	0.35	0.077	0.093	0.170
p-Value			0.005			0.003			0.341
IDI	0.015	−0.003	0.018	0.021	−0.004	0.025	0.007	−0.002	0.008
p-Value			0.006			0.007			0.323
FPG added to model with only APG									
UP	57	225	282	39	164	203	18	68	86
DWN	68	324	392	47	224	271	21	93	114
TOTAL	125	549	674	86	388	474	39	161	200
NRI			0.923	−0.093	0.155	0.062	0.077	0.155	0.078
p-Value			0.352			0.605			0.661
IDI	0.001	−0.000	0.002	0.001	−0.000	0.001	0.001	−0.000	0.001
p-Value			0.323			0.611			0.694
AGT added to model with only GRS									
UP	89	295	384	54	184	238	35	111	146
DWN	36	254	290	32	204	236	4	50	54
TOTAL	125	549	674	86	388	474	39	161	200
NRI	0.424	−0.075	0.349	0.256	0.052	0.307	0.795	−0.379	0.416
p-Value			<0.001			0.010			0.020
IDI	0.009	−0.002	0.011	0.007	−0.002	0.009	0.012	−0.003	0.015
p-Value			0.016			0.066			0.230

$NRI^{>0}$, continuous net reclassification improvement; IDI, integrated discrimination improvement; E, event; NE, non-event; UP, number of cases where the probability of MACE, as predicted by the restricted model, increased with addition of another variable to the model; DWN, number of cases where the probability of MACE, as predicted by the restricted model, decreased with addition of another variable to the model.

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prognosis in our post-MI patients. As abnormal glucose tolerance on OGTT, irrespective of its pathophysiological mechanism, predicted outcomes in our patients, the reproducibility of these measurements and its relation to long term glucometabolic status, though important in establishing a diagnosis of DM, may be less relevant when assessing prognostic risk.

This is the first study to test the additional prognostic implication of newly diagnosed AGT in post-MI patients with HRH. AGT worsened post-MI prognosis irrespective of HRH. Improved net reclassification with AGT suggests that AGT is a more powerful indicator of post-MI prognosis than HRH. Newly diagnosed AGT[8,18–23] and "stress hyperglycaemia"[1–3] adversely effects post-MI prognosis. However, none of these studies test for both HRH and AGT. This is clinically important for two reasons. Firstly, some guidelines[6] recommend no further glucose testing in the absence of AH on the suggestion that post-MI prognosis in non-diabetic patients is better in those without AH than in those with. APG alone may not be adequate to determine post-MI prognosis in patients without AH. Secondly, whether HRH is hitherto "undetected" or "stress induced" hyperglycaemia is much debated. In patients with HRH, AGT is a better indicator of post-MI prognosis suggesting that AGT and not AH itself that determines prognosis. Patients with IGT and NDM had worse MACE-free survival than those with NGT in both groups. NDM was an independent predictor of MACE in both groups suggesting that OGTT is useful in determining prognosis in both groups.

Most studies[1–3] suggesting the adverse effect of stress hyperglycaemia on post-MI prognosis measure a single glucose matrix, usually AH. Both FPG[24–27] and APG[1–3] when considered alone, predict post-MI prognosis. However 2 h-PG may be a better predictor of post MI prognosis than APG or FPG in this group. HbA1c has predicted post-MI prognosis in some[28–31] but not all studies.[32–36] The 2 h-PG, but not HbA1c, predicted prognosis in studies comparing the two.[32,35] In our study, 2 h-PG, but not APG or FPG, predicted post-MI prognosis in patients with and without HRH. Adding 2 h-PG, but not FPG, improved the logistic regression models that included APG only in patients without HRH suggesting that normal APG alone is inadequate in determining post-MI prognosis. The increased macrovascular morbidity associated with higher 2 h-PG rather than FPG seen here may be related to progression of atherosclerosis demonstrated with post-challenge rather than fasting hyperglycaemia.[37–41]

An observational study using retrospective analysis of data has its limitations. Missing variables e.g. anthropometry, lipid profile, left ventricular ejection fraction, coronary artery disease severity etc. could not be used in statistical models. Exclusion of small number of patients, albeit for valid reasons, and mainly Caucasian study population could affect the generalizability of the results. The effect of random glycaemic fluctuations and the likelihood that some normoglycaemic patients at baseline may have become hyperglycaemic or vice versa during follow up cannot be excluded. Without admission HbA1c we cannot exclude the presence of unrecognised hyperglycaemia. As OGTT was not repeated post-discharge, we cannot assess whether patients with admission hyperglycaemia recovered when the stress of acute illness was removed, confirming "true" stress hyperglycaemia. HbA1c as a glucose matrix may add to our diagnosis of pre-admission diabetes. However its role as a single glucose matrix, in post-MI prognostication is uncertain.

In patients without known diabetes, abnormal glucose tolerance, diagnosed on the 2 h-PG and not APG, determined post-MI prognosis. Abnormal glucose tolerance, mainly newly diagnosed DM, determined prognosis in patients without and with HRH and imposed an additional prognostic risk especially in the later. Thus APG as the lone glycaemic matrix, may not be enough to determine post-MI prognosis in patients without known diabetes. The glycaemic matrix of choice is hotly debated in this population. It may be reasonable to suggest that the most important test would be the one that determines long term prognosis i.e. 2 h-PG rather than the one deemed sufficient for use in the low-risk general population for epidemiological purposes even if simpler and more feasible i.e. HbA1c. This is especially so when clear evidence in favour HbA1c and against 2 h-PG in this high risk population is lacking.

CRediT authorship contribution statement

Sudipta Chattopadhyay: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing - original draft, Visualization, Project administration.**Anish George:**Validation, Data curation, Project administration.**Joseph John:**Conceptualization, Methodology, Writing - review & editing, Supervision.**Thozhukat Sathyapalan:**Writing - review & editing, Supervision.

Declaration of competing interest

All the authors declare that they do not have any conflict of interest in relation to this manuscript.

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