

# Myocardial Infarction and Prevalence of Diabetes Mellitus

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This study was designed to investigate the prevalence of diabetes mellitus in patients with acute myocardial infarction and to determine whether casual blood glucose measured at admission could be used to diagnose diabetes mellitus. It was prospective study that included all patients with acute myocardial infarction during a one year period at a Coronary Care Unit. Of 205 patients included in the study, 185 could be classified into three groups; 21% of these had previously diagnosed diabetes, 4% had newly diagnosed diabetes and remaining patients were categorized as non-diabetic. Casual blood glucose  $>11.1$  mmol at admission was found in 12 patients with no previously known diabetes but diabetes mellitus was confirmed in only six of these patients. One of four patients with acute myocardial infarction had diabetes mellitus. Increased casual blood glucose at admission was not reliable to establish a diagnosis of diabetes and thus follow up measures are necessary.

**Key words:-** Diabetes mellitus, Acute myocardial infarction, Prevalence, Casual blood glucose, Stress induced by hyperglycemia, Glucose tolerance test.

Diabetes mellitus is a strong risk factor for cardiovascular disorder including coronary heart disease<sup>1,2</sup>. In previous studies diabetes has been diagnosed in 10 to 24% of patients with acute myocardial infarction<sup>3,4,5</sup>. Furthermore, the age-adjusted prevalence of diabetes mellitus among patients with acute myocardial infarction has increased significantly over the past two decades. A true increase in diabetes, improved documentation in medical record and longer survival of diabetic patients are all factors underlying this increase<sup>6</sup>. Intensive insulin treatment and intensive secondary preventive measures may improve the outcome of acute myocardial infarction in diabetic patients<sup>7</sup>. Therefore it is important to identify patients with and without a previous diagnosis of diabetes. In non-diabetic patients the magnitude of the rise in plasma glucose during the early phase of acute myocardial infarction has been attributed to the severity of heart failure<sup>8</sup>.

A casual plasma level  $>11.1$  mmol at admission for acute myocardial infarction in non-diabetic patients occur in about 20% of the patients. However, in only about 20% of these cases it is likely to be a manifestation of pre-existing diabetes<sup>9</sup>. Consequently stress induced hyperglycemia at admission for acute myocardial infarction may over estimate the frequency of diabetes mellitus<sup>9</sup>. Earlier reports have shown that in patients with acute myocardial infarction casual blood glucose  $>11.1$  mmol at admission is likely to identify undiagnosed diabetes.

In the DIAGMI study<sup>11,12</sup> casual blood glucose  $>11.1$  mmol at admission to hospital identified with reasonable high precision undetected diabetes in patients with suspected acute myocardial infarction.

## Patients and methods

All patients admitted to Nishtar Hospital were suspected acute myocardial infarction were observed in the coronary care unit. During a two years period (October 1997 to

September 1999) 237 patients fulfilled the diagnosis criteria for acute myocardial infarction. Of these 237 patients 13 were excluded because of their unwillingness to participate in the study. In addition, 19 patients had more than one acute myocardial infarction during the study period in these patients only they first acute myocardial infarction was included in the subsequent data analysis, thus final sample consisted of 205 acute myocardial infarction patients.

Casual blood glucose was analyzed at admission and fasting glucose was measured on the 2<sup>nd</sup> and 5<sup>th</sup> day of the admission. Admission blood glucose values in patients with ongoing intravenous glucose infusion were excluded. At follow up at least one fasting blood glucose was between 5.6 and 6.6 mmol a 75 gm oral glucose tolerance test was performed.

Venous sampling was used for blood glucose analyzed in the ward and capillary blood glucose was taken during the 75 gm oral glucose tolerance test. The blood glucose samples were treated with a haemolysis reagent and glucose was determined enzymatically (Roche Diagnostica) and creatinine-kinase-B (CK-MB) was determined by an immunoinhibition method (Merck Diagnostica).

## Definition

Diabetes mellitus was established if the patient had been informed of the diagnosis by a physician before the admission or was undergoing treatment (diet, oral anti-diabetic agents or insulin). Diabetes mellitus was defined according to WHO criteria from 1985 as fasting venous or capillary blood glucose  $>7.6$  mmol on two occasions or 75 grams oral glucose tolerance test with a 2 hour capillary blood glucose  $>11.1$  mmol. The prevalence of diabetes was also analyzed using the criteria suggested by the WHO working group 1998<sup>13,14</sup> as well as the criteria from American Diabetic Association (ADA) 1997<sup>15</sup>.



*Myocardial infarction*

A diagnosis of myocardial infarction was established if at least two of following criteria were fulfilled, chest pain > 15 minutes. Serum creatinine kinase-B above the normal range 6-12 hours after onset of symptoms and development of new Q-waves or ST elevation typical of myocardial infarction in at least 2 of the standard ECG leads.

**Results**

Of the 205 patients 185 (94%) were eligible for investigations to establish a diagnosis of diabetes based on the 1985 WHO criteria. In the remaining 20 patients the classification was incomplete, 18 because of death in hospital and two because failed to participate in the follow up.

Fifty of the 205 patients had previous diagnosis of diabetes mellitus, over 90% of the diabetic patients could be classified as type-2 diabetes. Among all the diabetic patients two were diagnosed before 35 years of age while 45 had been diagnosed after 35 years of age. For the remaining three patients no information about age at the time of diagnosis was available. One was treated with diet and two with oral hypoglycemic agents. Non-classified patients were older compared with the classified patients, drop out rate was low.

Table 1. WHO criteria from 1998 for the diagnosis of diabetes mellitus

	Glucose concentration (mmol L <sup>-1</sup> (mg/dl <sup>-1</sup> ))		Plasma venous
	Venous	Capillary	
<b>Diabetes Mellitus</b>			
Fasting	6.1 (>110)	6.1 (>110)	>7.0 (>127)
2 hours postglucose load	>10.1 (>189)	11.1 (>200)	>11.1 (>200)
<b>Impaired glucose tolerance</b>			
Fasting (concentration)	<6.1 (<110)	<6.1 (<110)	<7.0 (<126)
2 hours postglucose load	<10.0 (<180)	<11.1 (<200)	<11.1 (200)
<b>Impaired fasting glycemic</b>			
Fasting 2 hours	>5.6 (≥100)	>5.6 (≥100)	>6.1 (≥100)
	<6.7 (<120)	<7.8 (<140)	<7.8 (<140)

*Prevalence of diabetes mellitus based on the 1985 WHO criteria*

Of 205 patients, 185 could be classified, 50 (27%) of these had history of diabetes, 10 (15%) patients had newly diagnosed diabetes and 125 patients (76%) were non-diabetic.

*Casual blood glucose at admission*

Casual blood glucose at admission was significantly higher among the diabetic patients although there was an overlap between non-diabetic, newly diagnosed diabetic and know diabetics. Twelve patients without previously known

diabetes had casual blood glucose at admission >11.1 mmol. Only 6 of these met the diagnostic criteria for diabetes at follow up in accordance with WHO criteria.

*Limitation of the study*

It would have been preferable to retest individual with normal blood glucose and perform oral glucose tolerance in all patients. Another limitation of this study is that haemoglobin. Aic is not used as diagnostic criteria for diabetes mellitus as it is highly sensitive marker. It should have been included in the study.

**Discussion**

In the present population based investigation every fourth patient hospitalized with acute myocardial infarction had diabetes mellitus. Although this is a considerably higher rate of occurrence than those reported by others<sup>3,4,5</sup>. It is comparable to that found in earlier Swedish study<sup>4</sup>. If an oral glucose tolerance test had been performed in all patients a slightly higher figure is likely to have been obtained. The prevalence rate of diabetes in the same age category of the population as our group of individual with acute myocardial infarction was close to 12%<sup>4,15</sup>. Consequently our data indicate that diabetes is about twice as common in acute myocardial infarction patients as compared with the general population. The absolute risk of cardiovascular death is three times higher for diabetes than for non-diabetic men after correction for other risk factors. The risk for acute myocardial infarction in diabetic subjects without previous myocardial infarction is comparable to the risk of reinfarction in non-diabetic patients with previous acute myocardial infarction<sup>16</sup>. Reduction of heightened blood pressure and elevated serum cholesterol has been shown to reduce the incidence of cardiovascular disease in patients with type-2 diabetes<sup>17,18</sup>. One study suggests linear association between glycemia and risk of coronary heart disease in middle aged and elderly patients with type-2 diabetes<sup>19</sup>. The recent documentation in the UK prospective diabetic study (UKPDS) that effective intervention to improve glycemic control and blood pressure reduce the rate of complication<sup>20</sup> together with indications that the time from the onset of elevated glucose to diagnosis may take many years suggests<sup>21</sup> that it is important to diagnose diabetes cardiac in order to permit intervention. Further the DIGAMI study suggests that identification and optimal metabolic treatment may improve the prognosis in diabetic patients with acute myocardial infarction. Our results emphasize the difficulty in establishing a diagnosis of diabetes in patients with acute myocardial infarction. There is great need to investigate glucose metabolism further in patients with acute myocardial infarction and without earlier evidence of diabetes mellitus.

**Conclusion**

One of the four patients admitted for acute myocardial infarction was found to have diabetes mellitus. Sixteen per



cent of these patients had no prior diagnosis of diabetes. Increased casual blood glucose at admission was not a reliable method of establishing a diagnosis of diabetes and follow up was necessary.

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