Health essays - myocardial infarction mortality

Myocardial Infarction Mortality

1. 0 Introduction

In the UK, about 838, 000 men and 394, 000 women have had a myocardial infarction (MI) at some point in their lives, (NICE clinical guideline 48, 2007). The latest statistics from the British Heart Foundation state that approximately 227, 000 people suffer from an acute MI (heart attack) each year (British Heart Foundation Statistics Website).

To put this figure in to perspective this equates to one person every 2 minutes. Mortality is at approximately 30% which is 68, 100 deaths in the UK per year. The National Service Framework (NSF) for Coronary Heart disease (CHD) is a 10-year programme published by the Department of Health in 2000 and has set key standards for the prevention and treatment of CHD.

Access to the right treatment for those who suffer from an AMI, is essential to reduce morbidity and mortality and improve clinical outcomes.

People with diabetes mellitus constitute a group of patients who have a higher risk of having an MI and also a poorer prognosis post infarction. The higher death and complication rates appear to be multifactorial but a significant finding in the Diabetes Mellitus Insulin-Glucose Infusion in Acute Myocardial Infarction (DIGAMI) Trial showed to reduce one year mortality by 30% (Malberg *et al* ., 1995). It’s recommended

1. 1 Primary Objective

- To determine the relationship between HbA1c and prognosis of patients in East Lancashire having a myocardial infarction.

1. 2 Secondary Objectives

- To assess the prognosis of patients below the glucose cut off threshold for DIGAMI treatment and whether or not this borderline category falls in to the highest risk group in terms of mortality and morbidity.
- To determine if there is both a clinical and analytical case to use fluoride oxalate tubes for plasma glucose and HbA1c collection and analysis in East Lancashire.
- To ascertain the effect of a previous DIGAMI audit conducted in 2006 by the Clinical Audit Team and reflect on any improvements of conformance to the protocol two years later.

If there is a significant relationship between HbA1c and prognosis then a risk stratification chart and a more clinically and analytically robust inclusion criteria on to the intensive treatment protocol (DIGAMI Regime) can be determined. This could lead to a better prognosis for a group of patients that fall into a borderline category that are not currently treated under the current protocol who potentially should be depending on the results of this study.

1. 3 Cardiovascular Disease

1. 3. 1 Incidence of CHD

The incidence of CHD follows different trends across the UK depending on various factors including regional, socio-economic and ethnic differences. There is a definite North-South gradient, and mortality rates are at the highest in Scotland and the North of England.

Social class inequalities in mortality rates show that male manual workers are 58% more likely to suffer premature death from CHD than non-manual

workers. Statistics also show that South Asians (Indians, Pakistanis, Bangladeshis and Sri Lankans), are more likely to suffer premature death with figures of 46% for men and 51% for women. This ethnic grouping the highest risk (Figure 1.).

The East Lancashire NHS Trust provides a service for over half a million people offering care across four hospital sites. The population of East Lancashire falls into one of the higher risk areas in the UK with local authority statistics for reflecting this fact. Age-standardised death rates per 100. 000 in Blackburn with Darwen, Burnley, Rossendale, Nelson and Pendle show that these areas fall into the upper fifth quintile for men and upper fourth and fifth quintile for women (Coronary Heart Disease Statistics 2005).

In the Lancashire NUTS-2 area, which includes Blackburn with Darwen Unitary Authorities 93. 4% of the 1. 41 million residents classified their ethnic group as white British, Irish or other white background. A further 5. 3% gave their ethnic group as Asian or British Asian. This figure is 1. 3% above the national average. Even more pronounced is when the East Lancashire population is singled out, where the percentage rises to 10. 8%. (Appendix ??). The sub region of East Lancashire contains the highest proportion of ethnic minorities which is a contributing factor to the high incidence of CHD in addition to the socio-economic differences compared with other regions.

Myocardial Infarction

1. 4. 3 Risk Factors

Pathophysiology

1. 4. 2 Morbidity and Mortality

1. 4 Diabetes

Although there have been significant advances in the care of many of the extrapancreatic manifestations of diabetes, acute myocardial infarction continues to be a major cause of morbidity and mortality in diabetic patients. Factors unique to diabetes increase atherosclerotic plaque formation and thrombosis, thereby contributing to myocardial infarction. Autonomic neuropathy may predispose to infarction and result in atypical presenting symptoms in the diabetic patient, making diagnosis difficult and delaying treatment.

The clinical course of myocardial infarction is frequently complicated and carries a higher mortality rate in the diabetic than in the nondiabetic patient. Although the course and pathophysiology of myocardial infarction differ to some degree in diabetic patients from those in patients without diabetes, much more remains to be known to formulate more effective treatment strategies in this high risk subgroup.

J Am Coll Cardiol, 1992; 20:

736- 744

Acute myocardial infarction in the diabetic patient: pathophysiology, clinical course and prognosis

RM Jacoby and RW Nesto

Myocardial function is further impaired in diabetic patients by the metabolic changes that occur in the early stages of myocardial infarction: insulin resistance and hyperglycaemia are induced by release of catecholamines, cortisol, glucagon, and growth hormone. 10 At the same time, secretion of insulin by the pancreatic islets is reduced, 11 which impairs the ability to compensate for this state of insulin resistance. The combination of low insulin concentrations and elevated catecholamine concentrations increases release of non-esterified fatty acids, which augment myocardial oxygen requirements and depress mechanical performance.

12 BMJ 1996; 313: 639-640 (14 September)

Editorials

Insulin infusion in diabetic patients with acute myocardial infarction

1. 4. 1 Pathophysiology

Mention stress hyperglycaemia

1. 5 Glycated Haemoglobin

Glycation is a nonenzymatic process of adding a sugar residue to amino groups of proteins. Normal adult haemoglobin usually consists of Hb A (97%), Hb A2 (2. 5%), and HB F (0. 5%). HbA1c is one of a group of a minor

haemoglobins separated from the major constituent Hb A. It has become the dominant measure of glycated haemoglobin because of improved analytical techniques and ease of routine separation and quantification.

HbA1c is formed by the condensation of glucose with the N-terminal valine residue of the haemoglobin β-chain to form an unstable Schiff base followed by dissociation or a Amadori rearrangement to form the stable ketoamine (Figure ????). The glycation of haemoglobin is essentially irreversible and its level depends on the lifespan of a patient’s red blood cell and the blood glucose concentration.

Tietz p791

HbA1c is primarily used as an indicator of glycaemic control and used in diabetic monitoring. The feasibility study of the DCCT trial (diabetes control and complications) published in 1993 provided evidence for the much hypothesised opinion that better glycaemic control would decrease long term complications of diabetes mellitus and that the HbA1c test can be used as a measure of this.

The UKPDS (U. K. Prospective Diabetes Study) followed on from these findings and conducted the largest clinical research study of diabetes focussing on reducing life-threatening complications by appropriate treatment including maintaining a HbA1c result of 7. 0% or below (see section 1. 5. 1??).

1. 4. 1 Utility of HbA1c

Type 2 diabetes can be diagnosed using two different criteria, the fasting plasma glucose (FPG) and the 2 hour glucose value of the oral glucose

tolerance test (OGTT) which is the ‘ gold standard’. The FDG cut-off value of 7. 0 mmol/L has been calculated to roughly correlate to the OGTT 2 hour diagnostic value of 11. 1 mmol/L and provides greater reproducibility. A major disadvantage to the patient is the requirement to fast prior to both of these protocols.

Glycated haemoglobin concentration is an indicator of the average blood glucose level over approximately 90 days. Though the lifespan of a red blood cell is normally 120 days, the contribution of the plasma glucose concentration to glycated haemoglobin differs depending on the time interval, with the largest influence on the HbA1c value being the most recent.

It provides a retrospective index of integrated plasma glucose levels and has been suggested to have a role to play in the screening and diagnosis of diabetes in addition to its primary role of monitoring diabetic control.

The debate of whether an HbA1c result could be used for diagnosis continues despite the generally accepted argument that the test as a single entity is not sensitive enough to provide definitive cut-off values and determine reference ranges because the values of the two populations; non-diabetics and diabetes overlap.

An HbA1c result above the upper reference limit however is specific for glucose intolerance. Another concern is the limitations of the HbA1c result in individuals with abnormal haemoglobinopathies and anaemias, especially when the latter is secondary to haemolysis or iron deficiency (Kilpatrick, 2005).

Glycation depends on the lifespan of a patient's erythrocyte and the blood glucose concentration so in these groups the results will not be accurately representative of metabolic control in comparison to reference ranges based on the general population.

1. 4. 2 Reason for the Study

It is highly unlikely that the HbA1c test will replace routine glucose testing for the diagnosis of type 2 diabetes but it may still have an invaluable role in this area. HbA1c levels may be less influenced by acute stress induced by an ischemic event compared with plasma glucose and therefore could be useful as a tool for differentiating patients with diabetes, and identifying undiagnosed cases in the inpatient setting.

Although the increased risk of CHD with type 2 diabetes is universally accepted, a study conducted by Khaw *et al.* of the general population showed that medically diagnosed diabetes only accounted for 20% of all CVD fatalities. The majority of fatal events came from apparently healthy individuals with a glycated haemoglobin > 6% in the absence of diabetes and this relationship was independent of other risk factors (Khaw *et al.,* 2002).

Minor glycometabolic dysregulation may be associated with an increased risk yet this route of research has been poorly explored. If a strong correlation exists then HbA1c could be used as a routine test in the primary prevention of CHD, and patients with suspected acute coronary syndromes can be diagnosed with dysglycemia. In this identified group of individuals, intensive treatment could improve the long term prognosis of the patient.

1. 5 Previous Studies

DIGAMI 1 and 2

DCCT

VA Cooperative Study

UKPDS

1. 6 Current Situation at the RBH

East Lancashire Hospitals NHS Trust provides a range of health care and acute services to the Boroughs of Blackburn, Burnley, Hyndburn, Pendle, Ribble Valley and Rossendale with a population of approximately 515, 000 falling into its catchment area. The primary purpose of the Pathology Department at Blackburn Royal Infirmary is to provide a high quality testing service for the diagnostic, screening and monitoring of patient samples.

Recent drivers for change revolve around The Pathology Modernisation Programme which was launched in 1999. This aims at improving the quality and efficiency of NHS pathology services and encourages the introduction of new technologies and practices to deliver high quality patient care and matching capacity with increased demand.

England’s National Health Service has embarked on an ambitious program of system reform. The Labour Government has committed to increase NHS spending to implement changes of streamlining services and improving quality of service.

One of East Lancashire Hospitals NHS Trusts Key Objectives is to streamline diagnostic services and to reduce overheads as part of a Trust wide cost

improvement programme. The aim is to work ‘ smarter’ rather than ‘ harder’ to balance activity with demand. However, current capacity to meet demand is almost at saturation point and we have reached the inevitable point in which processes have to change.

1. 6. 1 Post MI Management

DIGAMI

1. 6. 2 Laboratory Service to Users

The decision of treatment for some patients with a suspected MI can rely on the venous glucose result. It is therefore paramount that the result validated is accurate and precise.

1. 6. 2. 1 Glucose Stability

The MI patients treated as per DIGAMI protocol are diabetic patients or non-diabetics with a glucose of > 11. 1mmol/L. An area of contention is the fact that for inpatients, serum glucose is collected in Startedt S-Monovette® gel tubes containing no preservative and analysed on the VITROS 5, 1 FS chemistry system.

The manufacturers’ guidelines state the stability of glucose decreases by approximately 8% for every half an hour prior to separation of the serum from the cells (VITROS datasheet ??). Though samples from A+E are dealt with urgently this is a short timeframe from collection to result. Some bloods are taken via a paramedic collection on route to the accident and emergency department and therefore are delayed even longer prior to analysis.

The stability of serum glucose is a well known problem hindering the accuracy of results this is the reason that samples arriving from GP surgeries

are processed routinely on the Thermo Konelab analyzer using blood collected in tubes containing a fluoride oxalate preservative. It has been discussed to also use such tubes for ward samples, with all glucoses being run on the VITROS analyzer. Up to now the stability issue of hospital samples has not been thought of as a clinical hindrance because they are prioritised and processed sooner than the GP samples and therefore there has been a ‘ medically allowed tolerance’

The importance of the admission blood glucose result has come to light as it can be a deciding factor for the inclusion of MI patients on to the intensive DIGAMI treatment protocol, and as a direct consequence, will have a clinical impact on the prognosis of a patient.

Due to the glucose being metabolised by the cells and giving a falsely lower result, a group of borderline patients may not meet the inclusion criterion for DIGAMI as a result and have a worse prognosis than they should have. Therefore this is an issue of great clinical importance. This project should indicate to what extent the stability is a problem and approximately how many patients it affects.

If the HbA1c result could be utilised as a complimentary test to be used in conjunction with known diabetic status and admission plasma glucose then the inclusion criteria would be both more clinically and analytically reliable. Historically HbA1c analysis is performed by the haematology department on EDTA blood samples for logistical reasons.

If analytical stability and comparison studies show that fluoride oxalate tubes can be used accurately and precisely for glucose and HbA1c analysis then

one biochemistry tube would be sufficient for both tests. Laboratory practice for diabetic diagnosis and monitoring could then be a leaner process for cascade HbA1c testing in terms of archiving, retrieval and storage of samples.

1. 7 Clinical Audit

Clinical audit is a quality improvement process which is a component of clinical governance within the NHS introduced to improve patient care through a systematic review against explicit criteria and the implementation of change. Participation is recognized by the General Medical Council as an integral part of good practice and the results should be used to improve the quality of care.

The Myocardial Infarction National Audit Project (MINAP) is funded by the National Institute of Clinical Excellence (NICE) and is carried out by the Royal College of Physicians (RCP). It was established in 1999 as a method of clinical audit to examine the quality of management of myocardial infarction and shows how hospitals in England and Wales are performing against targets in the NSF for CHD.

1. 7. 1 Summary of 2006 DIGAMI Audit

In 2006, the clinical audit team conducted an audit with one of its' main objectives being to assess whether the DIGAMI protocol was being adhered to. This was a retrospective study in which the casenotes of 46 patients were viewed and information extracted. These patients were either known diabetics or had a plasma glucose of > 11. 1mmol, and had presented with cardiac pain.

A summary of the baseline characteristics was that over half of the patients were of Asian descent, there was a slight female prevalence and the majority included were known diabetics. They also concluded that the DIGAMI regime was only initiated in 24% of the cases, whereas all 46 patients should have been treated as per current protocol. Another non-conformance to the protocol was the fact that approximately 50% of the patients did not have a venous blood glucose checked by the biochemistry laboratory (Bharucha *et al.,* 2006). The results of this audit will be re-addressed in this study to ascertain the effectiveness of the recommendations and the impact of the results two years on.

Reasons for undertaking this project

According to estimates there are as many as a third of undiagnosed diabetics (as cited in Greci *et al.,* 2003). The DIGAMI regime is an intensive treatment protocol for the management of myocardial infarction in patients known to have diabetes mellitus or in patients with hyperglycaemia on admission. At East Lancashire NHS Trust, intensive treatment with intravenous dextrose and insulin reduce and control blood glucose levels to between 4-9 mmol/L.

Currently, there is a standardised inclusion criterion and treatment protocol rather than a treatment programme which is graded in intensity, and tailored to individual glycometabolic status. Hospital glucoses are analysed using serum collected in Starsedt Monovet 4. 2 ml gel tubes.

The manufacturers' guidelines state the stability of glucose could decrease by 7% every half an hour prior to separation of the serum from the cells.

Although samples from A+E are dealt with urgently this is a short timeframe. Paramedic collection of samples on route mean even longer time delays before separation.