GENERAL INTRODUCTION

Acute cardiac care has changed dramatically over the past decennia. In coronary care and general intensive care units, information technology was introduced for arrhythmia monitoring and other signal processing (1,2). More recently, information technology has been applied to assist clinical decision making. Chapter 1 provides a definition for clinical decision support systems (CDSS) in critical care and describes factors for successful implementation of such systems. Subsequent chapters present three groups of studies designed to improve patient care (I) using information technology to assist rapid diagnosis and treatment in patients with evolving myocardial infarction, (II) better managing the multitude of monitoring alarms and (III) improving glucose regulation in patients at an intensive cardiac care unit.

The first coronary care units were established to provide arrhythmia monitoring and treatment of life threatening arrhythmias in patients with acute myocardial infarction (AMI) (1,2). The introduction of thrombolytic therapy in the 1970’s (3) and later primary percutaneous coronary intervention for the treatment of AMI (4,5) provided specific challenges for the organization of coronary care. Since delay in treatment is associated with worse outcome (6,7), an efficient and effective pre- and in-hospital clinical pathway is required for patients with chest pain. Information technology could assist in the decision making process for patients with chest pain and suspected myocardial infarction.

We present different strategies to improve the interpretation of the pre-hospital 12-lead electrocardiogram (ECG) as this is a key element in the triage of patients with chest pain. One approach is to leave the decision making to the pre-hospital caregiver. Chapter 2 describes the ability of paramedics to diagnose ST-elevation AMI, and the influence of confounding electrocardiographic factors on their diagnosis. A different approach is to send the ECG to a cardiologist for analysis. Chapter 3 describes the technical aspects of implementing a system for pre-hospital ECG transmission from the ambulance to a cardiologist. Chapter 4 presents initial results and show examples of such system with regard to effectiveness in a subset of patients with chest pain.

Once a patient has arrived at the hospital, different approaches can be taken to minimize in-hospital delay to reperfusion therapy. In chapter 5 the effectiveness of a set of hospital care improvement strategies was evaluated with regard to reducing delay to percutaneous coronary intervention.

Improvements in patient monitoring technology have transformed the intensive cardiac care unit into an environment rich in advanced technological devices. The need to monitor an increasing number of clinical parameters in complex patients leads to an increase in alerts generated by the monitoring devices. Most of these alerts are not related to
life-threatening events (8-10). Therefore, in part two of this thesis, we investigated several approaches to manage the multitude of monitoring alarms. Chapter 6 describes the distribution of different types of patient monitoring alarms over time. To introduce interventions that can reduce frequency and improve relevance of alarms, a system was needed to collect and channel alarm data from different monitoring devices through a central gateway. Chapter 7 describes such a system. Once such a system is in place, it provides a platform to improve the delivery of the alarms to the dedicated caregiver. The use of electronic portable devices for this purpose is described in chapter 8.

Part three touches a controversial issue: glucose regulation and outcome in critical illness. In a general intensive care setting a study done in Leuven showed a reduction in mortality when glucose was strictly regulated (11). Subsequent studies (12,13), however, could not confirm these observations. Strict glucose regulation was also studied in patients with acute coronary disease. An overview of these trials is given in chapter 9. We studied the association between admission glucose or average glucose levels and subsequent mortality in high risk patients admitted to an intensive cardiac care unit (chapter 10).

Many different protocols exist to regulate glucose through intravenous insulin administration. We expect that adherence to such protocols can be improved with information technology. Chapters 11 and 12 describe the process of implementing a CDSS for glucose control in an intensive cardiac care unit. Chapter 13 describes the effect of a CDSS for glucose control on compliance with the insulin protocol and achievement of glycemic targets. An important characteristic of a CDSS is its ability to generate data on protocol or guideline compliance, which in turn can be used to modify and improve the system. In chapter 14 this process of using data acquired from the CDSS to make modifications to the protocol is described. Also, the effects of these evidence based modifications are investigated with regard to compliance with the insulin protocol and glucose levels.

Together, these three groups of studies reflect the ongoing process of improving patient care using dedicated information technology.

REFERENCES

Cardiology


