Cardiology Guidelines at Point of Care

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Abstract

Many Cardiology guidelines have been widely distributed by the professional societies (European Society of Cardiology, American College of Cardiology, American Heart Association, and the national Cardiology societies). In order to improve accessibility to problem-specific content from guidelines, we have developed a set of tools, methodologies and deployment strategies that provide quick and intuitive access to the clinically relevant section of European practice guidelines at appropriate moments of care delivery.

We have developed two guideline delivery systems, one as a stand-alone interactive system and one integrated into a patient information system. Both a PDA version and a PC web based version of the stand-alone system have been developed to support the cardiologist in the medical decision process. The usability of the systems have been tested by staff members of the Cardiology departments in Rotterdam and Cork (Ireland) in a very structured way. The users had an overall positive impression of the systems. Moreover they considered the systems as very useful.

1. Introduction

Guidelines for the management of patients with cardiovascular disease are designed to assist cardiologists and other physicians in their daily practice. Guidelines are based on sound evidence derived from well-conducted clinical trials as well as the evolution of clinical experience as judged by a panel of experts. The tools for prevention, detection, diagnosis and treatment of cardiovascular disease have markedly improved in the last decades, and continue to improve. Because the field is evolving so rapidly, the related guidelines must be upgraded periodically. The latest versions of the guidelines must be available for the practicing physicians.

Several programmes have been developed to access whether guidelines are being followed in clinical practice. Several surveys (e.g. The Euro Heart Survey Programmes) have documented that medical management (diagnostic strategy and treatment) often differs from guideline recommendations. The Euro Heart Survey on Heart Failure, conducted in 2000 and 2001, showed an apparent underuse of ACE-inhibitors and Beta-blockers[1]. The EUROASPIRE II study showed that the targets for secondary prevention medication were not met for statins, ACE inhibitors and Beta-blockers in the year 2000[2]. However, a significant improvement was observed in a series of surveys in later years.

Demonstrating the association between adherence to guidelines and better outcomes is an important step in motivating their adoption in clinical practice. Data from about 46,000 high-risk Acute Coronary Syndromes (ACS) patients treated at 403 US hospitals between 4/00 and 4/03 have been studied[3]. Hospitals were divided into quartiles based on overall guidelines adherence. Compared with the quartile of the hospitals with the lowest adherence (average risk-adjusted mortality = 5,8 %) the leading quartile showed significantly better patient outcomes (average risk-adjusted mortality = 4,0 %). One of the possible explanations for this difference is the lack of Percutaneous Coronary Intervention (PCI) facilities in the lagging centres, compared with the leading centres. Primary PCI is the recommended first-choice therapy for patients with evolving myocardial infarction.

An important problem for guideline adherence is that these guidelines are generally published in textual format via print and electronic media. The online versions of the guideline texts are often too extensive and too difficult to access in clinical practice. Automated support for guideline-based care in clinical settings is required.

Many types of guideline decision-support systems have been proposed. Some systems use knowledge models to facilitate patient-specific therapeutic models. In Rotterdam we are employing decision-support system framework Gaston, that has been linked to our Cardiology Information System (Thor2006)[4]. We have implemented the guidelines for secondary prevention and diagnosis and treatment of Marfan patients. Domain experts have extracted information from the guideline text, have interpreted it, and then encoded it in a computable formalism in Gaston. We have connected

Gaston to our systems for discharge and follow-up. Gaston uses patient data to interpret the knowledge base, generates a therapeutic advisory, and if required, justifies the advisory.

Another type of systems uses mark-up methodologies to serve guideline text excerpts relevant to patient context[5].

The objective of this study is the development and evaluation of computer-assisted access to medical guidelines at the point of care. These systems are using a dedicated variant of the mark-up methodologies.

2. Methods

We have developed two guideline delivery systems, one as a stand-alone interactive system and one integrated into a patient information system. The systems employ a set of generic questions related to the ACS and secondary prevention guidelines endorsed by the European Society of Cardiology. The Stanford mark-up tools were used for identifying and marking key segments of the guideline text [6]. The choice of generic questions was collaboratively agreed upon by domain experts from Stanford and Rotterdam. There are seven generic questions types:

Question type	Example
Definition	What is the definition of Killip Class?
Treatment	How can aspirin be used to treat or prevent myocardial infarction (MI)?
Diagnosis	How can echocardiography be used in the evaluation or diagnosis of MI?
Effect	What is the effect of beta-blockers on MI?
Risk factors	Is diabetes mellitus a risk factor for MI?
Sequelae or complications	What are the sequelae or complications for MI?
Pathogenesis and ethiology	What is the pathogenesis or etiology for MI?

Every (generic) question has an answer that is marked up in the guideline and stored in a database for easy retrieval. Answers to the questions and marked text excerpts are retrieved from a dedicated guideline database. Examples of a canonical question, the answer and the guideline text are shown in the next 3 figures.

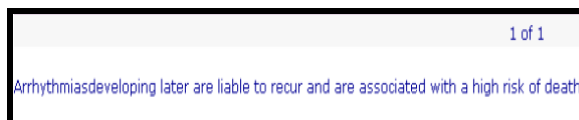Figure 1: example of a question about risk factors

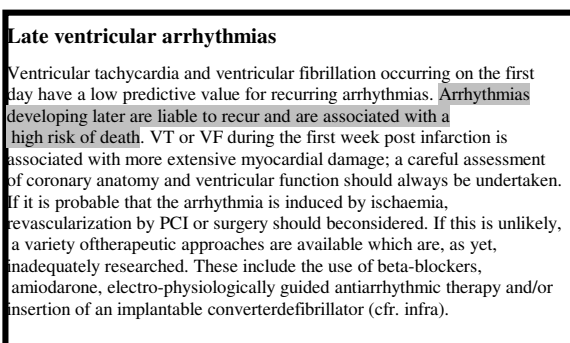Figure 2: answer on the question from figure 1

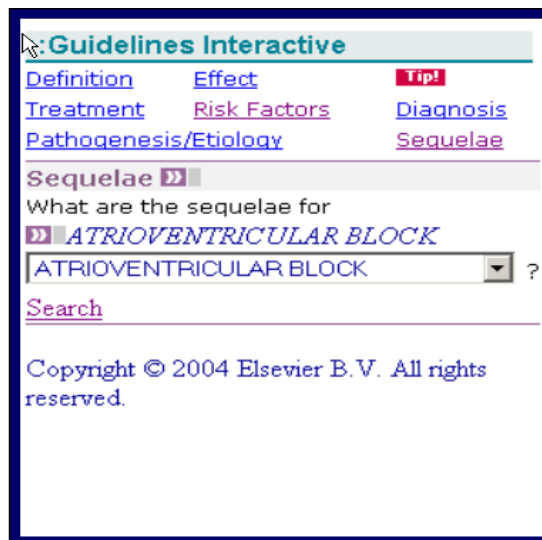Figure 3: guideline text related to the question in fig. 1

Figure 4: example of a question about sequelae on a PDA screen.

Both a PDA version and a PC web based version of the stand-alone system have been developed to support the cardiologist in the medical decision process. An example of a PDA screen is shown in figure 4.

At the point of care, the canonical questions are posed

via an interactive computer display or our Cardiology Information System (Thor2006). The web based discharge and follow-up module in Thor2006 gives the opportunity to relate selected data-items, like medication or risk factors to the most appropriate canonical question, resulting in advice regarding the patient from the guideline database. Figure 5 shows the window for the selection of a medication at discharge. The user may ask for information of this medication in the ACS guidelines.

Figure 5: medication selection module in Thor2006. Pressing the 'Q' button poses a question to the guideline database.
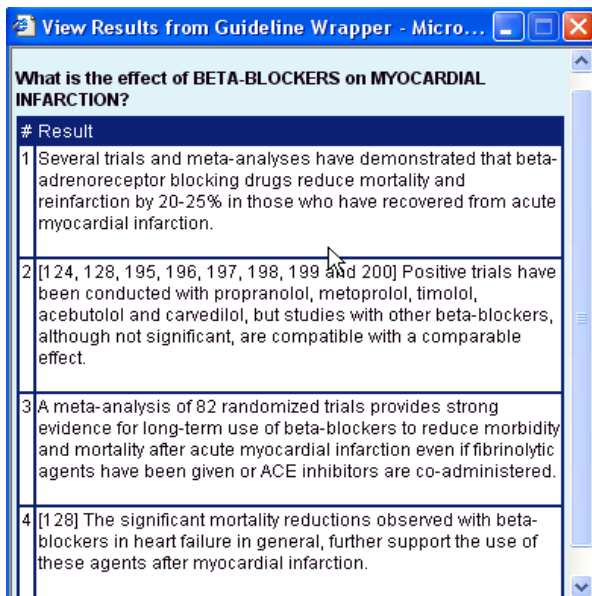

Figure 6: answer on the question from figure 5

If information is required, the system will generate a question from the combination of diagnosis and selected medication. The question will be sent to the guideline database. The returned answer (guideline text) will be presented in a special window (see figure 6).

Web Service based communication (SOAP protocol) is used for the exchange of questions and answers between THOR2006 and the central guideline database (housed in an Elsevier department in the USA). Questions, answers and guideline blocks are coded in XML strings.

3. Results

The usability of both the stand alone systems and the discharge module have been tested by 10 staff members of the Cardiology department in Rotterdam. The standalone systems have also been tested by 10 Cardiology staff members of Cork (Ireland),

The goals of this research were:
o To examine the ease of use of the interactive guidelines interface with representative users.
o Compare the effectiveness of the web based systems with the integrated THOR2006 system.
o To examine the effectiveness of the interactive guidelines concept with representative users.

The user research sessions were conducted by the user interface designer. Each session lasted approximately 60 minutes in a controlled setting and was conducted in a one-on-one interview format. Realistic task scenarios have been created. Each participant had to read a scenario and was asked to complete the task with each interface. Following the session, participants were asked to complete a questionnaire to rate and rank their preferences for key elements of the user interface and user experience.

Overall, the users related their experience with the systems as positive, and very useful. The interface of all systems was generally thought to be very clear and straightforward.

The most confusing or frustrating aspects of the systems were:
o poor terminology and question structure (stand alone system)
o not having more information. The answers were considered too brief.
o more experienced cardiologists commented that the information about risk factors was too basic to be useful
o a lack of a ability to enter free-text searches
The best aspects of the systems were:
o accessibility and ease of use
o the link from medication in the patient information system to guidelines information was very much appreciated by everybody. It appeared to be less basic, more informative than the information about risk factors.
o the handheld form-factor was desirable.
o linking the actual guideline text with the query answer.

4. Discussion and conclusions

We have developed a set of tools, methodologies and deployment strategies that provide quick and intuitive access to the clinically relevant section of European practice guidelines at appropriate moments of care delivery.

It must be noted that this question based approach allows clinicians to browse through documents in an easy way. The methodology is less suitable to generate therapeutic advisories from the guideline database regarding the actual patient status, the present medication and relevant laboratory results. We would expect the generation of a large number of questions and an enormous number of answers if the diagnosis, the risk factors, the medications and other treatment means and laboratory results of one patient are regarded. In Rotterdam we are using the decision-support system Gaston for the generation of therapeutic advisories. Both systems may be easily extended with hyperlinks to additional references such as literature references, text books, cardiology news reports or drug databases. This may provide the physician access to related information concerning a specific difficult patient problem.

Integrating a guideline delivery system with a patient information system is still a complex and challenging problem with much opportunity for additional research. The research is both medically oriented (e.g.: the influence on the quality of medical management) as technically oriented (e.g. : how to effectively pose questions and display the responses).

It is appreciated that management of individual patients is more complex than simply following the available guidelines. Individual patient characteristics may require a personalised approach, while application of guidelines may be hampered by lack of resources financial or otherwise. For example, in a few European countries statins are reimbursed only in patients with very high total cholesterol rates, >8 mmol/l, in spite of the evidence-based recommendations to prescribe these drugs in all patients with coronary disease and a total cholesterol rates >4.5 mmol/l [7].

References

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