Utilization of Custom-Made Databases in Both Medical Research and Patients' Treatment

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Abstract

Background: Hospital Information Systems widely used in departments of university hospitals are not sufficient for both storing data about patients treatment and long-term research. Clinicians often use custom-developed applications which are maintained without any cooperation with the management of the hospitals and mostly break law in the Czech Republic.

Objectives: This article describes using such an application in cooperation with the Hospital Information System. It also describes an example of a research of cost effectiveness thyroid gland diseases treatment using Radioiodine ^{131}I in outpatient regime compared to hospitalization or an alternative surgery.

Methods: The database application is developed in Visual Basic. The research studies the treatment by the Radioiodine ^{131}I in 45 patients. We evaluated the financial cost of radioiodine therapy in the outpatient regime and hospitalization compared with a surgery.

Results: The financial costs for 1 patient is 114 EUR, it means 16% if compared with the same treatment in a hospital and only 25% of the possible alternative operation.

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Conclusion: This study describes that the treatment by outpatient regime can be a motivating alternative compared to the treatment by ^{131}I at a hospital or even the surgery.

Keywords

Thyroid gland, cost effectiveness, Radioiodine, hospital information system, database

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1 Introduction

At the General University Hospital in Prague, there is used one Hospital Information System (HIS) for managing the patients' health documentation and for storing the laboratory results. The largest problem of the HIS is in its universality, because it has limitations when used at university hospitals, where the physician also needs to use some information system for long-term research purposes.

Since the HIS stores the progress of the patients' treatment in a form of text-based medical records, nearly each physician at various departments maintains its own duplicate databases in various forms, from easy made spreadsheets tables to some small file-based databases. Advance of these custom-made databases is in its structure.

The data are stored in particular fields and clinicians find this solution much more useful for evaluating some research data in patients watched in long-term studies. Also we see two disadvantages:

- Maintaining of custom databases at hospitals by clinicians is often without any cooperation with the

Figure 1: Ultrasonography module.

management and the IT department of the hospitals. This may lead to violation of law [1].

- Duplicity of the physician's work. The physician is using two applications simultaneously - Hospital Information System and his/her own application. Those applications mostly are not connected in any way, so each record must be manually typed twice, etc.

In this work I would like to show that custom-made databases can be very helpful for both research and patients treatment without any large requirements for clinicians work with PC.

2 Example of Using the Application During Medical Treatment

One of the examples is the module developed in the custom application, the ultrasonography module. During the ultrasonography examination, the clinician uses mainly the developed module which is connected with the Graphical client of the Hospital Information System. We used the standard programming interface of the Windows API. This gives the module ability to read data from opened record in the Hospital Information System [2]. This provides a clinician a comfort in using these two applications together. The clinicians simply open the patient's record in the HIS and the developed module can automatically search this record in its own database or create a new one.

Also, this application has a secured database. It is saved in a hospital data-store system which is accessible using the Windows Domain. So only the selected physicians have access to the data. This was performed with the cooperation with the IT Department of the hospital.

For clinicians, the advantage of this custom-made module is in two important things:

1. Data of the graphic examinations are stored in quantitative-based structural information. These results can be easily searched for any criteria. This is not currently possible in the HIS since the medical record is based on natural text-based sentences.

2. The clinician also needs to write the medical report in the HIS. This is performed automatically in the developed module. Using the Visual Basic programming language, there is automatically generated medical record in a natural language with data based from the application. We used fact, that the ultrasonography examination is mostly a repetitive work, mostly with rotation of given terms. Of

Table 1: Cost of particular treatments (Prices in EUR using 25 CZK/ 1 EUR exchange rate).

	^{131}I outpatient regime	^{131}I hospitalization	Surgery
Accumulation test	6 EUR	6 EUR	
Scintigraphy of thyroid using ^{98m}Tc	29 EUR	29 EUR	
Therapeutic 550 MBq ^{131}I	79 EUR	79 EUR	
Hospitalization TOTAL		585 EUR	314 EUR
Surgery (total thyroidectomy)			143 EUR
TOTAL	114 EUR	699 EUR	457 EUR

course, this is not applicable each time. So the clinician has always ability to complete the medical record as he/she wants. See Figure 1 including the generated medical report from the structured data.

3 Example of Using the Application for Long-Term Studies

We found that the database application can be used in types of research which requires long time (more than 2 years) of getting data or observation of the patients for such a research. And what is important, when the observed cases or methods of treatment are not very common, for example when the incidence of cases is in a number of 20 per year. We found very hard to maintain the data of those patients in the HIS. Mostly the data are unsearchable in the HIS after years when the department treats hundreds of patients per year.

3.1 Thyroid Treatment

The thyroid treatment by application of radioiodine ^{131}I in the thyroid is clinically used from the 40th of the last century. Indications for the treatment are for example differentiated carcinoma of the thyroid gland or thyroid hyperfunction [3]. This type of a treatment is widely used around the world and is certified as a save method by multiple studies [4] but in the Czech Republic, however, this method is still indicated relatively little and still is realized only in hospitals. The most used method of treatment is the surgery and the number of the noninvasive treatment is increasing very slowly [5]. The 3rd Medical Department together with the Department of Nuclear Medicine at 1st Faculty of Medicine is cooperat-

ing on patients' treatment by application of radioiodine ^{131}I without any hospitalization. We tried to evaluate the cost of the treatment together with the effectiveness of the treatment. Because the number of patients is very low even during 2 years of the study, we used the custom-made database application to store the research data. The reason was due to a large number of patients treated at the Endocrinology Department and after some years, it is not possible to find out all the observed patients in hundreds of patients.

3.2 Methods

This research took 22 months during the years 2008-2010. The treatment by Radioiodine ^{131}I was offered to 45 patients and finally it was performed on 39 patients (31 women, 8 men). We evaluated the financial cost of the radioiodine therapy in the outpatient regime and hospitalization compared with surgery.

The diagnostic and treatment by Radioiodine ^{131}I consist of those steps:

- Laboratory examination of the thyroid gland (TSH - thyroid stimulating hormone, FT4 - free thyroxine, FT3 - free triodothyronine, TPOAb - antibodies against thyroid peroxidase and TRAK - TSH receptor antibodies in serum using chemiluminescence analyzer by Centaur).

- Ultrasonography of thyroid nodules in patients with fine needle biopsy (FNAB) to exclude malignancy.

- Patients were given a fixed activity of 550 MBq in the form of Radioiodine ^{131}I capsules.

- Clinical and laboratory monitoring of thyroid parameters for 4-6 weeks and 2-6 months depending to actual health status of the patient.

Table 2: Contraindications using ^{131}I treatment.

a.	Pregnancy and breast-feeding
b.	Middle and hard endocrine orbitopathy
c.	Pregnancy sooner than 6 months before the ^{131}I application
d.	Malignant node in thyroid

We retrieved the cost of particular treatments, see Table 1.

3.3 Results

For the costs of treatments, we counted the Radioiodine accumulation test, thyroid scintigraphy with ^{99m}Tc Pertechnetate, the price of ^{131}I therapy capsules (according to the current price list of suppliers of radiopharmaceuticals) and in hospitalized patients, cost of hospitalization. Similarly, the cost of a thyroid surgery was evaluated according to the current tariff paid by insurance companies plus the cost of hospitalization (see Table 1). We used 25 CZK for 1 EUR exchange rate. By comparing the financial costs for 1 patient, we found that the cost of an outpatient radioiodine therapy (114 EUR) represents only 16% of the same treatment in a hospital and only 25% of the possible alternative operation.

3.4 Discussion

The treatment using ^{131}I has also some side effects, such as the post-radiation thyroiditis or development of the Graves-Basedow disease is up to 5% of patients. In patients with light orbitopathy the side effect can be treated by the low amount of prednisone, but in patients with developed orbitopathy it is determined as contraindication [6]. Other contraindications are described in the Table 2. The Radiodine treatment is not widely developed in the Czech Republic. Mostly there is a large distrust at this type of treatment in our country. This study describes that the treatment can be motivating alternative compared to the treatment by ^{131}I at a hospital or even the surgery. Another motivating aspect can be the effectiveness of the treatment, which is comparable with foreign countries (88 %) [7].

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