Image: a Cardiological Database. Twenty Years of Experience

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Abstract

A cardiological multidimensional database, Image, was implemented in the 1982 to store the most important data obtained during hospitalization of patients affected by cardiovascular disease.

The database is populated when the patient is discharge and subsequently enriched with follow up data. Patients are followed for at least five years, maximum for ten years. At the moment database contains almost 10000 patients.

In the population observed over the twenty years changes in demographic, clinical manifestations and therapeutic approaches of cardiovascular disease are found. Follow up data allow to correlate treatment approaches with prognosis.

The long-term Image database results essential 1) to obtain clinical data integration useful for playback consultation for health care or research purposes 2) to obtain epidemiological information on diseases 3) to follow the different impact of therapeutic procedures on prognosis.

1. Introduction

The rising of health care and hospital efficiency has underlined in the last ten years the necessity of clinical information system. Clinicians are daily confronted with a variety of data: different diagnostic tools are often used in the same patient to obtain a better definition of the pathology. Moreover it has recently increased the necessity to define the cost-effectiveness of clinical procedure to reduce health cost and redundancy of diagnostic tests. It is obvious that only an effective informative aid is able to guarantee the integration of activity, to archive amount of clinical data, to create clinical database useful for further social, economic, research studies. In spite of experiences in the field, still to-day the majority of patient records are paper based and in the majority of hospitals or institutions the clinical information systems generally support only minor sets of clinical data. Electronic supports seem time consuming and minor advantages are underlined.

To stress the utility of digital information system we report our twenty years experience in the field.

2. Methods

A cardiological multidimensional database, Image, was implemented in the 1982 to store the most important data obtained during hospitalization of patients affected by cardiovascular disease.

The system was set up in the cardiological department of CNR Institute of Clinical Physiology in Pisa to answer the cardiologist necessity to facilitate his research work with a minimal set of data and to achieve a diagnostic integration from different sources of patient data. The resulted electronic database is a multidimensional record collecting data extracted from different diagnostic procedure. Until 1994 HP-IMAGE 1000 system was used to archive data; in 1995 all the data bank was transfer to a PC with MS/DOS operative system, using the relational database DB3. The most important data obtained during hospitalization are saved as a database record (128 fields) and represent the patient characterization. Data are grouped in nine major categories: registry data, anamnestic information (presence and type of angina, presence and type of myocardial infarction, NYHA class, risk factors), uninvasive procedures (echocardiographic and elettrocardiographic data collected at rest and during stress test and nuclear medicine results), hemodynamic data (number of coronary lesions, site of revascularization, left ventricular function), diagnosis and treatment at discharge, follow-up (Figure1).

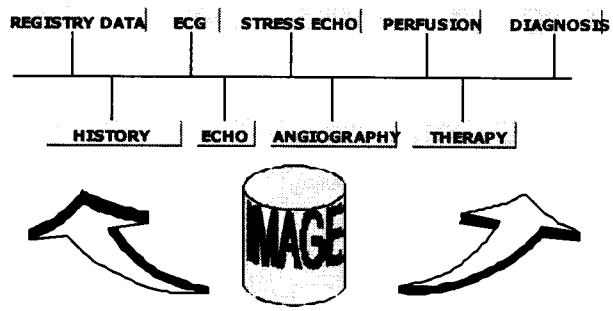

Figure 1. Image structure

The information of major clinical interest in IHD were

echocardiogram: end-diastolic left ventricular dimension, end-systolic left ventricular dimension, interventricular septum thickness and left posterior wall thickness, ejection fraction, type and site of kinetic alteration (left ventricle was subdivided into 16 segments and each segment was scored from normal to dyskinesia). Extraction of data is performed using commercial products as DBaseIII and FoxPro for Windows. Functions were implemented to decoder data before their extraction; moreover different procedure have been implemented to extract data as numeric file. This facilitates elaboration using Excel for Windows, BMDP, Statview for Macintosh etc.

The database is populated when the patient is discharge: data are extracted by the medical chart, written on paper and subsequently inserted in the electronic archive. The follow-up data are collected by questioners or telephone interview. At the first loading the patient is identified by a progressive number which is reassigned at each successive characterization occurring at each new hospitalization.

During the first ten years data were collected by the medical doctor in charge of the patient. In the last ten years data are extracted and PC inserted by two trained technicians with a medical doctor supervision. Before permanent storage a senior cardiologist checks each record for logical or clinical inconsistencies.

1. Results

Image stores the most important clinical information collected for each cardiac patient during the hospitalization: risk factors (diabetes, smoke, family history, hypertension and hyperlipemia), history of angina and/or myocardial infarction, presence of unstable angina, presence and site of ischemia and/or necrosis, data on global and regional left ventricular function, number and site of coronary lesions, site and type of revascularization interventions (CABG, PTCA and stent), permanent cardiac pacing, medical therapy.

Database contains 9967 patients, 7129 males, mean age 60±13 years; 1450 patients have more than one characterization (range 2-6).

Principal diagnoses are reported in Figure 2; 1413 patients have been hospitalized during an acute myocardial infarction; 1200 were affected by cardiomyopathy, 400 subjects were recognized as normal (free of cardiovascular disease).

Ten thousands stress tests (exercise or pharmacological) were stored; 8500 patients have data on coronary angiography. Figure 3 reports details on uninvasive and invasive procedures.

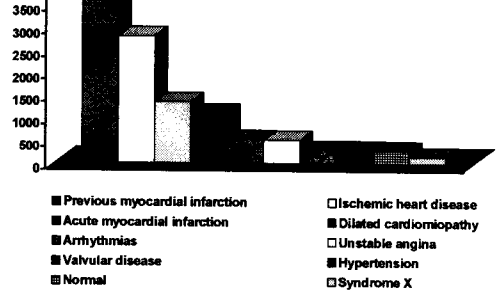

Figure 2. Patients grouped on the basis of principal diagnosis at discharge.

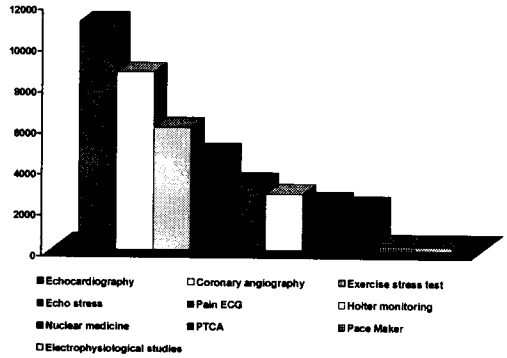

Figure 3. Invasive and uninvasive procedures.

In the population collected over the twenty years changes in age, gender and risk factors are observed: in the last ten years age progressively increased (51±8 vs 62±10 yrs) and more females were recovered (94% vs 81% males).

On the contrary the presence of coronary artery vessel disease remains almost constant (30%/year) (Figure 4) as well as the history of acute (12%) or previous myocardial infarction (55%).

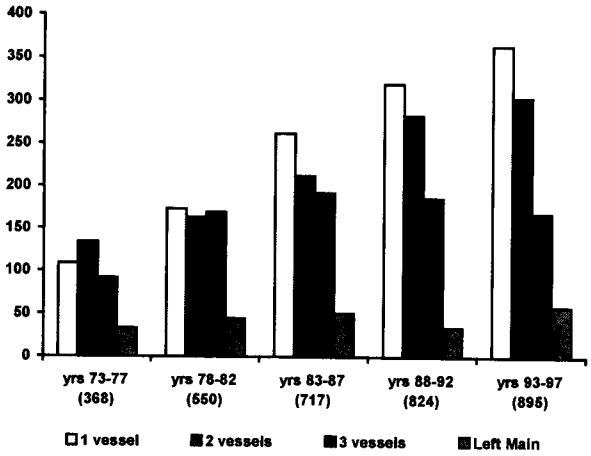

Figure 4. Incidence of coronary artery stenoses.

• Patients with <5 yrs	3338
• Average length (months)	77±62
• Deaths	2256
• Fatal myocardial infarction	321
• Non fatal myocardial infarction	525
• CABG	1446
• PTCA	1837
• Pace-maker	240
• Other cardiac surgeries	241

Patients are followed for at least five years, maximum for ten years. Major events in the follow-up are reported in Table I: 2256 deaths were found and 846 myocardial infarctions. Death for all cause is consistent over the years (14%) but cardiac death is slightly decreased (from 11,3 to 8,4%) (Figure 5). The retrospective analysis underlines also an increase of revascularization procedures in the last ten years (coronary angioplasty increased from 10% to 56%, coronary artery bypass from 18 to 27%) (Figure 5).

Follow-up data offers the possibility to obtain the prognostic impact of different clinical manifestations and of different treatments. Correlation between physiological or pathological parameters and major complications can be obtained.

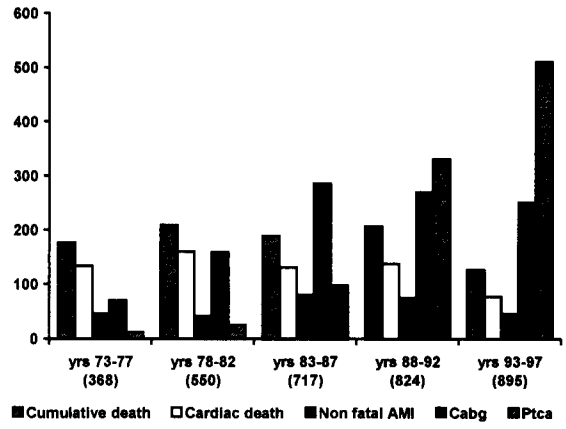

Figure 5. Follow-up major complications over the years.

Figures 6 and 7 show the survival curves obtained in patients affected by coronary artery disease; higher resting heart rate (Figure 6) obtained from ECG at admission have higher incidence of cardiac deaths in the follow-up. Moreover the incidence of cardiac death in patients treated with medical therapy is significantly related to the number of diseased coronary artery vessels.

Finally archive has been continuously used to select

4. Discussion

Clinical characterization of patients with suspected or asserted cardiovascular disease is frequently made difficult by heterogeneity of information derived from different techniques, at different time and by different specialists. Image allowed, with simple architectural, the integration of different sources of clinical data and created an instrument to verify continuously the impact of physiopathological knowledge on clinical practice.

The integration procedure was designed just for research help but its use supported the cardiologist's integration clinical process. The presentation of different tests in a summarized form pointed out at a glance possible incompleteness of the diagnostic process and it was a teaching instrument for future hospitalizations of the same patient or for other similar clinical cases. Due to the simplicity of the solution and the ability to synthesize all the available information Image was a useful instrument for many years. The simplicity of the codes have facilitated, after a proper training, its use also from non-specialists.

Research work was facilitated and multiple scientific publications in major international journals were published (1-4).

It provided an useful tool to start follow-up patients and to habituate doctor to keep in mind prognostic impact of diagnostic procedures or treatments.

In the next future Image automatically will retrieve all the available clinical and instrumental data data from the cardiological database, present now in the Institute.

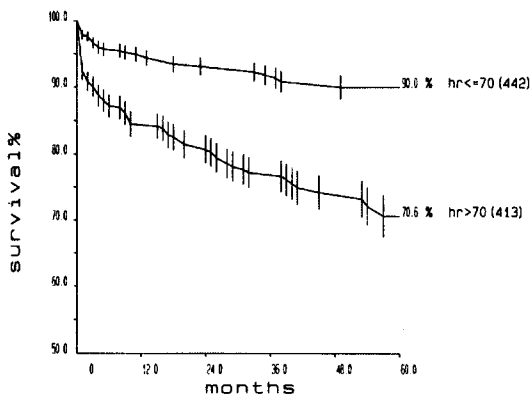

Figure 6. Higher resting heart rate is associated with significant higher number of cardiac deaths (Kaplan-Meyer survival curves).

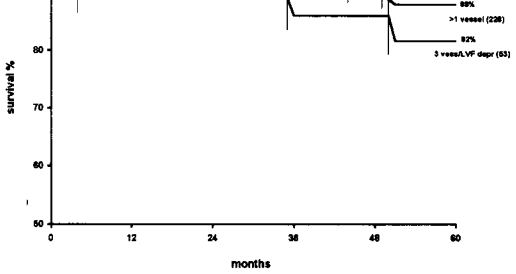

Figure 7. Multiple coronary artery disease is associated with significant higher number of cardiac deaths (Kaplan-Meier survival curves).

5. Conclusions

Image long-lasting experience underlines that a cardiological database is essential 1) to obtain clinical data integration useful for playback consultation for health care or research purposes 2) to obtain epidemiological information on cardiovascular diseases 3) to follow the different impact of therapeutic procedures on prognosis.

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