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Report Article

First Database Report on Cardiothoracic Surgery in Tehran Heart Center

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Abstract

Background: The use of cardiac surgical database is necessary for evaluating and improving the quality of care. The aim of this report was to provide useful information for surgeons in Iran and other countries for their daily practice.

Methods: We analyzed data from 14288 consecutive patients in four different types of procedures, namely isolated coronary artery bypass grafting (CABG), combined CABG and valve (CABG-V), only valve (V), and other adult cardiac surgical operations from 2002 to 2006.

Results: The activity load increased from 1765 in 2002 to 3309 surgical operations in 2006 with almost 87.2% of activity being isolated CABG. The mortality rate for CABG was 1%, which decreased from 1.7% to 0.9% over the five years. The mortality rates for CABG-V and V were 5.8% and 4.8% in the last year of the study, respectively. Over the 5 yr period, the proportion of urgent operations increased substantially from 4% to 24.5% ($P< 0.0001$), causing a reduction in elective operations. The mean length of hospital stay for the entire population was 8.38±5.74 d, which remained almost steady during the study period.

Conclusion: This database can serve as a valuable resource of preoperative measurers and surgical outcomes for surgeons and researchers with a view to improving overall surgical performance.

Keywords: *Cardiac Surgery, Iran*

Introduction

In the field of cardiothoracic surgery, the use of an up-to-date cardiac surgical database is necessary for evaluating and improving the quality of care, and there is no doubt that better results regarding each population can be achieved by evaluating data obtained from a subgroup of the same population.

By now, many surgery groups have established the national database for cardiac surgery (1- 3) and some of them have grown to be the largest database of their kind in medicine (4). It is clear that such datasets can present invaluable information on important issues such as work load, mortality rates, cost-benefit, and cost-effectiveness of procedures, all of which are important for governments and health care systems. These databases also provide an opportunity for developing and validating a clinical prediction rule for short-term and long-term outcomes of surgical procedures in the related population with a view to giving guidance to surgeons and other health professionals and thus improving different surgical and medical methods (5-9).

To that end, we present the first cardiac surgical database report: one of the 4 databases compiled in Tehran Heart Center (THC), which is affiliated to Tehran University of Medical Sciences. The main objective of this report is to present data which can be used by physicians in their assessment of the quality of care in cardiac surgery.

The THC surgery database was established in 2002. THC is a large dedicated center for cardiovascular diseases in Iran, and patients are referred to this hospital from all over the country. The department of surgery consists of 7 operating rooms, one intensive care unit (ICU) for open heart surgery, 4 post-ICU wards, and 5 post-sur-

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gery care wards. Our multi-disciplinary approach and expertise has gained us the reputation of being one of the best-prepared surgical practices. Our large volume, consisting of many complex and complicated procedures in all areas, including multiple arterial coronary revascularization and repair of great cardiac vessels, heart valves, and hypertrophic obstructive cardiomyopathy, reassures patients that they are receiving the best care possible from some of the most experienced and expertly skilled surgeons in the country.

These surgeons are committed to continually studying and evaluating new methods of surgical treatments and improving surgical outcomes through clinical and laboratory research in related areas.

A research group maintains a database designed to report pre-operational, operational, and post-operational information and outcome on cardiac surgical patients by presenting meaningful data to clinicians. This group comprises surgeons with more than 10 yr of experience in the field of cardiovascular surgery, general practitioners, epidemiologists, and biostatisticians. The data source is patients' medical records and face to face interviews. All the information is collected by trained general practitioners and is entered in the data system regularly on a daily basis. In this system, the validity of all the data is checked by reabstracting 10% of the patient entries and by re-entering 5% of the patients' records.

Definitions of variables are in accordance with the Society of Thoracic Surgeons (STS) adult database. According to our assessments, the databank has a high validity. Our database now contains detailed information on more than 14,000 patients who have been under our care over the last 5 yr. However, these data do not pertain to all the hospitals in the country. We hope that the second report will include the data from at least a few more hospitals in Iran.

Materials and Methods

This report has been arranged in 4 sections containing results of analyzing data on three different types of procedures: patients with isolated coronary artery bypass grafting (CABG), patients undergoing CABG and valve operations (CABG-V), and patients receiving isolated valve operations (V). At first a review of annual patients' characteristics and work load will be presented. Because of the importance of the mortality rate after surgery, the second section offers an analysis of this issue. The in-hospital mortality rating was based on the number of deaths that occurred during the 30 d of hospital admission in which the cardiac surgery was performed or during readmission in 30 d after surgery. The third section focuses on operative priority and waiting time. Prioritization of patients waiting means that some patients spend only a short period of time on the waiting list, while others are considered routine priority for a longer period of time. The surgical priority categories are as follows (10):

Elective Routine admission from a waiting list,

Urgent Surgery during current admission for medical reasons, and

Emergent Unscheduled patients with refractory cardiac compromise requiring surgical intervention irrespective of time of the day.

In the last section, the post-surgical length of stay (LOS) was derived by subtracting the cardiac procedure date from the discharge date. Length of stay is reported in average days.

Statistical analysis Numerical variables were presented as mean±standard deviation, while categorical variables were summarized by absolute frequencies and percentages. Categorical variables were compared using the Mantel-Haenszel chi-square test for trend across five years. For the statistical analysis, the statistical software SPSS version 13.0 for Windows (SPSS Inc., Chicago, IL) was used. All *P* values were 2-tailed, with statistical significance being defined by $P \leq 0.05$.

Results

Between January 2002 and December 2006, a total of 14288 cardiac surgical operations were performed in the cardiac surgical unit at THC. Surgical activity load increased from the 1st January 2002 to 31st December 2006 (Fig.1).

Almost 87.2% of our activity was primary coronary artery surgery, with operations on valvular heart disease and concomitant valve surgery comprising 7.2% and 3.5% of the workload, respectively. The distribution of procedure types for the years 2002 to 2006 has been depicted in Fig. 2. The proportion of CABG operations decreased from 87.8% to 85.1%, whereas the proportion of concomitant valve surgery and CABG in 2006 was more than twofold of that in 2002 (4.7% vs. 2.3%).

The final 2.1% of our workload (301 procedures) comprised adult congenital surgery, surgery of the thoracic aorta, and other miscellaneous procedures, which remained a static but an important part of our workload.

Patient Characteristics

CABG category From 12458 patients in the CABG category, 74.5% were male and 25.5% female. There was no significant change in this ratio over the last five years. The mean age of the patient population was 58.63±9.66 yr (range 13-88 yr), which remained steady over the study period. Some 14.0% of the patients (1744 cases) were 70 yr of age and over. The percentage of patients ≤ 50 yr was 21.7% (2708 patients), which showed a progressive decrease from 22.4% in 2002 to 20.4% in 2006 (P= 0.010). It is surprising that 386 (3.1%) patients undergoing CABG without valve surgery were ≤40 yr old and 8 (0.06%) of them were ≤30.

CABG and Valve category Of 494 patients undergoing CABG and concomitant valve operation, 65.8% were male and 35.2% female. The mean age of the patients in this category was 60.66±10.11 yr. The proportion of patients ≤50 undergoing CABG and concomitant valve surgery had an unremarkable increase from 12.2% in 2002 to 13.5% in the last year of the study. Whereas in 2002, 2.6% of patients undergoing CABG required valve surgery, in 2006 the proportion was substantially higher at 5.2% (P< 0.0001).

Combined CABG and mitral valve surgery comprised 69.6% (344 surgeries) of all CABG and valve operations. From these cases, 221(64.2%) had mitral valve replacement (MVR), 80(23.3%) annuloplasty, and 43(12.5%) reconstruction with or without annuloplasty. The proportion of CABG with concomitant MVR procedures increased from 34.1% in 2002 to 53.5% in 2006 in this category (P< 0.0001).

In this category, CABG and aortic valve procedure was performed in 199 (40.3%) patients, 99% (197) of whom had aortic valve replacement (AVR). The proportion of CABG with concomitant AVR procedures decreased from 53.7% in 2002 to 35.4% in 2006 (P= 0.003).

Combined CABG, mitral valve, and aortic valve surgery was performed in 56(11.3%), CABG and tricuspid valve surgery in 57(11.5%). None of the patients had concomitant CABG and pulmonary valve surgery.

Valve category Valve surgery with no other major cardiac surgery comprised 1035(7.2%) cases, 52.1% of whom were female and 47.9% male. The mean age of this group was 47.82±14.63 yr and increased from 46.78±15.06 in 2002 to 48.26±14.24 in 2006, insignificantly. The proportion of population ≤50 yr old was 53.8%, which decreased from 58.7% in 2002 to 51.7% in 2006, which was not remarkable. From 1035 surgical operations, 549(53%) were aortic, of which 267(48.6%) required isolated aortic valve surgery including 243(91%) AVR. A total of 718 mitral valve operations were undertaken, 247(34.4%) of them being isolated mitral valve procedures including 234(94.7%) cases of MVR. Joint aortic and mitral valve repair/replacement as an isolated primary procedure was performed in 277 of the 1035 patients (26.8%).

Of the 1035 procedures, 333(32.2%) were tricuspid valve operations, 67(20%) of them being tricuspid valve replacement. Pulmonary valve operation was performed in 10(1%) including one replacement.

In-Hospital Mortality Rate

The overall mortality rate was 1.6%, showing 222 deaths in 14288 procedures. This figure had a steady decrease from 2.6% to 1.5% over the study period. This reduction was significant through the five years according to the Mantel-Haenszel chi-square test for trend (P= 0.007) and was seen

in all the operative categories. Table 1 depicts the mortality rates of each operative category.

Table 1: Distribution of procedure types and related in-hospital mortality rate

Procedure type	Number of patients (%)	Number of deaths (%)
CABG	12458 (87.2)	123 (1.0)
CABG + Valve	494 (3.5)	40 (8.1)
Valve	1035 (7.2)	46 (4.4)
Adult congenital and others	301(2.1)	13 (4.3)
Total	14288 (100)	222 (1.6)

CABG: coronary artery bypass graft

The mortality rate for CABG with no other major cardiac procedure was 1% and decreased from 1.7% in the first year to 0.9% in the last year of the study (P= 0.015, by Mantel-Haenszel chi-square test for trend). Although this reduction was significant between 2002 and 2003, there were no significant changes in the mortality rate of all the procedures and different operative subgroups between 2003 and 2006. Fig. 3 and its control curve (Fig. 4) illustrate the reduction in the mortality rates in terms of the years of activity. Patients who underwent both valve and CABG surgery had the highest overall in-hospital mortality rate of 8.1% and stood at 5.8% in the year 2006 (Table 1).

Our institutional outcome for concomitant AVR and CABG since 2002 was 15 deaths in 197 procedures, giving a mortality rate of 7.6%. This figure reached 3.6% in 2006. The in-hospital mortality rate for 221 concomitant CABG and mitral valve replacements was 7.2%(16 cases). There were 46 deaths in 1035 isolated valve procedures (4.4%). The mortality rate was 4%(22 cases) for aortic valve, 4.3%(31 cases) for mitral valve, and 4.6%(11 cases) for combined aortic and mitral valve operations.

Operative Priority and Waiting Times

Over the 5 yr, we had 1681(11.8%) urgent and 54(0.4%) emergent in-hospital cases with which we had to contend. These patients deemed unable to leave the hospital, leading to the occupation of some hospital beds. It is noteworthy that over the 5 yr period, the proportion of urgent and emergent operations increased substantially from 4% to 24.5% (P< 0.0001), and the proportion of elective operations decreased from 96% in 2002 to 75.5% in 2006 (P< 0.0001) (Fig. 5).

Post-surgical length of hospital stay

The mean LOS for the entire population was 8.37±5.60 d. There were differences in the number of days that patients in different procedure categories stayed in the hospital. The average LOS for each operative category is demonstrated in Table 2. Figure 6 presents average post-surgical LOS in terms of the years of study.

Table 2: Average LOS for each operative category

Procedure	Number	LOS Mean ± SD
CABG	12335	7.81 ± 4.98
CABG + Valve	454	14.09 ± 8.14
Valve	989	12.96 ±7.63
Total	13778	8.37 ± 5.60

LOS: Length of hospital stay (day)
CABG: coronary artery bypass graft

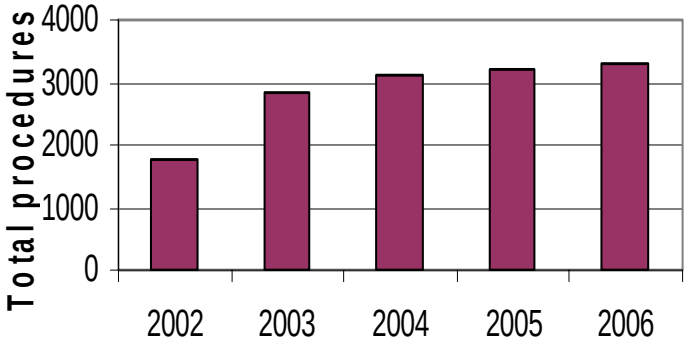

Fig. 1: Surgical activity between 1st January 2002 and 31st December 2006

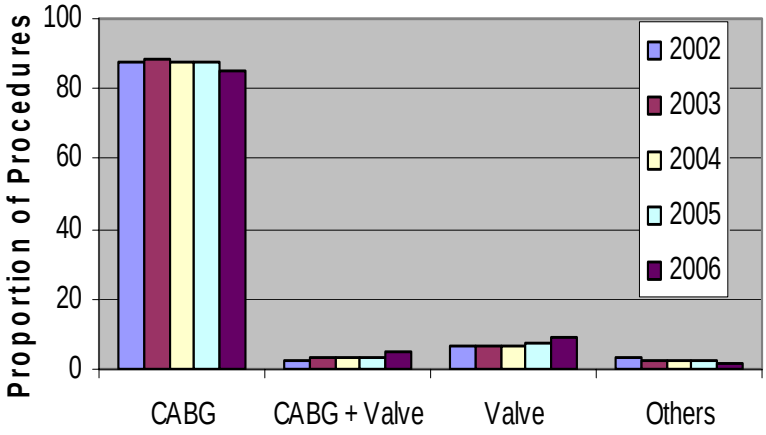

Fig. 2: Distribution of procedure type between 1th January 2002 and 31th December 2006 (n=14288)

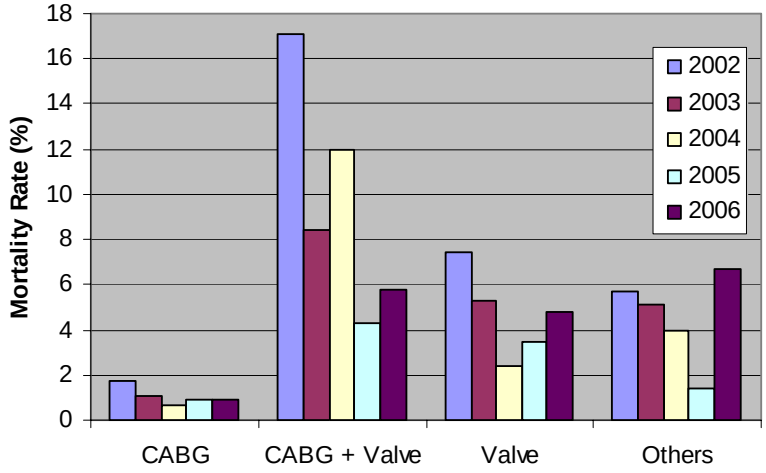

Fig. 3: Mortality rate of procedure type between 1st January 2002 and 31th December 2006 (n = 229)

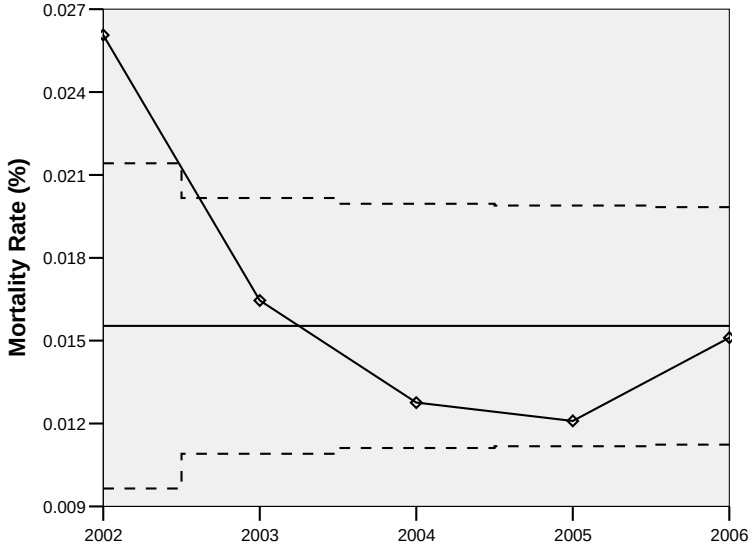

Fig. 4: Trend for mortality rate of all surgical procedures during the years of study. (Discontinuous lines shows percentage points with 95% confidence interval)

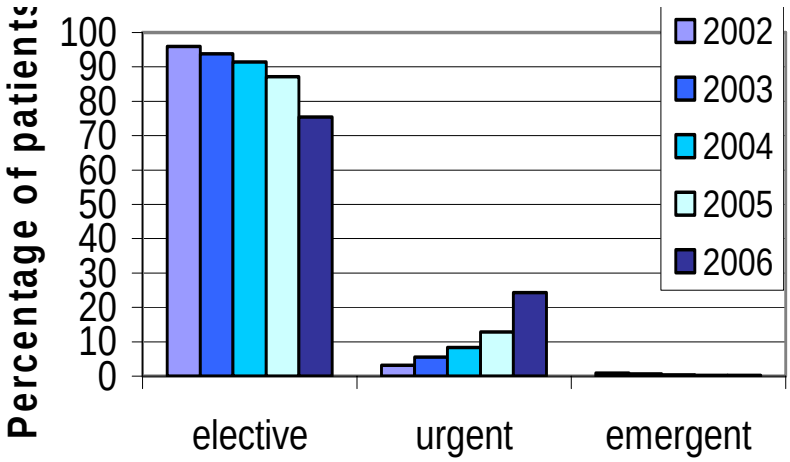

Fig. 5: Case-load priority from 1st January 2002 to 31st December 2006

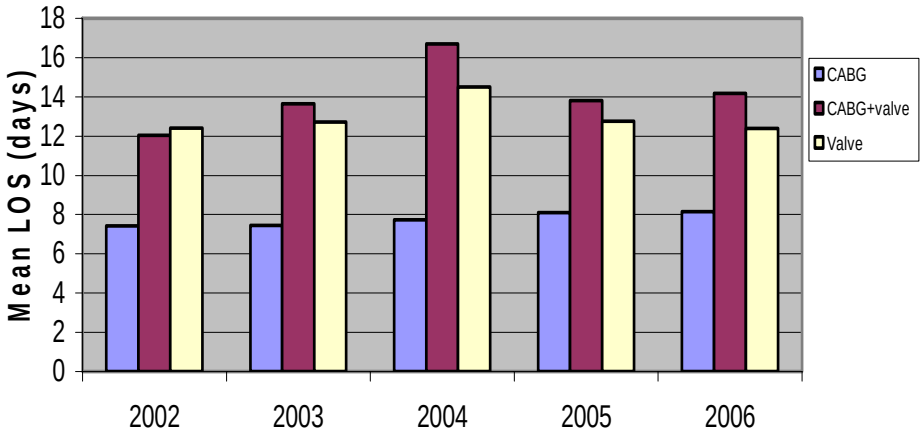

Fig. 6: Average length of post surgical hospital stay (LOS) by years of study

Discussion

The first cardiac surgery report of THC is invaluable for a variety of reasons: 1) no national cardiac data base had been established in Iran at the time this report was being prepared, 2) THC database, reflecting our overall activity and quality, can act as a valuable resource for Iranian clinical researchers, many of whom have published clinical papers during the last few years (11-14), and 3) this database by virtue of containing detailed information on more than 14,000 patients under our care over a 5-year period should enable us to evaluate our future activities and develop a rule for predicting major adverse outcomes in patients who undergo CABG.

Our overall activity had a good progression in the number of operations. There was a major increase of twofold in procedural activity performed in 2006 compared with total operations in 2002. With respect to the overall distribution of the type of surgery undertaken, most of the activity was primary coronary artery surgery. This ratio is compatible with the ratio reported using STS database (1). The proportion of operations in each operative category had no significant changes across the 5 yr, although there was a small increase in procedures for valvular heart disease. The overall number of CABG was declined by 4% because many patients were selected for angioplasty rather than for CABG.

Female patients comprised approximately one fourth of those undergoing CABG. These differences reflect the well-known sex differences in the prevalence of coronary artery disease rather than any

differences in treatment, or access to treatment, related to gender. Vaccarino et al. studied 51187 patients who underwent CABG and among them 29.7% were female (15). In 1998, a report of the Society of Thoracic Surgeons showed that 28.1% of patients having undergone CABG were female (16). The proportion of the women in the CABG operative category of our dataset (25.5%) seems compatible with those results.

The proportion of patients ≤ 50 yr old undergoing CABG was about twice that reported elsewhere (15, 17), showing a lower average age for CABG in Iran.

The un-adjusted surgical death rate for isolated CABG at THC ran at levels equal to or better than the reported rates in different studies (15- 17). There were 12458 patients undergoing only CABG, and we successfully reduced the mortality rate from 1.7% to 0.9% over the study period. Patients who underwent valve operation at the time of CABG had the highest mortality rate, while patients who underwent only CABG had the lowest mortality rate.

One of the important activities reported in this document was operative priorities and waiting times. In the first year of activity, the proportion of patients having elective admissions was 96%; and we observed a progressive decline in elective operations, reaching 75.6% in 2006, with a progressive gain in urgent work. It seems that our efforts to increase our overall activity led to an increase in the number of urgent cases referred to our center. This means that a considerable volume of our increased activity was spent on urgent surgery, giving rise to an increased average wait for elective revascularization.

The cost of surgery has been an important issue for governments and health care organizations, and there is a positive correlation between the cost of surgery and length of hospital stay (LOS). This measure represents how long a patient stays in the hospital after undergoing open heart surgery, which may reflect the success of the treatment. We did not examine the possible reasons for a slight and unremarkable increase in LOS during the years of activity for this report. A possible explanation for this trend is the increase in the proportion of the patients undergoing urgent surgery, necessitating longer stays in the hospital because of the higher likelihood of complications during and after surgery (6, 7).

In conclusion, over a 5 yr period, Tehran Heart Center's Research Group succeeded in developing a comprehensive cardiac surgery database for preoperative measurers and surgical outcomes in the Iranian population referring to this hospital. Nevertheless, this database is still in its primary stages and needs to be refined constantly. Further reports on this dataset will render it a more useful tool for clinicians and researchers.

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The authors declare that they have no Conflict of Interests.

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