Evolution of Cardiovascular Surgery at the *Instituto do Coração*: Analysis of 71,305 Surgeries

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Abstract

Background: Cardiovascular surgery has been undergoing transformations due to the advancement of percutaneous techniques, clinical treatment and primary prevention.

Objective: Evaluation of incidence and mortality of heart surgeries performed at the Instituto do Coração (InCor-HCFMUSP).

Methods: Using database from the Instituto do Coração, analysis was carried out on cardiovascular surgeries performed between 1984 and 2007, taking into consideration trends of main procedures and of mortality rates.

Results: In 24 years, 71,305 heart surgeries were performed, with an annual average of 2971 procedures. The number of coronary artery bypass graft surgeries, which in the 1980s had an average of 856/year, is currently around 1.106/year. Heart valve procedures increased from 400 to 597 surgeries per year, growing 36.7%, when compared to the 1990s. Repair of congenital heart disease also had a significant increase of 50.8% in relation to the last decade. Global mortality average rate, which at baseline was 7.5%, is currently at 7.0% and 4.9% among elective procedures. In coronary artery bypass graft surgery, current average mortality rate is 4.8% and 8.5% in valve surgery. Repair of congenital heart disease accounts for 5.3%.

Conclusion: Cardiovascular surgery continues increasing. The coronary artery bypass graft is still the most commonly performed surgery. However, profile of procedures has been undergoing changes with the largest increase of approach to cardiac valves and congenital heart disease. Mortality rates are higher when compared to international rates, reflecting the high complexity presented in tertiary service of national reference. (Arq Bras Cardiol 2010;94(2): 162-168)

Key Words: Thoracic surgery; mortality; databases; cardiovascular surgical procedures/trends.

Introduction

In recent years, we observed a rapid development in various areas of medicine. These changes were influenced by increasing technological advances, associated to accumulation of experiences and scientific information collected over time[1]. In this context, it is needless to stress importance of good quality health information system to guide formulation and evaluation of policies for our area and, especially, to enable society to monitor and evaluate efforts directed to such activities and results obtained[2].

Formation of database represents an important step towards the consolidation of services in health care. For this reason, the *Instituto do Coração* of *Hospital das Clínicas of Faculdade de Medicina of Universidade de São Paulo* (InCor-HCFMUSP) has developed several efforts to improve existing indicators and expand its thematic amplitude, either by conducting several studies internally with this objective or by participating and supporting initiatives of medical societies.

One of the proposals of collecting data from cardiovascular surgical procedures is the possibility to obtain reference bases of its practices, in which the institution, as a whole, and each surgeon, individually, can improve their qualities and their results[3-5].

The objective of this study is to evaluate data of heart surgeries performed in the last 24 years at InCor-HCFMUSP, a traditional institution that performs many surgical procedures and is highly representative in Brazil.

Methods

Performance of cardiovascular surgery service is related to number and types of surgeries most commonly performed. However, a key indicator of clinical competence is mortality rate. Definition of postoperative mortality most commonly used is hospital mortality or death until 30 days after surgery.

From database, of required insertion, of the Surgical Division of InCor-HCFMUSP, the following indicators of clinical performance were evaluated: surgical procedures performed and their hospital mortality rates.

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Results were collected from all cardiovascular surgeries performed between 1984 (starting year of our database) and 2007. We globally analyzed number and types of surgeries performed annually and mortality rate during this period. Procedures with higher incidence were analyzed separately. Data referring to mortality rate is not adjusted, since surgical risk only recently became part of our database.

For better interpretation of results, we divided these 24 years into three periods. Initial period, between 1984 and 1989, represents the 1980s in our database. Intermediate period, between 1990 and 1999, represents the 1990s. Current period, between 2000 and 2007, includes the last eight years of our sample. These periods were compared by means of analysis of variance, complemented by Bonferroni's t test. Significance level was 5%.

Results

In 24 years, between 1984 and 2007, at InCor-HCFMUSP, 71,305 cardiovascular surgeries were performed – an average of 2,971 surgeries per year. In the beginning, annual average of surgeries performed at the institution was of 2,122, shifting to 2,812 in the 1990s, with an increase of 32.5%, and 3,806 in the current period, with an increase of 35.3%, when compared to the 1990s. Gradual increase of observed cardiovascular surgeries within different periods was significant ($p > 0.001$ – Chart 1). Overall mortality average was 7.5% and is currently 7.0%. Among elective procedures, initial average mortality rate was 5.8%, it is currently at 4.9%. The observed decrease of mortality rate in the last period, either elective or overall, was not significant (Chart 2).

Coronary artery bypass graft surgery

Among different types of cardiovascular surgeries, number of coronary artery bypass graft surgeries performed in 1984 was 729, reaching a peak of 1,256 in 2002.

Considering initial period (1984-1989), average number of coronary artery bypass graft surgeries was 856 per year. In the 1990s, average was 1,013 per year, an increase of 18.3%. In current period (2000-2007), average was 1,106/year, with an increase of 9.2%, when compared to the 1990s. We observe that increase in coronary artery bypass graft surgeries was significant ($p > 0.001$) in the 1990s. However, when compared with the 2000s, increase was insignificant (Chart 3).

Annual average mortality rate of elective myocardial surgery (including stable angina, unstable angina, acute heart attack of the myocardium in first week and re-surgeries) in the 1980s and 1990s was, respectively, 4.4% and 4.3% and is currently 4.8% - which means that variations were not significant (Chart 4). Coronary artery bypass graft without extra-corporal circulation represented 2.5% in 1996 and currently represents 39.5% of isolated revascularizations.

Valvuloplasty

Heart valve surgeries increased 8.5% between 1980 and 1990, starting from an average of 400 surgeries per year to 434 surgeries per year. Currently, average is 597 valve surgeries per year, a significant increase ($p > 0.001$) of 37.6%, when compared to the 1990s (Chart 5). Number of valvuloplasties remains stable: around 20.3%, considering mitral valve and aorta surgeries. Annual average mortality rate of elective valve

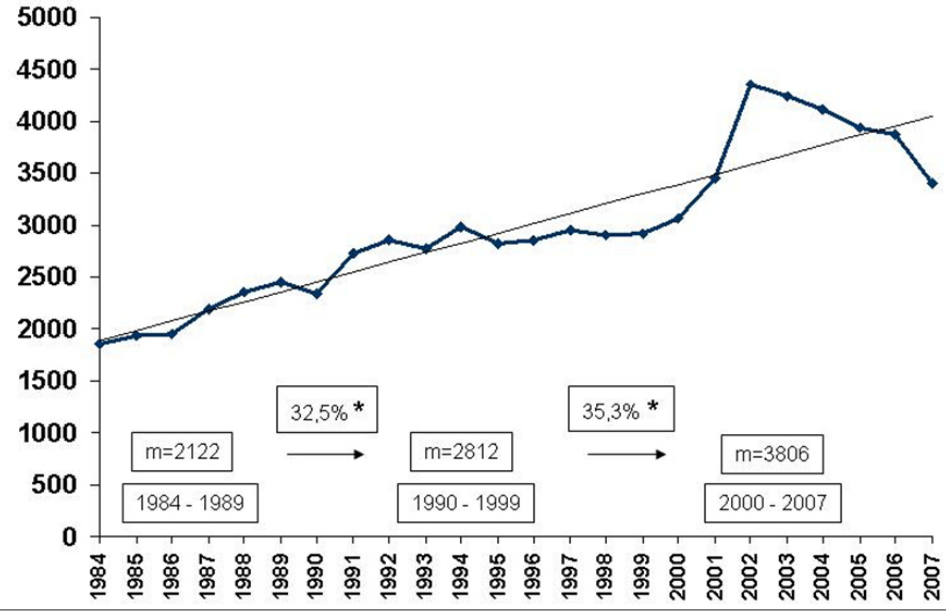

*Chart 1 - Annual growth of heart surgeries performed at InCor-HCFMUSP, between 1984 and 2007. Note that, during initial period between 1984 and 1989, annual average of procedures performed was 2,122, rising in the 1990s to 2,812 (increase of 32.5%) and to 3,806, in the current period (increase of 35.3%). * p > 0.001 among the periods analyzed.*

surgery (including valvular heart disease with pulmonary hypertension, endocarditis and reoperations), which in the 1980s was 7.6%, rose to 8.0% in the 1990s and now accounts for 8, 5% - not significant variations (Chart 6).

Arrhythmia surgery

Another segment that has increased a lot in recent years is arrhythmia repair surgery, mainly represented by artificial pacemaker implants, cardiac defibrillators or re-synchronizers to control heart failure. In the 1980s, on average, 238 surgeries per month were performed, increasing to 606 surgeries per month in the 1990s (increase of 155%). Currently, 1,018 surgeries are performed per month, representing an increase of 68.0%, when compared to the 1990s ($p > 0.001$ among the periods analyzed). In our area, these surgeries now account for 27.5% of all cardiovascular surgeries.

Congenital heart disease surgery

Surgery for repair of congenital anomalies has also been increasing among cardiovascular surgeries. In the 1980s, average number of surgeries for repairing congenital anomalies was 403 surgeries per year, increasing, in the 1990s, to 454 surgeries per year (increase of 12.7%). In current period, average number of surgeries increased to 685 per year, an increase of 50.8%, when compared to the 1990s. We observed that congenital heart disease repair surgeries have increased significantly ($p > 0.001$) since the 1980s (Chart 7). Average annual mortality rate of surgery for repair of congenital anomalies (including simple and complex congenital heart diseases and reoperations), which in the 1980s was 8.8%, decreased to 8.0% in the 1990s and is currently 5.3%, showing a significant decrease ($p > 0.034$) (Chart 8).

Discussion

The first point to be discussed is incidence of cardiovascular surgery, which is increasing in the institution. Coronary artery bypass graft surgery still is the most commonly performed cardiovascular surgery, but has a much lower growth rate when compared with heart valve surgeries or with congenital anomaly repair surgeries, which showed large increase in recent years. Despite an apparent decrease in the last two years, approximately 1,000 coronary artery bypass graft surgeries are performed per year at InCor-HCFMUSP. This number was higher at some point and has remained relatively stable.

Other institutions have shown a decrease of coronary artery bypass graft surgery, due to development of percutaneous revascularization and progress of clinical treatment, which have become more effective in controlling heart disease, preventing or delaying surgery[6,7]. In our area, these factors only partially explain a decrease in incidence of coronary artery bypass grafts surgeries. However, this decrease is more related to limitation of hospital beds for patients with coronary artery disease, since we have large list of patients waiting for surgery. Making a parallel with angioplasty, which also treats patients with coronary heart failure, we observed that interventional procedures of coronary angioplasty, which had greatly increased in 1990s, in recent years, also have been stable: approximately 2,000 procedures per year at InCor-HCFMUSP.

The fact that numbers of percutaneous interventions

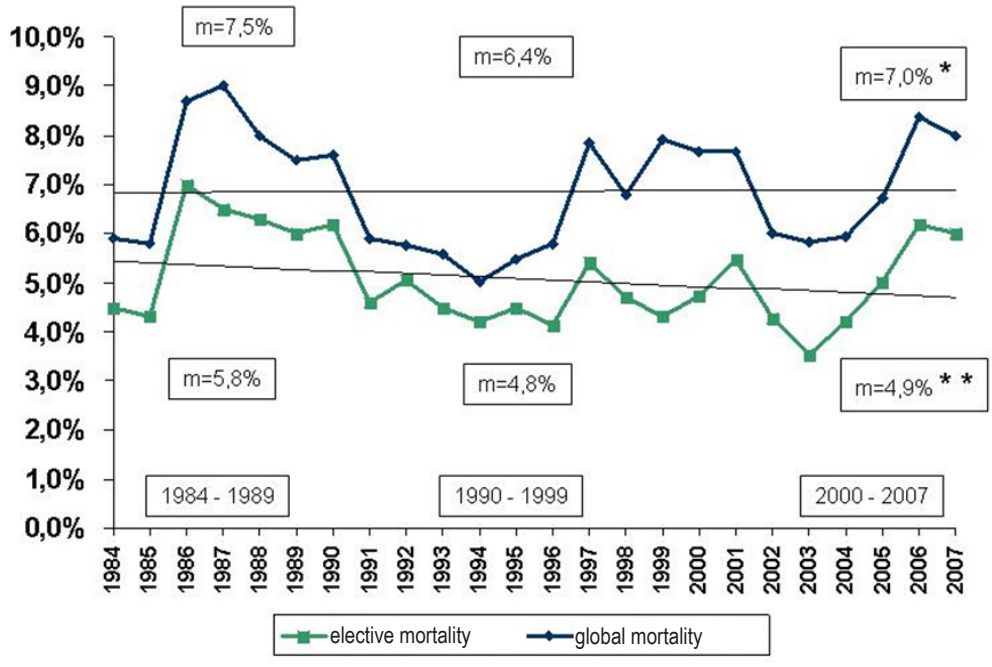

*Chart 2 - Global and elective mortality rate in cardiovascular surgeries performed at InCor-HCFMUSP, between 1984 and 2007. Global mortality average rate, which was7.5% at the beginning (1984-1989), fell to 6.4% in the 1990s and in the current period (2000-2007) was 7.0%. * p = ns between the periods analyzed. Among elective procedures, initial mortality average rate was 5.8%, falling to 4.8% – it is currently 4.9%. ** p = ns among the periods analyzed.*

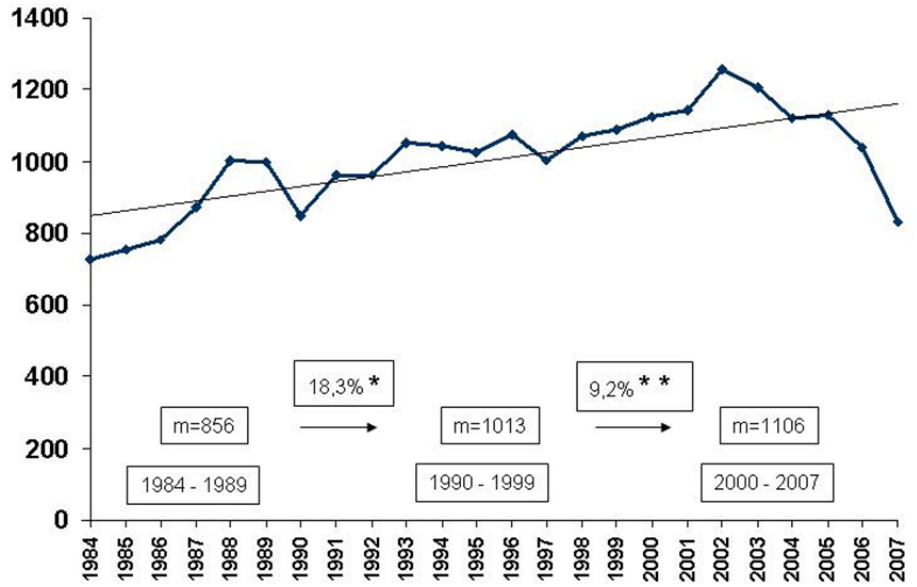

*Chart 3 - Annual growth of coronary artery bypass graft surgeries (CABG), performed at InCor-HCFMUSP, between 1984 and 2007. Considering the initial period (1984-1989), average of CABG performed was 856/year; in the 1990s, it was 1,013/year (increase of 18.3%) and, in current period (2000-2007), it was 1,106/year (increase of 9.2%). * p > 0.001 among the periods analyzed. ** p = ns among the periods analyzed.*

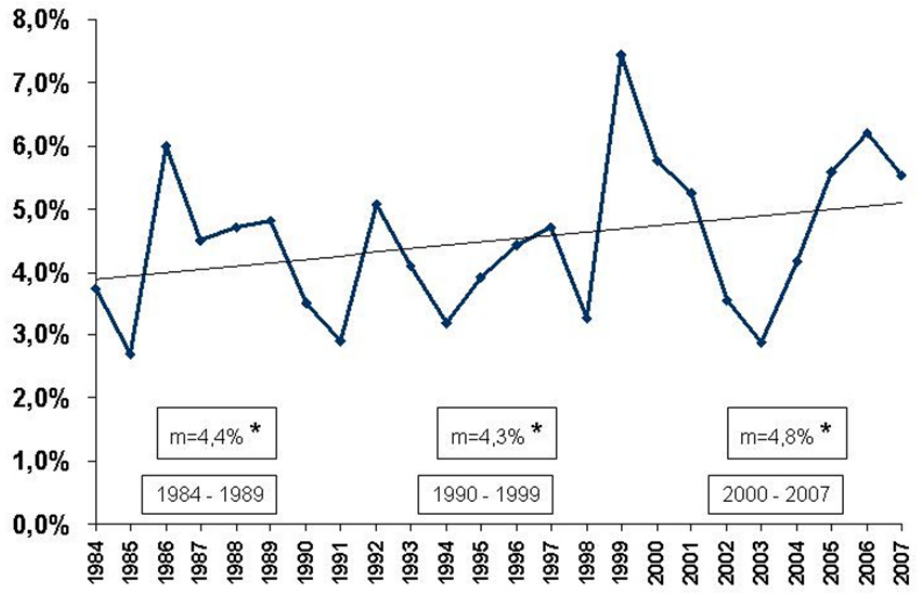

*Chart 4 - Mortality rate in elective coronary artery bypass graft surgery (CABG), performed at InCor-HCFMUSP, between 1984 and 2007. Note that, in the 1980s, mortality rate was 4.4% and is currently 4.8%. * p = ns among the periods analyzed.*

remained stable in the institution does not mean that there is a decrease in growth of this type of procedure, but that there is a repressed demand. In the case of coronary artery bypass graft surgery, there is a list of patients waiting for angioplasty, due to limitation of beds for admission.

Heart valve surgeries or congenital anomaly repairs surgeries, which had significant increases in late 1990s and early 2000s - reaching, respectively, 700 and 900 surgeries per year at InCor-HCFMUSP - decreased in the last two years. Again, we observed a great demand for these surgeries.

Children with congenital anomalies and patients with rheumatic or degenerative heart valve disease form a large

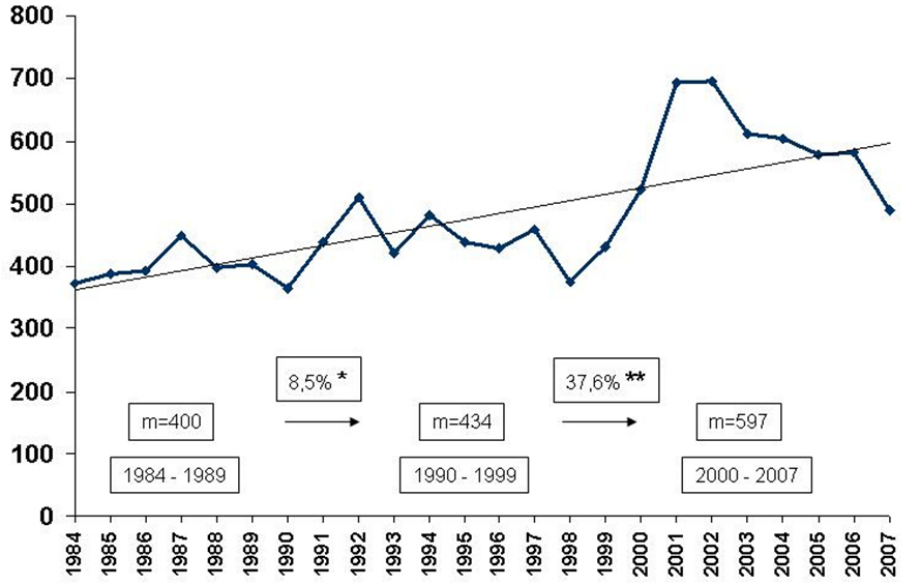

*Chart 5 - Annual growth of cardiac valve surgeries performed at InCor-HCFMUSP, between 1984 and 2007. Note that heart valve procedures had an increase of 8.5% between 1980 and 1990, going from an average of 400 surgeries per year to 434 surgeries per year. Currently, average is 597 surgeries per year (increase of 37.6% compared to the 1990s). * p = ns among the analyzed periods. ** p > 0.001 among the analyzed periods.*

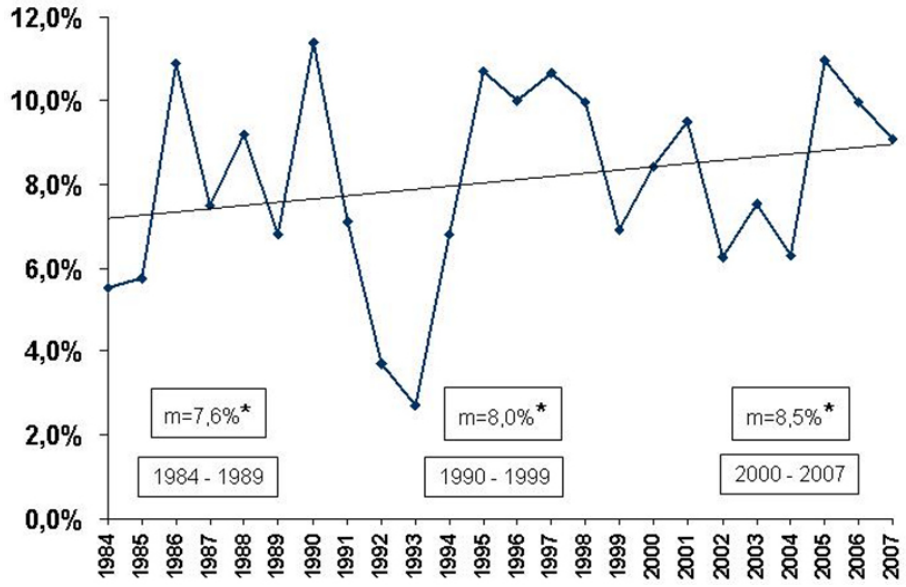

*Chart 6 - Mortality rate in elective valve surgery performed at InCor-HCFMUSP, between 1984 and 2007. Annual mortality average rate of elective valve surgery, which in the 1980s was 7.6%, rose to 8.0% in the 1990s and is currently 8.5%. * p = ns among the periods analyzed.*

awaiting list, showing that cardiovascular surgery still has much room to grow. Other institutions have also shown an increase in incidence of these diseases, whose treatment in general population is still surgical[6,8].

Procedures for arrhythmia, mainly represented by implantation of artificial pacemakers, defibrillators and re-synchronizers to control heart failure, increased significantly. This type of procedure, which has remained at high levels, has an advantage of being effective, present short hospital stay

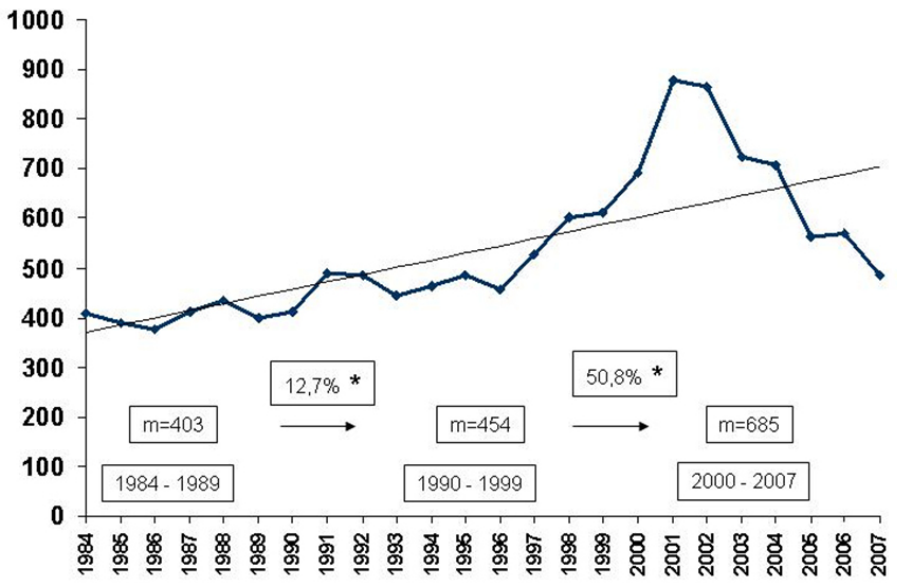

*Chart 7 - Annual growth of surgeries of congenital defects performed at InCor-HCFMUSP, between 1984 and 2007. In initial period, average number of surgeries to repair congenital anomalies was 403 surgeries per year, rising to 454 surgeries per year in the 1990s (increase of 12.7%) and currently to 685 surgeries per year (increase of 50.8%, when compared to the 1990s). * p > 0.001 among the analyzed periods.*

and high turnover of beds for admission.

The second point to be discussed is mortality rate in cardiovascular surgery. We observed in the institution that some procedures, such as coronary artery bypass graft surgery and valvular surgeries, maintained or had a slight increase in their average mortality rates in recent years (respectively 4.8% and 8.5%), while surgery for repair of congenital anomalies had their average mortality rates reduced (5.3%). Currently, despite the fact that average mortality rates in our institution are lower than national average, they are still higher than international average[4,9,10]. More recent information from American and European databases shows, not adjusted, average mortality rates

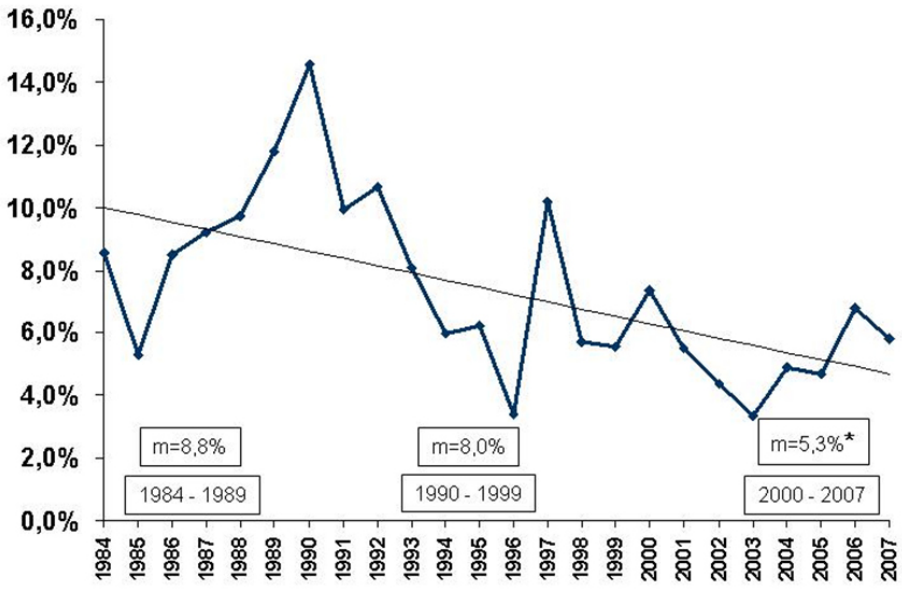

*Chart 8 - Mortality rate in congenital elective surgery performed at InCor-HCFMUSP, between 1984 and 2007. There is a decrease in mortality average rate of 8.8% to 8.0% between 1980 and 1990. Currently, mortality average rate is 5.3%. * p > 0.034 among the periods analyzed.*

between 1.5% and 6.8% for coronary artery bypass graft surgery grafts[4,6,11-14] and 2.8 and 8.9% for heart valve disease surgeries[12,14-16]. These data show that we have to reduce the mortality rates between 2.0% and 3.0% in coronary artery bypass graft surgery and between 4.0% and 5.0% in valvular surgery.

Interpretation and comparison of our results with those of other national or international institutions should be cautious, because our database requires insertion, while other large institutions have voluntary insertion. Another caution with comparisons is that our data are expressions of priority of admission, since the Instituto do Coração is a tertiary hospital of national reference and, therefore, receives and treats patients with high complexity. Perhaps, this is the main limitation of this study: the lack of stratification of risk factors in our population.

We know that operated population has increasingly advanced age and, therefore, have associated comorbidities, which increase the surgical risk[17].Only recently, we implemented risk factors *Euroscore*[18] and *Bernstein – Parsonnet score*[19] into our database. However, our current casuistry, which takes into account 24 years of our experience, does not address the risk factors.

Conclusion

From analysis of database, we can conclude that cardiac surgery continues to increase. Coronary artery bypass grafting is still the most commonly performed surgery, but profile of procedures has been undergoing changes with a greater increase in approach for heart valve and congenital anomaly repair and arrhythmia surgeries. Mortality rates are higher when compared to international rates, reflecting the high complexity presented in a tertiary service of national reference.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any post-graduation program.

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