

# Demographics, treatment and outcome of acute coronary syndromes: 17 years of experience in a specialized cardiac centre

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J-PS Awaida, J Dupuis, P Thérout, et al. Demographics, treatment and outcome of acute coronary syndromes: 17 years of experience in a specialized cardiac centre. *Can J Cardiol* 2006;22(2):121-124.

**BACKGROUND:** Epidemiological information on patients with acute coronary syndromes managed in specialized cardiac centres is limited.

**OBJECTIVE:** To report the evolution of demographics, treatment and outcome of patients admitted to a tertiary coronary care unit (CCU) over a 17-year period.

**METHODS:** A prospective database of 18,719 patients admitted from April 1986 to March 2003 in a 21-bed CCU was analyzed.

**RESULTS:** From 1986 to 2003, the number of admissions increased from 937 to 1577 per year, while the length of stay declined from 7.5 to 3.5 days. The mean age increased from 58.4 to 63.4 years, and the proportion of men remained stable at approximately 70%. The use of coronary angiograms increased from 49.8% to 81.1% in all patients, while fibrinolysis dropped to 0.4%. In-hospital mortality decreased from 9% to 1.5%. The percentage of overall instrumentation (arterial line, central venous catheter, temporary pacemaker, Swan-Ganz catheter and intra-aortic balloon pump) decreased from 38% to 8.1%. From 1995 to 2003, the proportion of stenting during percutaneous transluminal coronary angioplasty increased dramatically from 0% to 86%. In the past five years, surgical revascularization has remained stable at approximately 20% of all admissions. The proportion of patients discharged with a noncoronary chest pain diagnosis has remained constant at approximately 4%.

**INTERPRETATION:** There has been a tremendous increase in efficiency, with an approximate doubling of the admissions turnover rate in a tertiary CCU. Patients with acute coronary syndromes are stratified faster and treated more invasively. Therapeutic advances are reflected by an almost linear 0.5% per year decrease in in-hospital mortality.

**Key Words:** *Cardiovascular medicine; Critical care; Epidemiology; Intensive care*

Coronary artery disease remains the leading cause of death of American men and women (1). It causes major economic burden, with estimated direct and indirect costs of \$129.9 billion in the United States in 2003 (1). Coronary care units (CCUs) were designed to offer specialized care to patients suffering from acute myocardial infarction, with the role rapidly expanding to include unstable angina. The primary initial goal of CCUs was to monitor and prevent fatal arrhythmias. During the past 20 years,

## La démographie, le traitement et l'issue des syndromes coronariens aigus : 17 ans d'expérience dans un centre spécialisé de cardiologie

**HISTORIQUE :** L'information épidémiologique au sujet des patients atteints de syndromes coronariens aigus pris en charge dans des centres spécialisés de cardiologie est limitée.

**OBJECTIF :** Rendre compte de l'évolution de la démographie, du traitement et de l'issue des patients hospitalisés dans une unité de soins coronariens (USC) tertiaires sur une période de 17 ans.

**MÉTHODOLOGIE :** Une base de données prospective de 18 719 patients hospitalisés entre avril 1986 et mars 2003 dans une USC de 21 lits a été analysée.

**RÉSULTATS :** Entre 1986 et 2003, le nombre d'hospitalisations est passé de 937 à 1 577 par année, tandis que la durée d'hospitalisation a fléchi de 7,5 à 3,5 jours. L'âge moyen est passé de 58,4 à 63,4 ans, tandis que la proportion d'hommes est demeurée stable, à environ 70 %. Le recours aux coronarographies a augmenté, passant de 49,8 % à 81,1 % chez tous les patients, mais les fibronolyses ont chuté à 0,4 %. La mortalité hospitalière a diminué de 9 % à 1,5 %. Le pourcentage d'instrumentation globale (cathéter artériel, cathéter veineux central, stimulateur temporaire, cathéter de Swan-Ganz et sonde à ballonnet intra-aortique) a décliné de 38 % à 8,1 %. Entre 1995 et 2003, la proportion d'endoprothèses pendant l'angioplastie coronaire transluminale percutanée a considérablement augmenté, passant de 0 % à 86 %. Depuis cinq ans, les revascularisations chirurgicales sont demeurées stables, représentant environ 20 % de toutes les hospitalisations. La proportion de patients obtenant leur congé de l'hôpital avec un diagnostic de douleurs thoraciques non coronariennes est demeurée constante, à environ 4 %.

**INTERPRÉTATION :** L'efficacité a considérablement augmenté, puisque le taux de roulement des hospitalisations a presque doublé dans une USC tertiaires. Les patients atteints de syndromes coronariens aigus sont stratifiés plus rapidement et traités de manière plus efficace. Les progrès thérapeutiques sont reflétés par une diminution presque linéaire de la mortalité hospitalière de 0,5 % par année.

the development of various novel pharmacological and interventional strategies for the management of patients with acute coronary syndromes (ACS) has beneficially affected their outcome (2). Recently, there has been growing advocacy supporting the treatment of these patients in specialized 'Centers of Excellence' (3-5). Epidemiological information about the evolution of demographics, treatment and outcome of patients admitted to tertiary care centres over the past 15 years is limited.

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Received for publication April 7, 2005. Accepted November 14, 2005

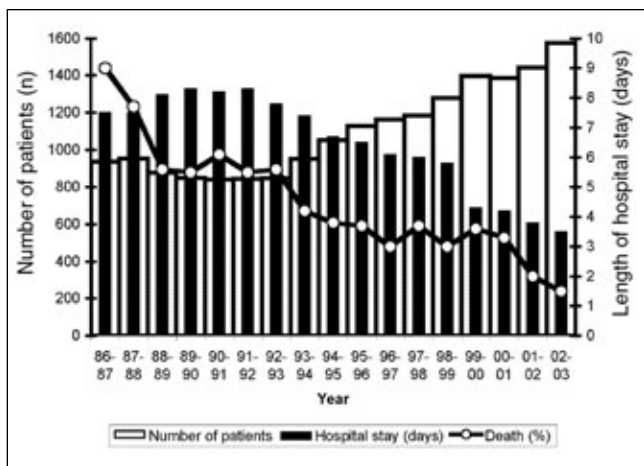


Figure 1) Evolution of the number of patients admitted to the coronary care unit per year (left y-axis), of the length of hospital stay (right y-axis) and of the in-hospital mortality from 1986 to 2003

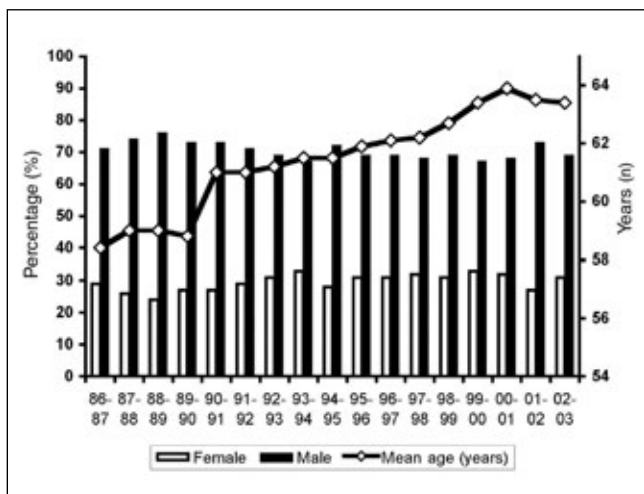


Figure 2) Evolution of the mean age (right y-axis) and sex (left y-axis) of patients admitted to the coronary care unit from 1986 to 2003

The Montreal Heart Institute (Montreal, Quebec) is a specialized tertiary cardiac centre with a high-volume percutaneous coronary intervention (PCI) laboratory that ensures 24 h, seven-day-a-week coverage, with state-of-the-art equipment and a 21-bed CCU (3-5). Most of the patients hospitalized at the Montreal Heart CCU (approximately 75%) are admitted through the emergency department, and approximately 25% are transferred from hospitals without interventional facilities for the usual purpose of invasive management and treatment. Patients are admitted and then discharged directly from the CCU without transfer to a step down unit; this particular feature of complete care in one geographic location has facilitated prospective data collection.

We undertook a study during a period of 17 years from April 1986 to March 2003. We sought to evaluate temporal changes in the demographics, treatment and outcome of ACS requiring CCU admission, with specific evaluation of age, sex, number of admissions, hospital stay, percentage of revascularization, fibrinolysis and mortality.

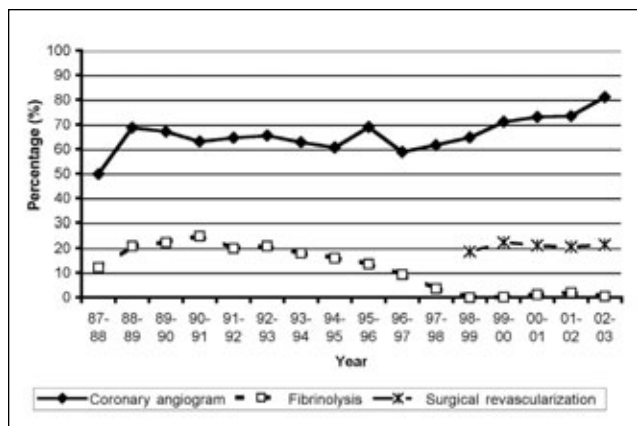


Figure 3) Evolution of the percentage of surgical revascularization from 1998 to 2003 and of coronary angiograms and fibrinolysis in patients admitted to the coronary care unit from 1987 to 2003

### METHODS

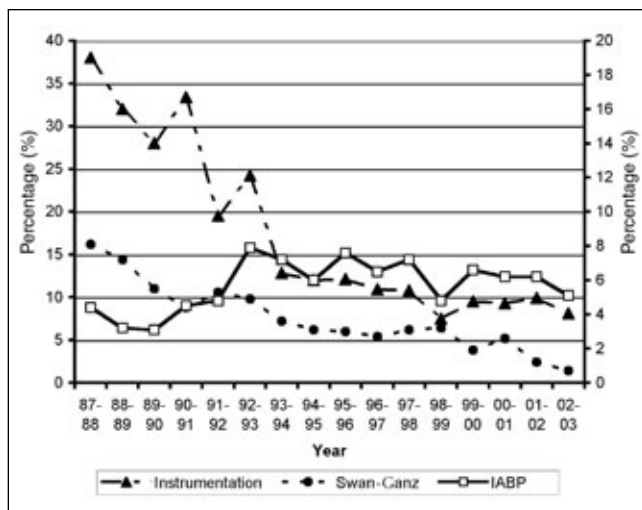
The data were collected prospectively from April 1986 until March 2003 on patients admitted to the 21-bed CCU of the Montreal Heart Institute. Each year was divided into 13 periods consisting of four weeks each. At the patient's discharge from the CCU, age, sex, duration of stay, death outcome, overall instrumentation (including but not limited to monitoring by Swan-Ganz and requirement of an intra-aortic balloon pump), fibrinolysis treatment received in the CCU, coronary angiogram and transfer for surgery were recorded. The total yearly number of CCU admissions was recorded at the end of March of each year. Information about age, sex, death, duration of stay and number of admissions was available from the beginning of data collection in 1986. Data on instrumentation, coronary angiogram and fibrinolysis were added only one year later, starting in March 1987. Information on CCU patients transferred for surgery was collected in the past five years.

Data on PCI for CCU patients were prospectively obtained from the catheterization laboratory database. Stenting procedures during PCI started in 1993 at the Montreal Heart Institute.

### RESULTS

From 1986 to 2003, 18,719 patients were admitted to the CCU. The yearly number of admissions increased from 937 to 1577 per year, while the duration of stay declined from 7.5 to 3.5 days, and in-hospital mortality dropped from 9% to 1.5% (Figure 1). The mean age increased from 58.4 to 63.4 years and the proportion of men remained stable at approximately 70% (Figure 2). The use of coronary angiograms increased from 49.8% to 81.1% of all patients admitted to the CCU, while fibrinolysis was almost abandoned, dropping to 0.4% (Figure 3). The proportion of patients requiring surgical revascularization remained stable at approximately 20% of all admissions (Figure 3). The proportion of patients with a final diagnosis of noncoronary chest pain remained stable, with an average of 4.3%.

The percentage of overall instrumentation decreased from 38% to 8.1% (arterial line, central venous catheter, temporary pacemaker, Swan-Ganz catheter and intra-aortic balloon pump), with a dramatic drop in the first six years and a smoother decline since 1993. The use of Swan-Ganz catheters progressively decreased from 8.1% to 0.7%. The use of intra-aortic balloon pump insertion, however, mildly increased from an average of 4% in the first five years to an average of 5.9% in



**Figure 4)** Evolution of the percentage of overall instrumentation (left y-axis) of Swan-Ganz and intra-aortic balloon pump (IABP) insertions (right y-axis) for patients admitted to the coronary care unit from 1987 to 2003

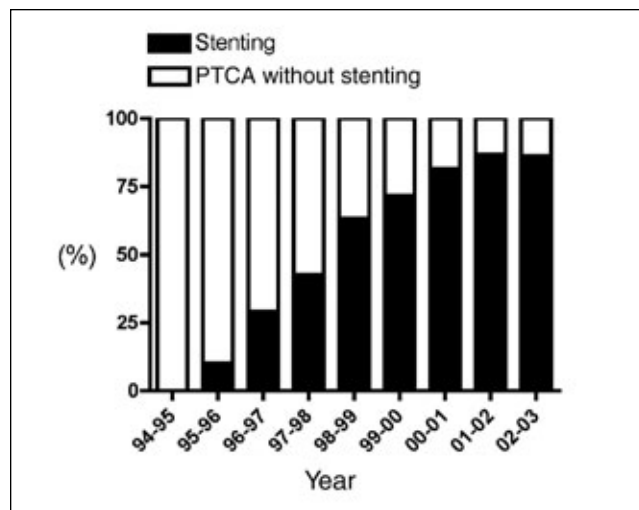
the past 11 years, and has remained stable thereafter (Figure 4). This increase probably reflects our adoption of this treatment modality for refractory angina as a bridge to revascularization surgery. From 1995 to 2003, the proportion of stenting during PCI increased dramatically from 0% to 86%, while percutaneous transluminal coronary angioplasty without stenting decreased from 100% to 14% (Figure 5).

## DISCUSSION

### Interpretation

The findings of the present study, representing the experience of a tertiary cardiac centre, reflect the changes in practice and the enhanced efficiency in patient care that have developed over the past two decades in a CCU. While the total number of treated patients has doubled in relation to hospital stays that have halved, the in-hospital mortality decreased by more than fourfold to a low yearly rate of 1.5%, despite the advancing age of the population treated.

Although we evaluated a different patient population, some of our results could be compared with those published by Shamiss et al (6), who also conducted a study in a tertiary care centre from July 1999 to July 2000. In patients hospitalized for non-ST elevation ACS, they found an older treated population (69 versus 63.4 years) and a longer hospitalization (8.2 versus 4.3 days) for the same time period. The proportion of men to women of 66% and in-hospital mortality of 4% were, however, comparable with ours (67% and 3.6%, respectively). The decrease in duration of hospital stay after a ST elevation myocardial infarction between 1990 and 1998 was studied by looking at the data of the Global Use of Strategies To Open occluded coronary arteries (GUSTO)-I, GUSTO-III and ASsessment of the Safety and Efficacy of a New Thrombolytic (ASSENT-2) trials (7). It reached 37% in the United States (from eight to five days) and 33% in Canada (from nine to six days), comparable with what we observed in all patients admitted in the CCU. In our study, we did not make the distinction among the various subsets of ACS considering the diagnostic criteria that have evolved during that period. This important reduction likely reflects the widespread adoption of an early aggressive strategy in ACS and the demonstration of the safety



**Figure 5)** Evolution of the percentage of stenting and percutaneous transluminal coronary angioplasty (PTCA) without stenting for patients admitted to the coronary care unit from 1994 to 2003

of early discharge (8). A contributing factor in Canada could have been the effort to reduce time to percutaneous and surgical revascularization procedures and an early retransfer of patients to referral centres. Another contributing factor in our centre could have been the discharge of patients directly from the CCU without transfer to a step-down unit or medical ward, which could delay discharge (9).

The early invasive strategy has gained popularity since the report of the initial FRagmin and fast revascularisation during InStability in Coronary artery disease-II (FRISC-II) trial (10) published in 1999 and Treat Angina with aggrastat and determine Cost of Therapy with an Invasive or Conservative Strategy – Thrombolysis In Myocardial Infarction 18 (TACTICS-TIMI 18) trial (11) in 2001 and later the Randomized Intervention Trial of unstable Angina-3 (RITA-3) trial (12). Although a slight increase in the rate of cardiac catheterization occurred after 1998, they were already high throughout the observation period, attesting an already aggressive attitude in tertiary care practice. This is also reflected by the rates of surgical revascularization that remained unchanged over the last five years, with approximately one of every five patients admitted to the CCU referred for coronary artery bypass graft surgery.

The proportion of stenting during PCI is similar to what was reported by the National Cardiovascular Data Registry between 1998 and 2000 (13), with 71% compared with 72% in our study during the same period. The dramatic increase in stenting during PCI is consistent with the data presented by Pate et al (14) who observed an increase from 25% to 90% in PCI procedures from 1995 to 2001; our results also show a substantial increase from 10% to 87% during the same period.

On the other hand, invasive monitoring with Swan-Ganz catheters has substantially progressively decreased since 1986. This is similar to what is reported in the literature (15) and possibly reflects the success of revascularization in reducing infarct size and the development of cardiogenic shock, as well as changing practice patterns. This decline in Swan-Ganz monitoring has been shown by others to reduce the rate of iatrogenic complications (16,17).

### Significance of the study

Our findings have historical interest and put numbers on the increasing performance of CCUs in managing more patients while reducing in-hospital mortality. Maximal use of resources in our tertiary care centre is exemplified by the doubling of the admissions turnover rate during this period. This supports recent editorials (3) that have advocated the implantation of specialized 'cardiac centres' for the care of patients with ACS, especially in view of the growing benefit of early invasive strategy in these patients. Our analysis supports the development of these centres and justifies the importance of rapidly implementing the most recent therapeutic advances in the care of patients with ACS.

### Limitations

Confounders of risk in ACS that were not collected may have contributed to the decline in mortality and length of stay. More specifically, over the years, a lack of uniformity in the nomenclature of discharge diagnosis prevented the analysis of outcome based on diagnosis. There is, however, a selection bias in favour of the 'higher-risk' patients for admission to our CCU because low-risk patients are generally admitted to another unit of our

institution. Surgical mortality was also not included in our analysis, but overall surgical mortality for revascularization in our institution has remained stable at between 2% and 2.5% over the past eight years. Although we observed a drastic reduction in in-hospital mortality, we also did not collect out-of-hospital events. A recent study (8) of 4551 patients admitted with myocardial infarction, however, found no association between declining length of stay and short-term mortality after hospital discharge.

### CONCLUSIONS

There has been a tremendous increase in efficiency in a tertiary CCU, with an approximate doubling of the admissions turnover rate. Patients with ACS are stratified faster and treated more invasively. Therapeutic advances are reflected by an almost linear 0.5% per year decrease in in-hospital mortality.

**ACKNOWLEDGEMENTS:** The authors thank Richard Cartier, Sylvie Lamadeleine and Carole Sanscartier for their invaluable technical support in the realization of this project. Drs Jocelyn Dupuis, Jean-Francois Tanguay and Anil Nigam are scholars from the Fonds de la recherche en santé du Québec.

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