

Coronary artery bypass surgery in young and elderly patients – results of 15 years study

Chirurgiczna rewaskularyzacja mięśnia sercowego w różnych grupach wiekowych – wyniki 15-letnich badań

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Abstract

Introduction: In the last two decades continuous improvements in medical treatment and interventional cardiology for coronary artery disease (CAD) have changed referral patterns for coronary artery bypass surgery (CABG) and have increased the number of older and high-risk patients proceeding to surgery.

Aim of study: This study was undertaken to analyze the trends and results of surgical treatment CAD in two populations: younger (<50) and elderly (>75), of patients referred to CABG during the last 15 years.

Material and methods: The study group consist of 7474 consecutive patients who underwent CABG procedure between 1987 and 2001. The study included all patients who were operated before 50-th year of age and after 75-th year of age. The analysis of 15 years was performed in five time intervals of 3 years each (1987-1989, 1990-1992, 1993-1995, 1996-1998 and 1999-2001).

Results: The number of young patients <50 referred to CABG has not been changing during this period. There is statistical significant increase of patients operated over 75 years of age and this population is getting older. Population of patients undergoing CABG before 50 years of age had less preoperative risk factors that was associated with lower EuroSCORE rate and low mortality. On base of EuroSCORE our findings demonstrated increasing of elderly patients who were referred to CABG with medium and high risk of surgery.

Conclusions: Despite the increase rate of high-risk patients, the risk of hospital mortality has not significantly changed but perioperative morbidity significantly increased in both populations especially over 75 years of age. We therefore believe that patients should not be denied CABG because of their age. However, clinical condition of patients before operation must be carefully analysed and indications for CABG should be individually considered especially in high risk elderly patients.

Key words: coronary artery bypass grafting, coronary artery disease, EuroSCORE

Streszczenie

Wprowadzenie: W związku z rozwojem zarówno leczenia zachowawczego, jak i kardiologii interwencyjnej, zmieniła się w ostatnich dwóch dekadach kwalifikacja chorych z chorobą wieńcową (CAD – *coronary artery disease*) do chirurgicznej rewaskularyzacji mięśnia sercowego (CABG – *coronary artery bypass surgery*). Badania wykazały, że wzrosła liczba chorych starszych z wysokim ryzykiem operacji.

Cel pracy: W pracy podjęto próbę przeanalizowania trendów i wyników chirurgicznego leczenia choroby wieńcowej wśród populacji chorych kwalifikowanych do operacji przed 50 i po 75 roku życia (r.ż.) operowanych w ostatnich 15 latach.

Materiał i metodyka: Badanie obejmuje grupę 7474 kolejno operowanych pacjentów, u których między 1987 a 2001 rokiem wykonano operację CABG. Do badania włączono chorych operowanych przed 50 i po 75 r.ż. Dla celów analizy 15 lat obserwacji, pacjentów podzielono na pięć grup po 3 lata (1987-1989, 1990-1992, 1993-1995, 1996-1998 i 1999-2001).

Wyniki: Nie obserwowano zmian liczby chorych kwalifikowanych do CABG przed 50 r.ż. Istotnie statystycznie wzrasta liczba chorych operowanych po 75 r.ż. Populacja pacjentów poddawanych CABG przed 50 r.ż. jest obciążona mniejszą liczbą czynników ryzyka operacji, co jest związane z niższą wartością EuroSCORE i niską śmiertelnością. Na podstawie EuroSCORE wykazano wzrost liczby chorych starszych kwalifikowanych do CABG ze średnim i wysokim współczynnikiem ryzyka operacji. Mimo wzrostu liczby chorych wysokiego ryzyka, śmiertelność szpitalna nie zmienia się, wzrasta natomiast liczba powikłań okołoperacyjnych, zwłaszcza wśród chorych po 75 r.ż.

Wnioski: Wiek nie powinien być uważany za przeciwwskazanie do przeprowadzenia CABG, ale należy dokładnie oceniać stan kliniczny chorych przed operacją i zindywidualizować kryteria kwalifikacji do CABG – zwłaszcza wśród osób po 75 r.ż.

Słowa kluczowe: pomostowanie aortalno-wieńcowe, choroba wieńcowa, EuroSCORE

Introduction

During the last few years, cardiac surgeons and cardiologist have noted the trends towards increased surgical treatment of older and high-risk patients (1-4). This study was undertaken to analyse the trends and results of surgical treatment coronary artery disease in two populations of patients referred to CABG during the last 15 years: young patients below 50 years of age and elderly patients above 75 years of age.

Material and methods

Between January 1987 and December 2001, 7474 consecutive patients underwent isolated myocardial revascularisation (CABG) at the University Medical Center Nijmegen, St. Radboud. All pre-, per-, postoperative and follow-up data are stored in our database CORRAD. The mean age of the total patients population was 63.1±9.6 years, median 64 years, a 10-th percentile of 49.9 years, and a 90-th percentile of 74.9 years. So we identified two groups of patients: group A: patients younger than 50 years old (N=764), 10% of total group and group B patients of 75 years and older (N=732), 10% of total group. These 15 years were subdivided into five time cohort of 3 years each. To evaluate the operative risk, EuroSCORE was used (5).

Surgical technique

The operative technique included a standard median sternotomy, and routine aortic and right atrial cannulation. All procedures were performed on a cardiopulmonary bypass with hypothermia 28-32°C. Myocardial protection was performed with an infusion of cold (4°C) crystalloid St. Thomas Hospital cardioplegia. Revascularisation was performed during single aortic cross-clamping.

Statistical analysis

The characteristics of patients in group A and B are presented as percentages for dichotomous and as mean±SD for numeric variables. The chi-square test and the unpaired t-test was used to analyse the differences between group A and B. For the time-related analysis the chi-square test and Anova for numerical variables were used. Statistical significance was assumed at $p < 0.05$.

Results

Preoperative characteristic

The number of younger patients (<50 years old) referred to CABG has not been changing during this period. The percentage of women operated in this population has been staying at the same level nearly 10-15%. There is a statistically significant increase in the population of patients operated over 75 years of age. In this population

subgroup the percentage of men and women referred to CABG is almost equal level (60 vs 40%).

In the younger group the number of patients referred to CABG with renal problems has been significantly increasing. There were no differences in other preoperative risk factors in this group. The number of patients with history of successful percutaneous transluminal coronary angioplasty (PTCA) significantly increased. The number of urgent operations among the patients operated before 50 years of age decreased but not significantly (tab. I).

During the study period the number of patients in the older group with renal problems undergoing CABG significantly increased. A number of patients referred to surgery with mild valvular disease, left main stenosis and with poor or bad left ventricle ejection fraction (LVEF) significantly increased in this group. The number of urgent operations decreased significantly in the subset of patients operated over 75 years, and the number of patients with history of successful (PTCA) not significantly increased (tab. II).

EuroScore test was performed in both groups, to estimate the risk of procedures and demonstrated an increase of elderly patients referring to CABG with medium and high surgical risk.

In the younger group a trend of increase in number of patients proceeding to surgery with higher EuroScore rates was noted from 1987 to 1998 with decline in the last period 1999-2001. In general, the patients undergoing CABG before 50 years of age had less preoperative risk factors which was associated with lower EuroScore rate and low mortality (tab. III).

Procedural variables

In both groups the number of sequential anastomoses including arterial significantly increased with concomitant trend of decline in the number of grafts per patient and distal anastomoses.

Postoperative course

There were significant increase in the number of renal problems in both groups and in the elderly patients a statistically significant increase in postoperative myocardial infarctions and pulmonary problems.

Discussion

The current study reveals that the practice of cardiac surgery is constantly changing. Hospital mortality and perioperative morbidity rates have declined substantially since the introduction of CABG. In the last two decades concomitant improvements in medical treatment and interventional cardiology for CAD have changed referral patterns for CABG and have increased the number of older and higher-risk patients referring to surgery (1, 6, 7).

Table I: The distribution of pre-, per-, postoperative parameters for each time period among patients operated before 50 years of age
Tabela I: Rozkład przed-, śród- i pooperacyjnych parametrów w różnym przedziale czasowym wśród pacjentów operowanych przed 50 rokiem życia

Time period / Czas trwania	1987-1989 (%)	1990-1992 (%)	1993-1995 (%)	1996-1998 (%)	1999-2001 (%)	p
Preoperative variables / Dane przedoperacyjne						
Number of patients / Liczba pacjentów	172 (11.6)	128 (10)	158 (9.9)	190 (10.5)	116 (8.3)	0.4
Females / Kobiety	17 (9.9)	12 (9.4)	19 (12)	34 (17.9)	16 (13.8)	0.12
Diabetes mellitus / Cukrzyca	11 (6.4)	12 (9.4)	20 (12.9)	21 (11.1)	12 (10.4)	0.43
Peripheral vascular disease / Miażdżycza obwodowa	12 (7)	13 (10.2)	13 (8.2)	13 (6.8)	6 (5.2)	0.64
Neurologic pathology / Incydenty neurologiczne	4 (2.3)	3 (2.3)	7 (4.4)	5 (2.6)	1 (0.9)	0.47
Chronic renal failure / Przewlekła niewydolność nerek	1 (0.6)	1 (0.8)	2 (1.3)	6 (3.2)	6 (5.2)	0.042
Pulmonary diseases / Choroby płuc	5 (2.9)	6 (4.7)	7 (4.4)	15 (7.9)	5 (4.3)	0.26
Preoperative PTCA / Przedoperacyjne PTCA	8 (4.7)	21 (16.4)	29 (18.4)	35 (18.4)	20 (17.2)	0.001
Recent MI / Przebyty zawał	83 (48.3)	67 (52.3)	76 (48.1)	101 (53.2)	59 (50.9)	0.83
Valvular disease / Współistniejące wady zastawek	7 (4.1)	2 (1.6)	1 (0.6)	5 (2.6)	2 (1.7)	0.28
Left main stenosis / Zwężenie pnia lewej tętnicy wieńcowej	13 (7.6)	11 (8.6)	11 (7.0)	15 (7.9)	17 (14.7)	0.18
Decreased LVEF / Obniżone LVEF	7 (4.1)	2 (1.6)	0	10 (5.3)	1 (0.9)	0.055
Re-do operation / Reoperacje	17 (9.9)	8 (6.3)	6 (3.8)	10 (5.3)	4 (3.4)	0.1
Emergency operations / Operacje pilne	2 (1.2)	0	2 (1.3)	6 (3.2)	1 (0.9)	0.09
Procedural variables / Dane śródoperacyjne						
Use of LIMA / Wykorzystanie LIMA	100%	82.8%	100%	93.2%	93.1%	0.01
Number of grafts / Liczba pomostów	2.6+0.8	2.4+0.8	2.2+0.6	2.0+0.9	1.9+0.5	0.01
Distal anastomosis / Zespolenia dystalne	3.5+1.2	3.4+1.3	3.2+1.1	3.0+1.3	2.9+1.1	0.01
Postoperative course / Przebieg pooperacyjny						
Postoperative MI / Zawał pooperacyjny	6 (3.5)	2 (1.6)	2 (1.3)	10 (5.3)	8 (6.9)	0.061
Sternal infection / Infekcja mostka	0	1 (0.8)	2 (1.3)	4 (2.1)	1 (0.9)	0.39
Postoperative CVA / Pooperacyjne CVA	1 (0.6)	0	0	1 (0.5)	0	0.69
Pulmonary problems / Powikłania płucne	15 (8.7)	5 (3.9)	13 (8.2)	12 (6.3)	7 (6.0)	0.479
Renal complications / Powikłania nerkowe	1 (0.6)	3 (2.3)	1 (0.6)	10 (5.3)	5 (4.3)	0.019
Mortality / Śmiertelność	8 (4.7)	0	1 (0.6)	2 (1.1)	0	0.002

LIMA – left internal mammary artery / tętnica piersiowa wewnętrzna lewa

MI – myocardial infarction / zawał serca

LVEF – left ventricular ejection fraction / frakcja wyrzutowa lewej komory

CVA – cerebrovascular accident / incydent naczyniowo-mózgowy

PTCA – percutaneous transluminal coronary angioplasty / przeszczóna angioplastyka wieńcowa

In our study, during last 15 years, the percentage of young patients (before 50 years of age) referred to CABG has not been changing. The percentage of women operated in this group is still at the same level (10-15%). In our material we noticed the trend to increase in the number of patients operated over 75 years of age.

The in-hospital mortality was low among the young patients and comparable with those presented in other papers (8-10). The mortality of patients operated over 75 years of age is relatively high but comparable with published data from other authors (11, 12). For the older patients, with limited long-term survival, it will be important to consider not only the survival, but also the quality of life to justify the benefits from CABG. According to Duits (13) who reviewed of seventeen prospective quality of life studies, only one study looked at an older group of patients after CABG. In that study (14) age above 70 years was associated with a lesser improvement of quality of life after surgery.

Our findings confirm that, during the last 15 years, there has been a time-related increase in the preoperative risk profile of both group of patients and it was associated with increase in postoperative complication rate (15).

Advances in technology and anesthesia, new approach to intensive care after surgery, improvement in medi-

cal management as well as methods of myocardial protection, use of internal mammary artery grafts, and multiple, sequential arterial conduits may have all contributed to a reduced mortality rate in last years (16).

During last 15 years, patients undergoing CABG before 50 years of age had less preoperative risk factors, what was associated with lower EuroSCORE rate, and low mortality as compared with elderly patients. However, in this group of patients EuroSCORE values were significantly increasing, from 1987 to 1998. EuroSCORE also demonstrated an increased percentage of elderly patients referring to CABG with medium and high risk of surgery.

Despite the increased rate of in high-risk patients, the risk of hospital mortality has not significantly changed. The number of patients with a successful (PTCA) in their preoperative history increased in both group but significantly in patients operated before 50 years of age, and this trend is common and related to other authors. A statistically significant decline in emergency operations is noticed in the older group of patients that can be explained by improvement of invasive and non-invasive cardiology treatment provided to stabilize patients before referring to CABG.

This study underlines the trends in the population of patients undergoing isolated primary myocardial revascu-

Table II: The distribution of pre-, per-, postoperative parameters for each time period among patients operated over 75 years of age
Tabela II: Rozkład przed-, śród- i pooperacyjnych parametrów w różnym przedziale czasowym wśród pacjentów operowanych po 75 roku życia

Time period / Czas trwania	1987-1989 (%)	1990-1992 (%)	1993-1995 (%)	1996-1998 (%)	1999-2001 (%)	p
Preoperative variables / Dane przedoperacyjne						
Number of patients / Liczba pacjentów	60 (4.2)	105 (8.2)	164 (10.3)	230 (12.3)	173 (12.9)	0.08
Females / Kobiety	21 (35)	52 (50)	58 (35.4)	101 (43.9)	68 (39.9)	0.12
Diabetes mellitus / Cukrzyca	12 (20)	10 (10)	34 (20.9)	44 (19.1)	28 (16.2)	0.23
Peripheral vascular disease / Miażdżycza obwodowa	13 (21.7)	20 (19)	37 (22.6)	43 (18.7)	31 (17.9)	0.823
Neurologic pathology / Incydenty neurologiczne	3 (5)	7 (6.7)	15 (9.1)	22 (9.6)	27 (15.6)	0.059
Chronic renal failure / Przewlekła niewydolność nerek	1 (1.7)	0	4 (2.4)	14 (6.1)	9 (5.2)	0.042
Pulmonary diseases / Choroby płuc	9 (15)	10 (9.5)	27 (16.5)	31 (13.5)	31 (17.9)	0.36
Preoperative PTCA / Przedoperacyjne PTCA	2 (3.3)	9 (8.9)	8 (4.9)	13 (5.7)	20 (11.6)	0.066
Recent MI / Przebyty zawał	29 (48.3)	53 (50.8)	84 (51.2)	135 (58.7)	83 (48)	0.22
Valvular disease / Współistniejące wady zastawek	5 (8.3)	3 (2.9)	24 (14.6)	35 (15.2)	20 (11.6)	0.01
Left main stenosis / Zwężenie pnia lewej tętnicy wieńcowej	6 (10)	13 (12.4)	18 (11)	28 (12.2)	38 (22)	0.01
Decreased LVEF / Obniżone LVEF	4 (6.7)	3 (2.9)	0	25 (11.9)	12 (6.9)	0.03
Re-do operation / Reoperacje	2 (3.3)	8 (7.6)	19 (11.6)	22 (9.6)	11 (6.4)	0.23
Emergency operations / Operacje pilne	15 (25)	18 (17)	17 (11.4)	23 (10)	17 (9.8)	0.01
Procedural variables / Dane śródoperacyjne						
Use of LIMA / Wykorzystanie LIMA	100%	59%	100%	87.8%	90.2%	
Number of grafts / Liczba pomostów	2.6+0.7	2.3+0.6	2.3+0.6	2.0+0.8	1.9+0.5	0.01
Distal anastomosis / Zespoleńia dystalne	3.7+1.1	3.9+1.4	3.8+1.0	3.5+1.1	3.3+1.1	0.01
Postoperative course / Przebieg pooperacyjny						
Postoperative MI / Zawał pooperacyjny	5 (8.3)	8 (7.6)	8 (4.9)	14 (6.1)	23 (13.3)	0.04
Sternal infection / Infekcja mostka	0	1 (1.0)	5 (3.0)	5 (2.2)	10 (5.8)	0.06
Postoperative CVA / Pooperacyjne CVA	2 (3.3)	2 (1.9)	5 (3.0)	7 (3.0)	10 (5.8)	0.45
Pulmonary problems / Powikłania płucne	3 (5.0)	4 (3.8)	21 (12.8)	28 (12.2)	22 (12.7)	0.05
Renal complications / Powikłania nerkowe	3 (5.0)	2 (1.9)	21 (12.8)	26 (11.3)	20 (11.6)	0.019
Mortality / Śmiertelność	7 (11.7)	11 (10.5)	12 (7.3)	16 (7.0)	20 (11.6)	0.41

LIMA - left internal mammary artery / tętnica piersiowa wewnętrzna lewa

MI - myocardial infarction / zawał serca

LVEF - left ventricular ejection fraction / frakcja wyrzutowa lewej komory

CVA - cerebrovascular accident / incydent naczyniowo-mózgowy

PTCA - percutaneous transluminal coronary angioplasty / przeszkrónna angioplastyka wieńcowa

Table III: EuroSCORE scale in younger and elderly patients in the 15-years period
Tabela III: Wartości EuroSCORE w grupach pacjentów operowanych przed 50 i po 75 roku życia

Time period, population <50 Czas trwania, populacja <50	1987-1989 (%)	1990-1992 (%)	1993-1995 (%)	1996-1998 (%)	1999-2001 (%)	p
EuroSCORE						
Low / Niskie	148 (86)	91 (71.1)	101 (63.9)	82 (43.2)	108 (93.1)	
Medium / Średnie	21 (12.2)	32 (25)	47 (29.7)	91 (47.9)	7 (6.0)	
High / Wysokie	3 (1.7)	5 (3.9)	10 (6.4)	17 (8.9)	1 (0.9)	
Mean EuroSCORE / Średnie EuroSCORE	0.9+1.4	1.7+1.7	2.4+1.7	3.2+1.4	0.6+1.0	0.01
Time period, population >75 Czas trwania, populacja >75	1987-1989 (%)	1990-1992 (%)	1993-1995 (%)	1996-1998 (%)	1999-2001 (%)	p
EuroSCORE						
Low / Niskie	0	0	0	0	0	
Medium / Średnie	42 (70)	21 (58)	109 (66.5)	92 (40)	104 (60)	
High / Wysokie	18 (30)	44 (42)	55 (33.5)	138 (60)	68 (40)	
Mean EuroSCORE / Średnie EuroSCORE	5.1+1.7	5.5+2.0	5.1 (1.8)	6.3 (2.1)	5.6 (2.1)	0.01

larisation during the last few years. Despite the advances in medical and surgical treatment, the mortality rate has not changed in elderly patients, which corresponds with increase in the number of patients undergoing surgery with high EuroSCORE rate. We therefore believe that

such patients should not be denied CABG because of their age but we have to carefully assess their clinical condition before the operation and the indications for CABG should be individually considered, especially in high risk elderly patients.

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Received: December 12, 2003

Accepted: April 1, 2004