PRACA ORYGINALNA

Clinical assessment of MIDCAB-surgery by means of computed tomography

Odległa ocena pomostowania MIDCAB z wykorzystaniem tomografii komputerowej

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ABSTRACT

BACKGROUND

The patients (pts) who underwent minimally invasive coronary artery bypass (MIDCAB) are the population where the routine noninvasive diagnostic tests are insufficient for the proper follow-up. Multislice spiral computed tomography (MSCT) coronary angiography allows to detect atherosclerotic lesions within coronary arteries. However, its usefulness for bypass grafts patency assessment is not recognised well enough.

AIMS OF THE STUDY

The aims of the study were the prospective evaluation of the cumulative rates of clinical outcome in pts who underwent MIDCAB and examination of the patency of the LIMA-LAD anastomosis in symptomatic patients in the 64-row MSCT.

MATERIAL AND METHODS

176 pts (146 males, 30 females, aged 54±10 yrs) who underwent MIDCAB between 1999-2001 were followed-up for 5.5±0.8 years. MACE (major adverse cardiac events) and MAE (major adverse event) were collected. 44 pts with symptomatic exercise examination received MSCT evaluation.

RESULTS

43 pts (24%) had history of MACE and MAE. 29 pts (16%) of them had non-cardiac-surgery related events. Six pts (3.4%) died due to cardiac reasons. Six pts (3.4%) experienced myocardial infarction and in 25 pts (14.2%) coronary intervention had to be performed (in 4 pts within LAD and 2 within LIMA-LAD anastomosis). In 44 pts MSCT coronary angiography was performed. Total occlusion of LIMA-LAD anastomosis was diagnosed in 4 pts, confirmed by invasive coronary angiography. Two patients who had PCI of LIMA-LAD anastomosis during the follow-up had normal flow by connection in MSCT.

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CONCLUSIONS

Long-term follow-up after MIDCAB revealed a relatively high rate of cardiovascular events, mainly not connected with surgical technique but with natural progression of the coronary disease. The new generation MSCT seems to be promising as means of assessment of bypass grafts patency.

KEYWORDS

minimally invasive coronary artery bypass, multislice spiral computed tomography

STRESZCZENIE

WSTĘP

Pacjenci po chirurgicznej rewaskularyzacji serca wymagają okresowej diagnostyki, która pozwoli na wczesne wykrycie zmian zwężających w pomostach naczyniowych. 64-rzędowa tomografia komputerowa (MSCT) jest nieinwazyjnym badaniem szeroko stosowanym dla obrazowania zmian miażdżycowych w naczyniach wieńcowych.

CEL PRACY

Celem pracy była odległa kliniczna ocena pacjentów leczonych metodą MIDCAB (małoinwazyjna, endoskopowa rewaskularyzacja chirurgiczna) oraz ocena drożności pomostu LIMA-LAD z wykorzystaniem 64-rzędowej tomografii komputerowej.

MATERIAŁ I METODY

Przeprowadzono badania u 176 pacjentów (146 mężczyzn, w średnim wieku 54 ± 10 lat) operowanych w latach 1999–2001 (średni czas obserwacji 5,5±0,8 lat). Oceniano wystąpienie MACE (major adverse cardiac events) i MAE (major adverse events). U 44 chorych (38 mężczyzn, w średnim wieku 54 ± 10 lat) z nawrotem stenokardii wykonano elektrokardiograficzną próbę wysiłkową i badanie MSCT (Toshiba Aquillon), w którym oceniano drożność pomostu LIMA-LAD.

WYNIKI

W trakcie obserwacji u 43 pacjentów (24%) wystąpiły zdarzenia MACE i MAE. Sześciu pacjentów (3,4%) zmarło z przyczyn sercowych. u 29 pacjentów (16%) wystąpiły zdarzenia nie związane z zabiegiem MIDCAB. U sześciu pacjentów wystąpił zawał serca, u 25 chorych wykonano przez skórną angioplastykę tętnic wieńcowych (u 4 pacjentów w zakresie LAD, u 2 w zespoleniu LIMA-LAD). W MSCT zamknięcie pomostu LIMA-LAD stwierdzono u 4 chorych, co potwierdzono w badaniu koronarograficznym. Dwóch pacjentów, którzy mieli w wywiadzie PCI LIMA-LAD wykazało w obserwacji odległej prawidłowy przepływ przez zespolenie LIMA-LAD.

WNIOSKI

Odległa obserwacja kliniczna pacjentów leczonych EACAB ujawniła stosunkowo dużą ilość zdarzeń naczyniowo-sercowych, nie związanych z techniką chirurgiczną, a z postępem choroby. Nowa generacja wielorzędowej tomografii komputerowej pozwala na precyzyjną, nieinwazyjną ocenę pomostów tętniczych.

SŁOWA KLUCZOWE

małoinwazyjna endoskopowa rewaskularyzacja chirurgiczna, wielorzędowa spiralna tomografia komputerowa

INTRODUCTION

The patients who underwent coronary bypass graft operation, also those with the usage of the left internal mammary artery anastomosis with the left anterior descending artery (LIMA-LAD), constitute a special population where the regular clinical examination and noninvasive diagnostic tests in some areas are insufficient to recognize the significant lesion in bypass grafts or native vessels. Multislice spiral computed tomography (MSCT) can be used as a noninvasive technique for the detection of changes in coronary arteries and bypass graft patency (1, 2, 3). Complete visualization of coronary arteries and bypass grafts is a prerequisite for MSCT coronary angiography to become an accepted clinical tool for the assessment of patients with suspected lesion in bypass grafts.

Previous studies showed high sensitivity and specificity of MSCT for the detection of significant obstructive lesions in coronary arteries (1, 2). We evaluated the diagnostic accuracy of MSCT coronary angiography for the detection of significant lesions in anastomosis LIMA-LAD after revascularization.

The aims of the study were:

1. to analyze the five years' follow up in terms of the cumulative rates of major adverse cardiac events and mortality in patients who underwent minimally invasive coronary artery bypass (MIDCAB)
2. to examine the patency of the anastomosis LIMA-LAD in the symptomatic patients after MIDCAB by the 64-row MSCT.

MATERIAL AND METHODS

2.1. STUDY POPULATION

We examined 176 patients (146 males, 30 females, mean age 54 ± 10 years), who underwent MIDCAB 5 years ago (1999-2001, mean time follow up 5.5 ± 0.8 years). The patients were referred to our center from all the country. A minimally invasive surgical endoscopic technique (soft tissue atraumatic retractor) was performed, in which the left internal mammary artery was anastomosed on the beating heart to the left anterior descending artery through a small left anterior thoracotomywithin intercostal space (atraumatic coronary bypass). At the time of the operation all patients had a significant (>70%) 1-vessel coronary disease (LAD disease). Some of them (28 pts - 16%) had non-significant lesions in the other coronary arteries. 87 (49,4%) of pts had prior myocardial infarction and 35 (19.9%) of studied group had prior percutaneuos coronary intervention. Seven patients (4%) had low ejection fraction (< 40%). Table 1 shows baseline characteristics.

Table 1. Baseline characteristics

Cardiovascular risk factors	Value ± SD
Level of cholesterol (mg%)	**223 ± 46**
Hypertension	**74 (42%)**
Diabetes	**12 (6.8%)**
Smoking	**98 (56%)**
BMI (mean ± SD) kg	**25 ± 4**

SD = standard deviation, BMI = body mass index

During the five years' follow up the major adverse cardiac events (MACE) were reported. They were defined as a cardiac death, non-fatal myocardial infarction and hospitalization due to acute coronary event. We also collected non-cardiac-surgery related major adverse events (MAE), defined as non-cardiac death, PCI in native vessels and transient ischemic attack (TIA).

After the clinical examination fifty pts (28%) who reported symptoms of stenocardia were diagnosed with echocardiography examination and exercise treadmill tests. They were included to the study subgroup and referred to the MSCT. Forty four of them (38 males, 6 females, mean age 58 ± 9 years) were tested using MSCT. In six patients MSCT was not performed due to: 1) arrhythmias found during examination before MSCT (atrial fibrillation, frequent extrasystoles) or 2) historical exclusions that were elicited just before MSCT (contrast related allergy, bronchospasm). No patient had increased exposure to radiation in the last 12 months (>15mSV).

In pts with abnormal results of MSCT invasive coronary angiography was performed.

The study protocol was approved by local ethics committee. In patients who gave informed consent exercise treadmill test, TTE and MCST were done.

2.2. TRANSTHORACIC ECHOCARDIOGRAPHY (TTE)

Two-dimensional transthoracic echocardiographic examination was carried out using Toshiba Aplio™ with a 3.5 MHz transducer. One cardiologist performed and analyzed all echocardiograms.

Images were obtained from parasternal long-axis, parasternal short-axis, apical 2-chamber and apical 4-chamber views. Measurements were taken from appropriate views.

LVEF was calculated using Simpson‘s rule and this parameter was used for the follow up analysis.

The examination was performed at baseline and at the end of follow-up period.

2.3. TREADMILL EXERCISE TEST

After a 30-min seated rest, a standard Bruce symptom/sign-limited exercise test was performed. Leads II, V2 and V5 were monitored continuously. A 12-lead electrocardiogram was printed at the end of each stage or when clinically indicated, and at 1-min intervals in the recovery phase. Blood pressure was measured at baseline and during the last minute of each stage, unless otherwise indicated.

The test was interrupted when maximal heart rate (HR_{max}) was achieved, or one or more of the following end points were reached: progressive angina, ST-segment depression 0.2 mV or elevation >0.1mV, hypertensive response of >250/115mmHg, SBP drop of >10mmHg, signs of hypoperfusion, fatigue, central nervous system symptoms, dyspnea, severe arrhythmia or the subject’s desire to stop.

The test was considered adequate if the patient reached maximal heart rate or if a product of SBP multiplied by HR was 18 000 or above.

The test was found ‘positive’ for ischemia when horizontal or down sloping ST-segment depression of ≥0.1mV mm at 0.08s from the J point occurred in 2 contiguous leads, and/or if the patient reported a typical chest pain consistent with an effort.

Additionally, the test results were analyzed for: exercise capacity (in METs), maximal HR, maximal BP and the reason for terminating (unless HR_{max} and/or target SBPxHR achieved).

2.4. MSCT CORONARY ANGIOGRAPHY

The multislice computed tomography (MSCT) was performed 5 years after EACAB in a follow up using Toshiba Multislice Aquilion System (Toshiba Medical System, Japan) with 64-slice system. Craniocaudal scanning with 64-slice system has improved slice thickness to 0.5 mm and fastened gantry rotation time to 330 ms at tube voltage 120-135 kV, 300-500 mA with a prospective ECG- triggered X-ray tube modulation in all patients. Scanning was performed during breath-holding. A segmental reconstruction algorithm was used to allow the inclusion of patients with a range of heart rates. Retrospective electrocardiographic gating was performed to eliminate cardiac motion artifacts. We excluded patients with atrial fibrillation and high number of ventricular extrasystolic beats or patients.

To reduce motion artifacts and decrease the dose of radiation by reducing heart rate, we used β-blockade with 50 to 100 mg metoprolol p.o. in all patients. The patients who were known to have exclusion criteria such as relevant atrioventricular conduction defect, heart rate less than 55 bpm had no B-blokers administered.

Non-ionic contrast material (Ultravist 370, Schering AG) was injected in the antebrachial vein (120 ml in three phases, phase one-70 ml, flow 5.0 ml/s-100% contrast, phase two-with 30 ml the same flow-60% contrast and 40% saline, phase three-20 ml 4.0 ml/s flow-100% saline, using a dual-head power injector-Injector CT2, Medtron, Germany).

Data acquisition was computed and analyzed on Vitrea post-processing workstation (Vital Images) using 2-D et 3-D viewing mode. Electrocardiographically gated datasets were reconstructed automatically at different time of the R-R cycle length to approximate end-diastole phase of cardiac cycle. Additional reconstruction windows were constructed after the examination of datasets if motion artifacts were present. Scans were analyzed by consensus of two observers unaware of the clinical data. Images were evaluated using 0.5 mm thin-slab maximum intensity projections (MIP) and curved multiplanar reconstructions (cMPR).

Calcium score (CAC) scan was performed with non-contrast protocol. Foci of CAC were identified by an experienced radiologist and scored using semiautomatic commercial software on a Vitrea post-processing workstation (Vital Images) by detection of at least three contiguous pixels (voxel size =1.03 mm^3) of peak density ≥130 Hounsfield units (HU) within a coronary artery. The software calculated lesion-specific scores as the product of the area of each calcified focus and peak CT number (scored as 1 if 131 to 199 HU, 2 if 200 to 299 HU, 3 if 300 to 399 HU, and 4 if 400 HU or greater) according to the Agatston method. We calculated the value of calcium score in left main (LM), left anterior descending artery (LAD), left circumflex artery (LCX), right coronary artery (RCA) areas and total calcium score in all vessels.

15-segment American Heart Association model of the coronary tree was employed. Each identified lesion was examined using maximum intensity and multiplanar reconstruction techniques along multiple longitudinal axes and transversely. Lesions were classified by the maximal luminal diameter stenosis seen in any plane. All vessels and grafts were analyzed quantitatively as well as by the qualitative scale. Results were also analyzed for coronary stenoses grater than 50% luminal narrowing by artery, by segment and by patient.

2.5. INVASIVE CORONARY ANGIOGRAPHY (CA)

Invasive coronary angiography was performed by an experienced cardiologist according to standard techniques only in patients with abnormal results of MSCT after inform consent. Sones technique via a brachial approach was applied in cases where vascular access was not possible via a femoral approach. The experienced cardiologist evaluated all coronary bypass angiograms by quantitative coronary analysis (QCA) with automated vessel contour detection. Segmental disease was analyzed in each vessel using the same 15-segment model employed for MSCT analysis. Stenosis severity in each segment was classified according to the maximal luminal diameter stenosis present in each segment. The luminal diameter stenosis exceeding > 70% were defined as significant.

2.6. STATISTICS

Statistical analyses were performed using STATISTICA data analysis software system (StatSoft Inc., version 6, 2001). Continuous variables were described by means and standard deviations.

In order to check the normality of the distribution, the Shapiro-Wilk test was performed. In case of a normal distribution the t-test was performed; otherwise the U Mann-Whitney test was used. For discrete variables chi-square test was used. For correlative analysis, the Spearman rank correlation coefficient (r) was calculated.

The analysis of survival was performed using proportional hazard model (Cox regression) and Kaplan-Meier estimator.

Values were considered significant at $p<0.05$.

RESULTS

3.1. STUDY POPULATION, CLINICAL, TTE, TREADMILL EXERCISE RESULTS

In group of 176 patients who underwent MIDCAB we found 14 (7.9%) pts who had history of major adverse cardiac events (MACE) and 29 (16%) pts with history of non-cardiac-surgery related major adverse events (MAE) at the maximum of the follow-up period. There was no in-hospital mortality. During the follow-up eleven pts died, six of them (3.4%) due to cardiac reasons. Six patients (3.4%) had non-fatal myocardial infarction which were not located in the territory of the LAD. During the follow-up in 25 pts (14.2 %) percutaneous coronary intervention (PCI) was performed, including two (1.1%) patients who had interventions in LIMA-LAD anastomosis and 23 (13.1%) with procedures in different coronary arteries. One patient had history of transient ischemic attack. We observed no strokes. Table 2 presents the MACE and MAE in patients after MIDCAB.

Table 2. MACE and MAE after MIDCAB

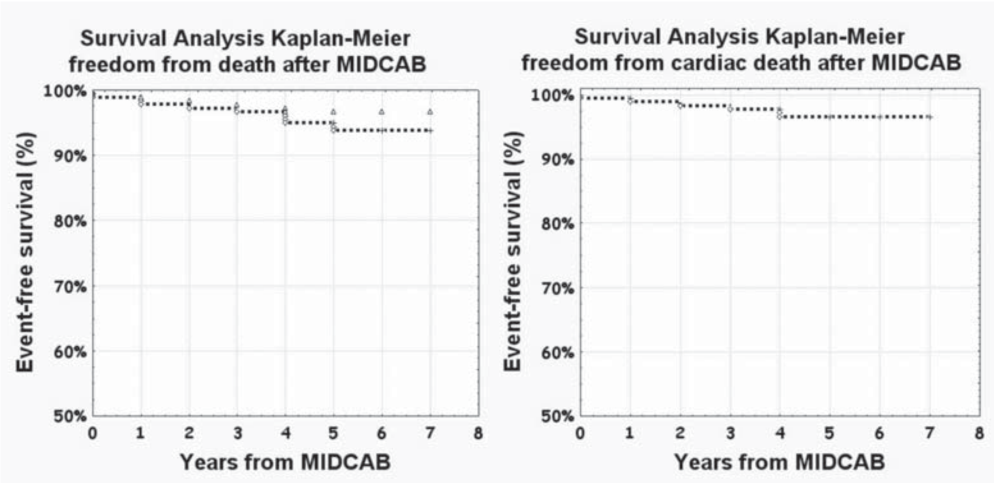
Parameter	*N=176 pts*	*n (%)*
	MACE	**14 (7.95%)**
	MAE (non-surgery related)	**29 (16.5%)**
Death		
	All	**11 (6.25%)**
	Cardiac death	**6 (3.4%)**
MI		
	nonfatal MI after MIDCAB	**6 (3.4%)**
PCI		
	PCI LIMA-LAD anastomosis	**2 (1.1%)**
	PCI LAD	**4 (2.3%)**
	PCI D1	**2 (1.1%)**
	PCI LCX	**4 (2.3%)**
	PCI RCA	**13 (7.4%)**
TIA		
	TIA after MIDCAB	**1 (0.5%)**

MACE = major adverse cardiac events, MAE = major adverse events, MIDCAB = minimally invasive coronary artery bypass, MI = myocardial infarction, PCI = percutaneous coronary intervention, LIMA = left internal mammary artery, LAD = left anterior descending artery, D1 = diagonal branch, LCX = left circumflex artery, RCA = right coronary artery, TIA = transient ischemic attack

At the maximum of follow-up 83 pts (47.2%) suffered from hypertension, 17 pts (9.7%) had diabetes and 68 pts (38.6%) continued smoking. One hundred seventy pts (97.1 %) received beta-blockers, 120 pts (68%) statin and all received ASA postoperatively. The mean body mass index in this group was 26 ± 4 kg/m^2.

Figure 1 shows Kaplan-Meier survival curves– freedom from death of any causes and cardiac death.

Figure 1. Kaplan-Meier analysis-freedom from death and cardiac death after MIDCAB



Cox regression analysis revealed statistically significant inverse relationship between 5-year risk of death and left ventricular ejection fraction as well as between cardiac death and left ventricular ejection fraction (HR = 0.88 p = 0.002916 and HR = 0.84 p = 0.000567, respectively).

Fifty patients out of the 176-patient group who suffered from symptoms suggesting recurrent ischemia (history of effort angina symptoms, presenting positive exercise test, MACE) were enrolled during the period from May 2006 to September 2006 and referred to MSCT. Six patients were not examined because they had contraindications for MSCT or did not give consent to undergo MSCT. The results of all tests are shown in Table 3.

Table 3. The results in symptomatic patients after MIDCAB

Parameter	*N=50 pts (% of all pts after MIDCAB)*	
MACE		
	MACE	**4 (2.3%)**
	MAE (non-surgery)	**7 (4.0%)**
	PCI (total)	**9 (5.1%)**
	PCI LIMA-LAD anastomosis	**2 (1.1%)**
	MI	**2 (1.1%)**
EF (%) in TTE		
	before MIDCAB	**56 ± 6%**
	after MIDCAB	**61 ± 10%**
Cholesterol		
	Level of cholesterol (mg%)	**193 ± 42**
Exercise test		
	Follow up	
	Test "positive"	**17 (34%)**
	SBP x HR	**19263 ± 10464**
	Time exercise (min)	**7.44 ± 2.63**

MIDCAB = minimally invasive coronary artery bypass, MACE = major adverse cardiac events, MAE = major adverse events, PCI = percutaneous coronary intervention, MI = myocardial infarction, LIMA = left internal mammary artery, LAD = left anterior descending artery, EF = ejection fraction, TTE = transthoracic echocardiography, ECG = electrocardiogram, SBP = systolic blood pressure, HR = heart rate

Forty four of them (38 males, 6 females, mean age 58 ± 9 years) were examined using MSCT. MSCT coronary angiography was performed as a first line tool to assess the LIMA-LAD anastomosis and coronary status. Four patients from this subgroup had history of major adverse cardiac events (MACE) during the follow-up and 7 patients had non-surgery related MAE. Two of them had non-fatal myocardial infarction and 9 had percutaneous coronary intervention (PCI). Four patients had PCI LAD due to new significant lesion. Only in two patients PCI was performed in LIMA-LAD anastomosis.

In Cox regression analysis, we did not find any statistically significant relations between the 5-year risk of major adverse cardiac events (MACE) and any of following clinical parameters: age, sex, ejection fraction, calcium score, level of serum cholesterol and triglycerides in this subgroup of patients.

Out of 50 examined patients 17 (34%) were found positive for ischemia during treadmill exercise test (5 of which (10% of total) presented with stenocardia not reflected by the test typical ECG changes). In other 3 cases (6%) test was inconclusive. In the rest of participants test results were negative (n = 15; 30%). The mean duration time of exercise test was 7.44 ± 2.63 min. None of the participants achieved target maximal HR during Bruce protocol. 48 of them were treated with beta-blockers. The reasons for test termination were as follows: >0,2mV ST segment depression – 20%, stenocardia – 13%, blood pressure limit – 31%, fatigue – 31%, other reasons – 5%. Patients with positive result of exercise test did not differ significantly from those with negative results in terms of plasma lipid parameters (193 ± 42 vs 196 ± 43, respectively). There was no difference in exercise capacity with regard to gender. Age of the participants was negatively related to maximal HR achieved during the test (r = - 0,5203; p<0,05) and to HR max x SBP max product (r = - 0,4745; p<0,05).

3.2. MSCT RESULTS

MSCT was done in 44 patients from symptomatic group including all the patients with positive exercise test. LIMA-LAD anastomosis was not found in 4 patients (9%), which was confirmed by invasive coronary angiography. Two patients who had already had PCI of LIMA-LAD anastomosis showed normal flow by that connection in MSCT during the follow-up. The average diameter of LIMA was 2.2 ± 0.7 mm.

In the group of 17 patients with positive results of exercise test, 13 showed progress of coronary artery disease in different arteries confirmed by MSCT, but none of them had significant lesion. Seven of them had PCI during the follow-up period (2 patients in RCA, 2 patients in LCX and 3 patients in LAD).

The analysis of Calcium score indicated that the mean total Calcium Score was 392 / 206 (average/ median) and in LM, LAD, LCX, RCA regions were respectively 34 / 0, 180 / 83, 48 /15, 131 / 22. A greater calcium deposit was observed in LAD and RCA regions.

Spearman correlation analysis showed a significant positive linear relation between Calcium Score in any studied coronary vessel and plasma level of total cholesterol and triglycerides However, there was no statistically significant relation between Calcium Score and plasma HDL and LDL levels (Table 4).

Table 4. Correlation between Ca Score (individually LAD, LCX and RCA) and lipid parameters

	LAD Ca Score	LCX Ca Score	RCA Ca Score
Triglycerides	r = 0.5012; p=0.007	r = 0.4872; p=0.009	r = 0.5305; p = 0.004
Total Cholesterol	r = 0.5580; p = 0.002	r = 0.4094; p = 0.031	r = 0.4182; p = 0.027
LDL Cholesterol	0.1834; p = NS	-0.0219; p = NS	-0.0274; p = NS
HDL Cholesterol	-0.1068; p = NS	-0.1396; p = NS	-0.1285; p = NS

Ca score = calcium score, LAD = left anterior descending artery, LCX = left circumflex artery, RCA = right coronary artery, LDL=Low-density lipoprotein, HDL=High-density lipoprotein, r = correlation coefficient; NS = not significant, p = statistically significant (p≤0,05)

Patients with positive result of exercise test did not differ significantly from those with nega-

tive result with regard to Calcium Score total (210 vs 198, respectively). None of exercise test parameters (exercise capacity, HR max, HR x SBP max) correlated with Calcium Score. Additionally, there was no significant correlation between Calcium Score and age within studied group.

We compared LVEF obtained by using TTE and MSCT. There were no significant difference between the results (61 $\pm$ 10% vs 65 $\pm$ 14%, respectively).

The mean X-ray exposition (dose-length product DLP) during MSCT was 1294 $\pm$ 108 mGy x cm^2 and the effective dose was 22 $\pm$ 1.8 mSv.

DISCUSSION

Currently there are numbers of different minimally invasive methods in revascularization of the heart as indicated in previous studies (4, 5, 6, 7, 8, 9). The basic aim of these methods is to decrease perioperative mortality rates. However, is it equally important to improve the long-term prognosis for this group of patients. In recent publications (4, 5, 10, 11, 12) authors documented the superiority of the endoscopic atraumatic coronary artery bypass grafting over direct primary stenting in LAD revascularization, despite slightly higher costs of the surgical procedure. In our observation we analyzed a greater group of patients than in our previous study (4). In other publications (6, 9, 12) similar groups of patients underwent MIDCAB.

This study reports on the results of a 5 year long MIDCAB follow- up of patients who where operated in our center. They were referred from several cardiologic centers from all the country. The survival in a five-year follow up was 93.75 % patients (only six patients died due to cardiac reason, three of them had low ejection fraction <40%). Our results indicate that long term effects are promising. In the article written by Holzhey et al. Kaplan-Meier analysis revealed a 5-year survival of 91.9% and a 7-year survival of 89.4%. Similar results were received by other authors (4, 5, 6, 8, 9, 11, 13).

In one article published by Boodhowani (6) during a 27-month follow up period all patients were free of significant anginal symptoms and nobody died due to the cardiac reasons. Furthermore, in comparison with our results for all patients who underwent MIDCAB (14 MACE in five-year follow up – 176 pts, the freedom of major adverse cardiac events 92%), Holzhey's at al (12) reported similar frequency of major adverse cardiac events as in our study (55 MACE in five-year follow up – 1347 pts, the freedom of major adverse events 89.5%). A number of cardiac events observed during the 5 year follow – up proved not to be related to the surgery technique involved but seemed to reflect the natural progress of the disease.

While comparing the pertinent literature (7) we found the similar ejection fraction in Holzhey's (12) article (EF was 61 $\pm$ 14% vs 61 $\pm$ 10% in our patients).

CABG and MIDCAB are standard procedures performed in patients with coronary artery disease. Within the group of 176 pts, fifty had symptoms suggesting recurrence of coronary heart disease. There are different methods to evaluate the patency of bypass graft and coronary arteries but conventional coronary angiography (CCA) still remains the "gold standard". CA has some limitations such as a small definable risk, the need for multiple staff members, and the cost related to the procedure itself and the ensuing observational period.

Nevertheless MSCT is becoming an equally promising option. Previous reports (1, 2, 3) described the results with the usage of 16-row and 32-row MSCT. Few studies documenting 64-row MSCT suggest that the method is adequate for evaluating both coronary arteries and bypass grafts. However the analysis of coronary stent patency is limited with its usage.

In our study we used a 64 – row MSCT in symptomatic patients after EACAB. The remaining ones did not show any heart problems in a 5 year follow-up. According to the criteria discussed in the Methods, not all the patients were qualified for the MSCT. We detected only 4 occluded anastomoses LIMA-LAD in forty four patients. We observed that MSCT showed 100% specificity in detecting occluded anastomoses LIMA-LAD which were confirmed by CA. The sensitivity in detecting LIMA-LAD occluded anastomoses was not assessed due to small number of patients with significant lesions in LIMA-LAD connection. In comparison to our results, Martuscelli's article (10) presented that 16-slice MSCT has high accuracy in the diagnosis of graft stenosis and occlusion (sensitivity and specificity of identifying graft stenosis >50% are 90% and 100%, respectively). Similar results were reported by Ko et al (2) in their article (sensitivity and specificity of 93% and 99%, respectively).

However a number of previously conducted analyses showed that 64-row MSCT is characterized by a very high specificity in detecting patency of bypass graft (1,2). Accordingly, a correct image of the contrasted anastomosis at proximally closed LAD indicates clearly that the anastomosis LIMA-LAD is patent.

The basic difficulty in the analysis of anastomoses was constituted by the clips. Arterial graft (LIMA, RIMA) studies may require a longer scanning distance, a longer breath-holding time and a larger radiation dose. An increase in table speed to cover a longer scanning distance may compromise the spatial resolution of MSCT coronary angiography. The limitations of this nature have already been reported by other authors. Nevertheless, it is accepted that MSCT may be used in evaluating the patency of anastomoses in patients after MIDCAB (1, 2, 3).

In conclusion: MIDCAB technique is a well recognized method of treatment. The long-term follow up after MIDCAB revealed a relatively high rate of cardiovascular events, which were not connected with surgical technique but with progress of the coronary artery disease. The new generation of 64-row MSCT seems to be promising for a reliable assessment of LIMA-LAD anastomosis in patients with previous MIDCAB. However our study was limited by the fact that coronary angiography verification was performed only in patients with abnormal MSCT images.

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