

# Invasive treatment of coronary artery disease in octogenarians

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## Abstract

**Introduction:** There are many patients aged over 80 years among those hospitalised for coronary artery disease (CAD). The unanswered question is whether invasive treatment of such patients is effective and safe.

**Aim:** To assess and compare one-year clinical outcomes after percutaneous coronary angioplasty (PTCA) and surgical coronary artery bypass grafting (CABG) in patients aged over 80 years and in younger patients.

**Method:** There were 63 patients aged over 80 years suffering from CAD who underwent either PTCA or CABG. The control group consisted of 40 patients aged 60-65 years treated in the same way. Data on medical history, cardiovascular risk factors, and angiographic findings were analysed. The potential risks of the procedures, post-procedural complications as well as the clinical status at the end of one-year follow-up were evaluated.

**Results:** There were 24 surgical revascularisation procedures and 39 PCIs performed in the very old patients. Stable angina was found in 29 cases, unstable angina in 19 and acute myocardial infarction in 15 patients. There were three in-hospital deaths and 18 periprocedural complications were noted. During the one-year follow-up period six deaths occurred, persistent or recurrent angina was found in 11 patients after PCI and two after CABG. There were no deaths in the control group and the incidence of minor complications was similar to the senile group. In younger patients who underwent CABG, CCS class at one year was lower than in the very old ones.

**Conclusions:** The invasive treatment of coronary artery disease in octogenarians is feasible with satisfactory results and acceptable procedural risks.

**Key words:** octogenarians, coronary artery disease, PTCA, CABG

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## Introduction

In 2003, there were 3906 patients aged over 80 years hospitalised for different forms of coronary artery disease (CAD) in the Silesian Province [1]. Such a remarkable number of senile patients among all patients with CAD raises the question of whether therapeutic procedures normally used in younger patients are also effective and safe in senile ones. Special attention is required in such patients as they

suffer from CAD complications, especially heart failure, multiorgan atherosclerosis as well as from various comorbidities [2]. The effect of the treatment on quality of life is another consideration [3]. There is growing evidence that percutaneous coronary angioplasty (PTCA) and coronary artery bypass grafting (CABG) procedures are beneficial in patients after the age of 80 years [4-7], although they are performed in such patients less often than in younger ones [8].

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## Aim

The aim of the study was to assess and compare one-year clinical outcomes after PTCA and CABG in patients aged over 80 years and in younger patients.

## Methods

There were 63 patients aged over 80 years suffering from CAD who underwent invasive treatment at the Third Department of Cardiology or Second Department of Cardiac Surgery of the Silesian Medical University between July 2002 and July 2003. These were 63 consecutive patients admitted to the hospital with CAD diagnosis, except for nine subjects, who were found ineligible for revascularisation. Coronary artery bypass grafting was performed in 24 patients and PTCA in 39. The control group consisted of 40 consecutive patients aged 60-65 years, hospitalised in the same period, i.e. June 2002 – June 2003, and receiving similar treatment.

Demographic data as well as first CAD diagnosis time, medical history including previous myocardial infarction (MI) and interventions, comorbidities, coronary angiographic and echocardiographic findings were analysed. The length of hospitalisation and post-discharge destinations were taken into consideration as well.

In CABG patients, the risk score by Euroscore [9] was calculated and the type of procedure (on-pump vs off-pump) recorded. The Jeopardy Score and TIMI score were used to stratify the risk in PTCA patients [10-12].

Complications of the procedures and data on whether revascularisation was complete or not were also analysed.

Data on angina occurrence, home independence and rehospitalisations were collected at the end of the follow-up period.

## Statistical analysis

Chi-square test and the Fisher exact test were used for the comparison of nonparametric variables. Mean values were compared by Student's t-test. A p value of less than 0.05 was considered significant. All parameters were presented as either mean values  $\pm$  SD or numbers and percentages.

## Results

Demographic and clinical data are shown in Table I.

There were no significant demographic or clinical differences between the two groups with the exception of body mass index (BMI), which was higher in the very old patients. The time from the first CAD diagnosis to the index hospitalisation in octogenarians undergoing CABG (n=24) ranged from 2 months to 20 years, mean  $9.8 \pm 7$ , and was significantly longer than in PTCA patients (n=39), in whom it ranged from 1 month to 20 years, mean  $5.3 \pm 5$  (p=0.03). The history of clinical symptoms in 18 senile subjects was relatively short, lasting from a few weeks up to 6 months; the remaining 43 patients were symptomatic for 4-20 years.

**Table I.** Demographic and clinical data

	Senile Group N=63	Control Group n=40	p
Age [years]	80-89 (82 $\pm$ 2)	60-65 (63 $\pm$ 2)	<0.05
Gender (number of women)	35 (56%)	10 (25%)	NS
Body mass index	19-27 (22 $\pm$ 2)	20-38 (27 $\pm$ 4)	<0.05
Stable angina (CCS class)	29 (7- CCS 2, 22- CCS 3)	24 (5- CCS 2, 19- CCS 3)	NS
<b>ACS with ST segment elevation,</b>	<b>15</b>	<b>8</b>	NS
M-A score	2-7 (mean 4.7)	1-4 (mean 2.6)	
Anterior wall infarction	8	3	
Inferior wall infarction	5	5	
Lateral wall infarction	2	0	
<b>ACS without ST segment elevation (on admission)</b>	<b>11, 2-4 (mean 2.6)</b>	<b>5, 1-3 (mean 1.9)</b>	NS
TIMI risk score	19	8	
UA (final diagnosis) Braunwald's classification	(15-IIB, 4-IIIB)	(8- IIB)	
Mean CCS class (excluding pts. with MI)	3.2	3	NS
Time from first CAD diagnosis	1 mo-20 yrs (mean 8.3 $\pm$ 5 yrs)	1 wk-15 yrs (mean 4.5 $\pm$ 3 yrs)	NS
History of MI	27 pts (12 ant, 13 inf, 2 ant+inf)	20 pts (6 ant, 10 inf, 2 later, 2 ant+inf)	NS
Previous coronary revascularisation	6 pts (5 PTCA, 1 CABG)	4 pts (4 PTCA)	NS

Abbreviations: M-A score – Monow-Autman score; ACS – acute coronary syndrome; UA – unstable angina

**Table II.** Coronary artery disease risk factors and comorbidities

	Senile Group n=63	Control group n=40	p=
Arterial hypertension	48 (76)	31 (78)	NS
Serum LDL cholesterol >100 mg%	<b>44 (70)</b>	<b>19 (48)</b>	<b>0.04</b>
Diabetes mellitus	17 (27)	13 (33)	NS
Smoking	30 (48)	26 (65)	NS
Extra coronary atherosclerotic vascular disease	20 (32)	6 (15)	NS
History of Stroke	4 (6)	3 (8)	NS
Atrial fibrillation	11 (17)	5 (13)	NS
Peptic ulcer	8 (13)	8 (20)	NS
COPD	5 (8)	2 (5)	NS
Heart failure	13 (20) (11- NYHA 2, 2- NYHA 3)	4 (10) (1-NYHA 2, 3- NYHA 3)	NS
Anaemia	<b>12 (19)</b>	<b>0</b>	<b>0.01</b>
Increased serum creatinine level	7 (11)	0	NS

COPD – Chronic Obstructive Pulmonary Disease, numbers percentages (in brackets) are given

**Table III.** Coronary angiographic findings in the senile group (S), including subgroups, i.e. senile CABG pts. and senile PTCA pts. and the control group (M)

Coronary angiography	CABG senile subgroup n=24	PTCA senile subgroup n=39	p	Total senile group n=63	Control group n=40	p=
1-vessel disease	0	7	0.038	7	10	NS
2-vessels disease	4	21	0.004	25	12	NS
3-vessels disease	20	11	0.0001	31	16	NS
Left main disease	6	1	0.01	7	2	NS
Number of vessels with >1 stenosis	61	42	0.0001	103	37	0.001
Number of total occlusions	15	15	NS	30	9	0.02

All senile patients had cardiovascular risk factors and suffered from concomitant diseases (Table II). One patient was diagnosed as having gastric cancer (on endoscopy done for upper gastrointestinal bleeding in CABG postoperative period), two had nodular goitre, one Addison's disease and two depression. In the control group, one patient had previously undergone colon tumour resection and was suffering from schizophrenia. Significantly more patients that were senile had LDL-cholesterol level increased and presented with anaemia (the lowest haemoglobin concentration was 10.4 g%).

There were no significant differences in echocardiographic findings between the groups. Left ventricular ejection fraction (LVEF) was 48±10% in senile patients and 50±8% in the controls (NS); mitral regurgitation was found in 22 (35%) octogenarians and 4 (10%) controls (NS).

In senile patients, coronary angiography revealed significantly more frequent total vessel occlusions as well

as a higher number of arteries per patient with more than one significant stenosis. Multi-vessel disease and left main CAD were more frequent in senile CABG patients than in those treated with PTCA; they also had more vessels with >1 significant lesion. Angiographic data are shown in Table III.

Coronary artery bypass grafting data on both groups are shown in Table IV. The Euroscore was higher in senile patients, and incomplete revascularisations and off-pump procedures were performed more frequently in such patients. Additionally, in octogenarians treated with PTCA the rate of complete revascularisations was significantly lower (Table V). Eight senile and six younger patients received adjunctive treatment with abciximab after PTCA (all had acute MI).

No significant troponin-I level elevation following revascularisation was found in either group. Elevated serum creatinine levels were observed more frequently in the senile group (Table VI).

**Table IV.** CABG data on senile and control patients undergoing surgical revascularisation

Parameter	CABG senile group n=24	CABG control group n=20	p
Euroscore (range, mean $\pm$ SD)	4-11; 6.3 $\pm$ 1.1	0-8; 2.4 $\pm$ 1.9	0.001
Complete revascularisation [n, %]	9 (28)	18 (90)	0.001
OPCAB procedures [n]	14	4	0.02
Mean number of grafts per patient [n]	1.9	2.6	0.001
Implanted grafts [n]	46	52	NS
	Arterial (17): LIMA-LAD – 17  Venous (29): to LAD – 5 to OM – 9 to RCA – 10 to IM – 3 to D1 – 2	Arterial (19): LIMA-LAD – 19  Venous (33): to LAD – 1 to OM – 16 to RCA – 16	

LIMA – left internal mammary artery; LAD – left descending artery; RCA – right coronary artery; OM – obtuse margin artery; IM – intermedia artery; Cx – circumflex artery; D1 – 1<sup>st</sup> diagonal branch; LM – left main coronary artery; OPCAB – off-pump coronary artery bypass grafting

**Table V.** Angioplasty details in PTCA subgroups of senile and control populations

Parameter	PTCA senile group n=39	PTCA control group n=20	p
Jeopardy score (range, mean $\pm$ SD)	1-5; 2.7 $\pm$ 1.2	1-4; 2.9 $\pm$ 1	NS
Complete revascularization	9 pts (23%)	15 pts (75%)	<0.01
TIMI 3 flow	39 vessels (90%)	23 vessels (100%)	NS
PTCA in AMI [n]	14	8	NS
Number of treated vessels	1 vessel (32): LAD – 11 stents, 2 BA RCA – 11 stents, 2 BA Cx – 3 stents, OM – 3 stents  2 vessels (4): LAD stent and Cx stent – 3 LM stent and Cx stent – 1  3 vessels (1): LAD, RCA stent and Cx-BCA  43	1 vessel (17): LAD – 7 stents, 1 BCA RCA – 7 stents, 1 BCA Cx – 1 stent,  2 vessels (3): LAD stent and Cx -BCA – 1 LAD stent and RCA-BCA-1 LAD and Cx- BCA – 1  23	

LAD – left descending artery; RCA – right coronary artery; OM – obtuse margin artery; IM – intermedia artery; Cx – circumflex artery; D1 – 1<sup>st</sup> diagonal branch; LM – left main coronary artery; BCA – balloon coronary angioplasty

Early and late complications are summarised in Table VII. There were post-CABG complications in 12 patients with one intraoperative death (4%) due to low cardiac output syndrome. Five patients required intra-aortic balloon pumping (IABP) and epinephrine infusion. Ischaemic stroke on the first postoperative day was diagnosed in one case, and there were also single cases of upper gastrointestinal (GI) bleeding, postoperative bleeding that required resternotomy, mediastinitis, pneumothorax and mesenteric ischaemia. The patient with GI ischaemia was transferred to the surgical ward,

operated on, but eventually died on the 26<sup>th</sup> postoperative day.

Complications occurred in six senile patients undergoing PTCA. Two (5%) women died in hospital, one with post infarction ventricular septal defect, who had refused surgery, the other presenting with acute MI, renal failure and acute mesenteric embolism. One patient remained symptomatic after primary PTCA and required additional coronary intervention on two other vessels. During the procedure ventricular fibrillation occurred in three

**Table VI.** Troponin-I and renal parameters in treated patients

	CABG		p=	PTCA		p=
	senile group n=24	control group n=20		senile group n=39	control group n=20	
Abnormal troponin-I level*	4 pts (17%)	11 pts (55%)	NS	5 pts (13%)	0	NS
Range of measurements	1.5-5 ng/ml	0.26-4.08 ng/ml		0.12-0.38 ng/ml	–	
Cr concentration >1.4 mg% (at admission)	3 pts (12.5%)	1 pt (5%)	NS	4 pts (10%)	0	NS
Peak Cr concentration [mg%]	1.8	1.43	NS	1.7	–	NS
Postoperative Cr increase	<b>10</b> pts (42%)	<b>1</b> pt (5%)	<b>0.05</b>	<b>11</b> pts (28%)	<b>1</b> pt (5%)	<b>0.04</b>
Cr increase above 1.4 mg% level	<b>5</b> pts (21%), peak value – 2.4 mg%	<b>0</b>	<b>0.05</b>	5 pts (13%), peak value – 2.59 mg%	0	NS

Cr – serum Creatinine; \* – excluding patients with AMI

**Table VII.** Early and late postprocedural complications in senile patients and in controls

Complications	PTCA		p<	CABG		p<
	senile group n=39	control group n=20		senile group n=24	control group n=20	
In-hospital death [n]	2	0	NS	1	0	NS
Perioperative complications (excluding fatal events) [n]	4	3	NS	11	5	NS
Death in the follow-up period [n]	2	0	NS	4	0	NS
Angina during the follow-up period [n]	11	2	NS	2	1	NS
Mean CCS class	1.5	1.2	NS	<b>1.5</b>	<b>1</b>	<b>0.01</b>
Hospitalisation in the follow-up period [n]	6	2	NS	6	2	NS
Deaths (total)	6	0	NS	5	0	NS

patients (including one with AMI) which was successfully terminated with DC shock.

There were no deaths in the control group. In five CABG patients the following complications were noted: stroke, bronchopneumonia, postoperative bleeding, transient visual dysfunction, and atrial fibrillation. Atrial fibrillation occurred in two patients and catheter insertion site haematoma in one patient after PTCA.

The length of hospitalisation and post-discharge destinations are shown in Table VIII. In CABG patients, there were no differences in the duration of the hospital stay; in PTCA senile patients, in-hospital treatment was significantly longer.

The clinical status of all discharged patients was surveyed either by phone call or by mailing a questionnaire at 12 months (Table VII). There were four fatal events in the CABG octogenarian group: one in the early postoperative period (on the 26<sup>th</sup> day, as mentioned before) and three in the late postoperative period, of which one was caused by ischaemic stroke eight months postoperatively, and in the other two the

cause was unknown. In total, there were five (21%) deaths in the very old patients undergoing CABG.

In senile patients treated with PTCA, there were four (10%) fatal events including two in the late follow-up, one due to biliary disease and one in the fourth postprocedural month following cerebral stroke.

Two (8%) senile patients after CABG complained of persistent angina: one of them with CCS 2 class symptoms underwent stent implantation into the previously untreated vessel six months after the operation; the other (CCS class 1) received medical treatment alone. In PTCA patients, eight had recurrent and three persistent angina (total of 11 pts. [30%]); of these six had CCS class 1 and five CCS class 2 symptoms. Only one of them had a coronary stent implanted into the previously non-instrumented vessel; in the remaining ten only pharmacotherapy was used. The mean CCS class was 1.5 in both subgroups.

There were six rehospitalisations in post-CABG senile patients during one-year follow-up, including one for coronary artery stent implantation, one for

**Table VIII.** Length of in-hospital stay and post-discharge destinations in senile and control groups

	PTCA		p<	CABG		p<
	senile group n=37	control group n=20		senile group n=23	control group n=20	
Hospitalisation (days) (mean value $\pm$ SD, range)	7 $\pm$ 3 (3-14)	4 $\pm$ 2 (2-10)	0,01	12 $\pm$ 5 (7-30)	10 $\pm$ 3 (8-14)	NS
Home discharge	35	20	NS	12	14	NS
Transfer to another hospital	2	0	NS	11	6	NS

pacemaker implantation, two for GI tumour operations (both patients survived, one gastric and one colon tumour resection), and two for pleural effusion evacuation. The number of re-admissions was the same in PTCA senile patients, the reasons being: coronary stent implantation, pacemaker implantation, bronchopneumonia, heart failure decompensation, hypotension and atrial fibrillation.

There were no significant differences between the two groups in terms of complication rate, except for a lower mean CCS class in younger CABG patients.

Home independence data for senile patients were gathered, including both the pre-hospital and post-discharge period: 23 of them had been living in the preoperative period on their own, and 22-post discharge (one patient moved to live together with her family). Two patients required daily assistance before and three after discharge. Additionally, according to the questionnaire, eight patients continued to do gardening, one to drive a car, and two to travel.

## Discussion

The mortality rate in the perioperative period of 5% and 4% in PTCA and CABG senile patients respectively, as well as the late mortality of 10% and 21%, are consistent with published results [2,4] despite the fact that over 50% of our patients presented with either unstable angina or AMI. The high-risk profile of the patients included in our study is confirmed by the high-risk score calculated for subjects undergoing CABG based on the Euroscore formula (median: 6.3), and PTCA on the Jeopardy Score (median: 2.7), the Morrow-Antaman score (median: 4.7) and the TIMI risk score (median: 2.6).

The incidence of complications was not significantly higher in the senile patients than in their younger counterparts. Invasive treatment in the older patients was as frequent as in younger ones, contradicting the observations of others [8] showing significantly higher rates of intervention in younger groups. This might be explained by the hypothesis that only severe symptoms, or evidence of high risk as well as very long duration of clinical symptoms, would make the physician refer such patients for invasive treatment [13]. The history of symptoms in the senile patients

was significantly longer in those undergoing CABG compared with PTCA, and a similar trend with respect to younger patients was reported by others [14].

The burden of atherosclerotic coronary lesions in octogenarians treated with surgery was higher and reflected the way the patients were referred for either CABG or PTCA. In the senile patients, the lesions were more advanced than in the younger subjects, with more arteries with multiple lesions and more totally occluded vessels.

The CAD risk factors were present in all very old patients in our study. According to other reports, such patients should have had fewer risk factors than their younger counterparts; such a trend however was not found in our group [8]. Similarly to the reported groups [3], comorbidities were common in the senile patients, but no significant differences between younger and older subjects were noted.

Both CABG and PTCA procedures were relatively safe and their complications were neither more serious nor more frequent in the senile patients than in the younger ones. No patient had significant troponin-I elevation after the procedure. Relatively few senile patients received complete revascularisation, significantly fewer than their younger counterparts did. Furthermore, the number of implanted grafts was also lower in the very elderly. This might be explained by the higher number of total occlusions (total of 30) as well as by the individual operator tendency to limit the extent of the procedure. In 14 senile patients, off-pump CABG was performed, significantly more often than in the younger group. Off-pump procedures are generally believed to reduce postoperative complications, especially strokes in very old patients [15, 16]. Consistently with published data, arterial grafting in over 70% of senile patients proved to be beneficial in terms of permanent angina relief [17, 18].

Fifty percent of senile patients suffering from AMI who underwent primary PTCA received adjunctive treatment with GP IIb/IIIa blockers without bleeding complications. The safety and efficacy of these agents in octogenarians have been studied in larger populations and no significant risk of major, life-threatening haemorrhagic complications has been implicated [19].

Increased serum creatinine level and anaemia were observed in relatively more senile patients, in about 10% and 20%, respectively. The prevalence of anaemia, defined by the WHO as haemoglobin concentration of less than 12 g% in women and 13 g% in men, is estimated to be 3-60% in persons >85 years old. Low haemoglobin levels can facilitate syncope or heart failure. It is however unclear whether anaemia correction by means of pharmacotherapy is beneficial [20].

On the contrary, the fact that serum creatinine levels were increased at baseline or after CABG or PTCA procedures in as many as 20% of all elderly patients indicates that renal function should be carefully monitored, including creatinine clearance assessment, dosing of administered medications adjusted, and appropriate hydration during procedures requiring contrast injections to be provided.

Differences in the length of hospital stay were observed only between the senile and younger PTCA patients (with longer hospitalisations in the former group). This is probably due to typically longer in-hospital treatment after CABG as compared with post-PTCA management which usually takes about 2-3 days. It is assumed that only the senile post-PTCA patients must have required additional diagnostic tests or prolonged rehabilitation.

There were no differences between the older and younger patients in terms of post-discharge destination (another hospital or home). Similar to other reports [3], no tendency to transfer senile post-surgical patients to nursing institutions was observed in our series: all patients except one returned eventually to their homes.

Although the effect of the treatment on quality of life in the senile patients was not appropriately assessed in our study, there is no doubt that substantial symptomatic relief was achieved. The mean CCS class was reduced from over 3 at baseline to 1.5 at 12 months post discharge. In contrast to the CABG population, where at one year mean CCS was higher in the senile patients, no difference in CCS was found in the post-PTCA patients. This discrepancy might be explained by the higher rate of off-pump procedures in the senile patients and the lower overall number of grafts implanted.

Home independence rate did not change after the procedures and some patients were able to return to their leisure time activities and hobbies. The beneficial effect of cardiac surgery or PTCA on the quality of life in the elderly is well documented and according to many [5, 6, 21] age *per se* should not be the most important factor in choosing invasive or medical therapeutic strategy.

## Conclusions

1. Invasive treatment of coronary artery disease by means of either PTCA or CABG in patients aged over 80 years is feasible and relatively safe, providing exceptionally careful clinical care required to control frequent comorbidities is ensured.
2. PTCA and CABG procedures in very old patients provide substantial symptomatic relief and facilitate their return to normal or near-normal lives.

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## Leczenie inwazyjne choroby wieńcowej u osób po 80. roku życia

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### Streszczenie

**Wstęp:** Pacjenci po 80. roku życia stanowią dużą grupę chorych hospitalizowanych z powodu choroby niedokrwiennej serca. Powstaje pytanie, czy zastosowanie u nich leczenia metodami inwazyjnymi jest skuteczne i bezpieczne.

**Cel:** Analiza przebiegu hospitalizacji grupy osiemdziesięcioletnich i starszych pacjentów poddanych zabiegom PTCA i CABG na przestrzeni roku i porównanie z grupą młodszych pacjentów.

**Metoda:** Grupę badaną stanowiło 63 pacjentów powyżej 80. roku życia z chorobą wieńcową, poddanych zabiegom PTCA i CABG. Grupę kontrolną utworzyło 40 chorych w wieku 60–65 lat leczonych angioplastyką lub operacyjnie. Analizowano dane dotyczące dotychczasowego przebiegu choroby, czynników ryzyka i wyniku koronarografii. Oceniano również ryzyko i powikłania zabiegów, a po roku zebrano informacje o stanie wypisanych pacjentów.

**Wyniki:** W grupie badanej wykonano 24 operacje CABG i 39 zabiegów angioplastyki. U 29 leczonych rozpoznano stabilną dławicę piersiową, u 19 niestabilną postać dławicy, u 15 ostry zawał mięśnia sercowego. W czasie pobytu w szpitalu zmarło trzech chorych. Powikłania okołozabiegowe wystąpiły u 18 chorych. W okresie obserwacji zmarło 6 osób, nawrót bądź utrzymywanie się bólów stenokardialnych obserwowano u 11 chorych po przebytej angioplastyce wieńcowej i u dwóch będących po zabiegu CABG. W grupie kontrolnej nie wystąpił ani jeden zgon, częstość innych powikłań była porównywalna z grupą badaną, w podgrupie chorych operowanych klasa CCS oceniana po roku była niższa niż w grupie badanej.

**Wnioski:** Leczenie zabiegowe choroby wieńcowej u chorych osiemdziesięcioletnich przynosi zadowalające rezultaty i obarczone jest akceptowalnym stopniem ryzyka.

**Słowa kluczowe:** osiemdziesięciolatek, choroba wieńcowa, PTCA, CABG

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