Efficacy of Primary Percutaneous Transluminal Coronary Angioplasty for Acute Myocardial Infarction in Patients Aged ≥ 80 Years

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Abstract

The therapeutic result of primary percutaneous transluminal coronary angioplasty (PTCA) in the elderly was assessed in 20 of 44 patients ≥ 80 years old (range 81—92 years, mean age 84 ± 3 years) with acute myocardial infarction who underwent primary PTCA and the results compared with 194 younger patients (< 80 years) who underwent primary PTCA during the same period. In-hospital prognosis, and long-term outcomes were investigated. Emergency coronary angiography was performed in 47.7% of the patients with acute myocardial infarction in the elderly group with 45.5% receiving primary PTCA. Primary PTCA was successful in 95.0% of the elderly group, showing no significant difference from the younger group. In-hospital mortality showed no significant difference between the elderly group and the younger group (5.0% vs 4.1%). However, the incidences of pump failure of the heart and bleeding complication requiring blood transfusion were higher in the elderly group during hospitalization. The 2-year survival rate for the elderly group was 82.5 ± 9.3%, which was better than previous studies.

These results suggest that primary PTCA has a good success rate in the elderly patients with acute myocardial infarction, and decreases the in-hospital mortality and improves the long-term outcome. However, this study was conducted retrospectively in a small group of patients. The efficacy of primary PTCA for the elderly remains to be clarified in a larger prospective trial.

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Key Words
■ Myocardial infarction, treatment (acute)　　■ Elderly
■ Angioplasty (primary percutaneous transluminal coronary angioplasty)

INTRODUCTION

The rapid increase in the elderly population in Japan has caused an increase in older patients with cardiovascular disease. It is of great importance to explore the most effective treatment for elderly patients with acute myocardial infarction (AMI), a condition characterized by high mortality. The PAMI study[1] demonstrated that primary percutaneous transluminal coronary angioplasty (PTCA) for AMI is therapeutically superior to thrombolytic therapy, showing markedly better survival rates for

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patients aged ≥ 70 years. Good results of primary PTCA have also been reported for elderly patients with AMI aged ≥ 80 years[2]. Accordingly, high survival rates can be expected for elderly patients with AMI treated with primary PTCA instead of thrombolytic therapy[3,4]. We studied the safety and efficacy of primary PTCA in patients with AMI aged ≥ 80 years.

SUBJECTS AND METHODS

Between January 1994 and July 1997, 265 patients with AMI were admitted within 24 hours after onset of chest pain to the Heart Center of St. Marianna University School of Medicine. Of these, 44 patients were ≥ 80 years of age. Primary PTCA was performed in 20 of 44 patients aged ≥ 80 years, and these 20 patients (range 81 to 92 years, mean age 84 ± 3 years) were designated the elderly group. Primary PTCA was also performed in 194 of 222 patients aged < 80 years (range 37 to 79 years, mean age 62 ± 10 years) during the same period and designated the younger group. The elderly group was retrospectively compared with the younger group in terms of in-hospital and long-term outcomes.

Criteria for emergency coronary angiography and primary angioplasty

At our hospital, patients with AMI aged < 75 years are usually treated with primary PTCA or thrombolytic therapy. On the other hand, patients with AMI aged ≥ 75 years are treated with primary PTCA or conservative therapy without thrombolysis due to the high risk of hemorrhagic complications after thrombolysis. All patients with evidence of AMI undergo emergency coronary angiography (CAG) after informed consent as long as there are no contraindications. Emergency CAG is performed using the following criteria : 1) Electrocardiographic evidence of AMI (ST elevation ≥ 0.1 mV in at least 2 contiguous leads) ; and 2) less than 24 hours since onset of chest pain compatible with AMI. The diagnosis of AMI is based on the CAG criteria together with a creatine kinase elevation of greater than 2 times normal.

Primary PTCA was performed for patients with Thrombolysis in Myocardial Infarction (TIMI)[4] grade 0− II. Successful primary PTCA was defined as a combination of TIMI grade III in the infarction-related coronary artery and < 50% stenosis after the procedure.

Procedures for emergency coronary angiography and primary angioplasty

Anticoagulant therapy consisted of a 5,000 U bolus of intravenous heparin, followed by continuous drip infusion of 10,000 to 15,000 U/day. If oral administration was possible, 81 mg of aspirin was given with a single additional intraarterial injection of 5,000 U of heparin before emergency CAG. Irrespective of recanalization outcomes, intraaortic balloon pumping (IABP) was used in patients with unstable hemodynamics and those failing to achieve a TIMI grade III rating for blood flow due to massive thrombosis or coronary dissection. Stents were implanted in patients with residual stenosis rates exceeding 50% after primary PTCA or with dissection or residual thrombosis.

Prognosis survey and statistical testing

After discharge from the hospital, a prognosis survey was conducted as of March 1, 1998. Questionnaires were mailed to patients who failed to come to the outpatient clinic. All values are expressed in mean ± standard deviation. Data were statistically analyzed for two-group comparison by Student's unpaired t-test for continuous figures and the χ^2 test for proportions. Life table analysis used the Kaplan-Meier method. The significance level cutoff was set at ≤ 5%.

RESULTS

Treatment selection for acute myocardial infarction in the elderly

Forty-four patients with AMI aged ≥ 80 years, who presented within 24 hours of the onset, were considered for recanalization therapy. Of these, 21 (47.7%) underwent emergency CAG, whereas the remaining 23 (52.3%) were treated medically without recanalization therapy. Three patients had severe non-cardiac disease (chronic renal failure or old cerebral infarction or colon cancer), 2 patients would not keep still during the procedure and others refused informed consent. Of the 21 patients who underwent emergency CAG, one with TIMI grade III was treated medically. The remaining 20 (45.5%) with TIMI grade 0− II were treated with primary PTCA.

Comparison of in-hospital prognosis between elderly and younger groups
1) Patient characteristics (Table 1)

Mean age was 84 ± 3 years for the elderly group

Table 1 Characteristics of elderly and younger patients

	Elderly ($\geq$ 80 yr)	Younger ($<$ 80 yr)	p value
No. of patients	20	194	
Age (yr)	84±3	62±10	
Range (yr)	81−92	37−79	
Male/female	12/8	152/42	0.11
Diabetes mellitus	2(10.0)	44(22.7)	0.19
Hyperlipidemia	2(10.0)	65(33.5)	0.031
Hypertension	6(30.0)	81(41.8)	0.31
Smoking	3(15.0)	88(45.4)	0.009
Killip class on admission			
I	7(35.0)	109(56.2)	
II	6(30.0)	52(26.8)	
III	5(25.0)	27(13.9)	0.049*
IV	2(10.0)	6(3.1)	
Hours to recanalization	8.1±6.1	9.3±7.0	0.58
Mean peak creatine kinase (IU/l)	3,078±3,162	3,030±2,173	0.95
Ejection fraction (%)	51±12	52±14	0.78

( ): %. Continuous values are mean±SD. *p=0.049 for the difference in the proportion of Killip class III or IV between the 2 groups.

Table 2 Angiographic characteristics and selection of interventional method in elderly and younger patients

	Elderly ($\geq$ 80 yr) (n=20)	Younger ($<$ 80 yr) (n=194)	p value
Angiographic characteristics			
Extent of CAD			
1 VD	10(50.0)	128(66.0)	
2 VD	8(40.0)	50(25.8)	0.34
3 VD	2(10.0)	16(8.2)	
Left main trunk	1(5.0)	1(0.5)	0.047
Target vessel			
Left anterior descending artery	9(45.0)	84(43.3)	
Left circumflex artery	1(5.0)	26(13.4)	0.55
Right coronary artery	10(50.0)	84(43.3)	
Interventional method			
Plain old balloon angioplasty	15(75.0)	162(83.5)	
Stent	5(25.0)	32(16.5)	0.34

( ): %.
CAD=coronary artery disease; VD=vessel(s) disease.

and 62 ± 10 years for the younger group. The elderly group were less likely to have a history of hyperlipidemia or smoking (10.0% vs 33.5%, p = 0.031; 15.0% vs 45.4%, p = 0.009, respectively). Seven patients in the elderly group and 33 patients in the younger group were in Killip class III or IV. The incidence of Killip class III or IV was higher in the younger group on admission (35.0% vs 17.0%, p = 0.049). There was no significant difference between the 2 groups in the time to recanalization, peak creatine kinase or ejection fraction.

2) Angiographic characteristics and interventional method (Table 2)

The elderly group were more likely to present

Table 3   Comparison of initial outcomes and in-hospital prognosis in elderly and younger patients

	Elderly ($\geq$ 80 yr) ($n=20$)	Younger ($<$ 80 yr) ($n=194$)	p value
PTCA success	19 (95.0)	164 (84.5)	0.21
In-hospital mortality	1 (5.0)	8 (4.1)	0.85
Urgent CABG	1 (5.0)	4 (2.1)	0.41
Acute or subacute occlusion	0	5 (2.6)	0.47
Repeated angioplasty	0	4 (2.1)	0.52
Cardiac complications			
Cardiogenic shock	2 (10.0)	3 (1.6)	0.017
Severe congestive heart failure	4 (20.0)	6 (3.1)	0.001
Forrester subset III or IV	9/18 (50.0)	40/146 (27.9)	0.048
Complete AV block	4 (20.0)	11 (5.7)	0.017
Sustained VT, Vf	2 (10.0)	12 (6.2)	0.51
Non-cardiac complications			
Bleeding requiring transfusion	4 (20.0)	8 (4.1)	0.003
Cerebrovascular accident	0	0	
Renal dysfunction requiring hemodialysis	0	2 (1.0)	0.65
Adjunctive treatments			
IABP	3 (15.0)	42 (21.6)	0.49
Respirator	4 (20.0)	6 (3.1)	0.001
Surgical vascular repair	1 (5.0)	0	0.002

( ): %.

PTCA = percutaneous transluminal coronary angioplasty; CABG = coronary artery bypass grafting; AV = atrioventricular; VT = ventricular tachycardia; Vf = ventricular fibrillation; IABP = intraaortic balloon pumping.

with left main trunk lesions (5.0% vs 0.5%, $p =$ 0.047). The infarct-related vessels were the left anterior descending artery in 9 patients (45.0%), the left circumflex artery in one (5.0%) and the right coronary artery in 10 (50.0%). In the younger group, the infarct-related vessels were the left anterior descending artery in 84 patients (43.3%), the left circumflex artery in 26 (13.4%) and the right coronary artery in 84 (43.3%). Stent implantation was required in 5 elderly (25.0%) and 32 younger patients (16.5%). There was no significant difference in the treatment rate of stent implantation.

3) In-hospital prognosis (Table 3)

The primary PTCA success rate was 95.0% for the elderly group and 84.5% for the younger group, without significant difference between the 2 groups. There was no significant difference in in-hospital mortality (5.0% vs 4.1%), coronary artery bypass grafting (CABG) (5.0% vs 2.1%), acute or subacute occlusion (0% vs 2.6%) or repeated angioplasty of the infarcted vessel (0% vs 2.1%).

Several cardiac complications were observed. The incidences of cardiogenic shock (10.0% vs

1.6%, $p = 0.017$), severe heart failure requiring prolonged hospitalization (20.0% vs 3.1%, $p =$ 0.001), and complete atrioventricular block (20.0% vs 5.7%, $p = 0.017$) were significantly higher in the elderly group than in the younger group. The non-cardiac complication of bleeding requiring blood transfusion was significantly higher in the elderly group (20.0% vs 4.1%, $p = 0.003$).

Some adjunctive treatments in addition to primary PTCA were performed. The incidences of respiratory management using respirators (20.0% vs 3.1%, $p = 0.001$) and complication at the puncture site requiring surgical repair (5.0% vs 0%, $p =$ 0.002) were significantly higher in the elderly group. There was no difference in the use of the IABP.

Long-term outcome of elderly patients primary angioplasty

Only one of the 20 elderly patients died during the hospital stay. Long-term outcome was assessed in all of the remaining patients. The mean follow-up period was 77 $\pm$ 52 weeks (range 12 – 184
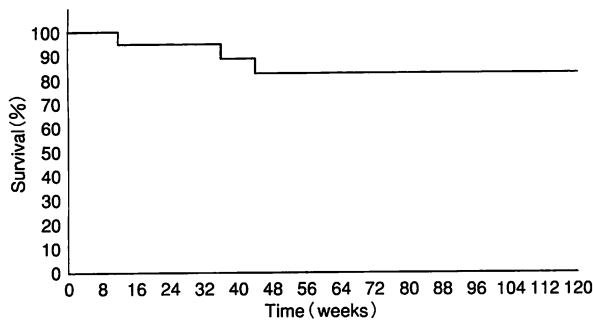
Fig. 1 Kaplan-Meier survival analysis demonstrated cumulative 2-year survival rate of 82.5 ± 9.3% in the elderly group

weeks). Three deaths occurred during follow-up due to cardiac accident (one patient), non-cardiac accident (one patient), and unknown (one patient). The cumulative survival rate for 2 years after discharge was $82.5 \pm 9.3\%$ (follow-up rate 100%; Fig. 1).

DISCUSSION

Our study supports the idea that primary PTCA for patients ≥ 80 years old is just as successful as primary PTCA in younger patients. Despite the high incidence of severe complications such as cardiogenic shock and heart failure, the in-hospital mortality was not different from that of the younger patients. However, the lower proportion (46%) of patients undergoing primary PTCA was a limitation in the treatment of elderly patients with AMI.

Present status of recanalization therapy for elderly patients with acute myocardial infarction

Although it is evident that recanalization therapy for elderly AMI patients lowers their mortality and improves their prognosis[5], recanalization therapy is performed less often in the elderly than in the young. Weaver et al.[3] reported that the treatment rate of intravenous thrombolytic therapy was significantly lower for patients ≥ 75 years old than younger patients (5% vs 29%, $p < 0.0001$), and that emergency CAG or primary PTCA rates were also significantly lower for patients > 75 years old (5% vs 22%, $p < 0.0001$). The data from the National Registry of Myocardial Infarction 2[4] revealed the mean age of patients without recanalization therapy was 71.3 years, which is significantly higher than the mean age of patients undergoing recanalization therapy (61.4 years). In our study,

patients who presented within 24 hours after onset of AMI were considered to be qualified for recanalization therapy. Even so, emergency CAG was performed in only 47.7% of patients ≥ 80 years old. This low rate for elderly AMI patients is probably because: 1) Elderly patients ≥ 65 years old are at increased risk of hemorrhagic complications thrombolytic therapy, 2) many elderly patients have a past history of hemorrhagic disease, 3) electrocardiography on admission often demonstrates no classic changes indicating AMI, thus delaying diagnosis until after the best time frame for recanalization therapy[3], 4) physicians tend to hesitate to perform invasive treatments in elderly patients.

Comparison of thrombolytic therapy and primary angioplasty for recanalization in the elderly

Elderly AMI patients ≥ 75 years old are reported to show less reduction in mortality than younger patients, even after thrombolytic therapy[6]. The relative utility of thrombolytic therapy for recanalization is considered to be low for the elderly[7]. The risk of hemorrhagic complications also discourages the use of thrombolytic therapy in the elderly. Devlin et al.[8] reported higher incidences of congestive heart failure and death in patients with AMI $\geq$ 76 years old , with no differences in the causes of death between the old and young. They suggested that impaired myocardial reserve may be the cause of death, and concluded that more aggressive recanalization strategies, such as PTCA and CABG, are necessary to improve the prognosis for elderly patients with AMI. In recent years, the advantage of primary PTCA over thrombolytic therapy has been demonstrated in the PAMI study[1] and the GUSTO IIb study[9]. The PAMI study showed a lower in-hospital mortality and lower incidence of nonfatal reinfarction with primary PTCA than with tissue-type plasminogen activator (t-PA) (12.0% vs 5.1%, $p = 0.02$), with a significantly lower in-hospital mortality and lower incidence of reinfarction in elderly patients aged ≥ 65 years old (8.6% vs 20.0%, $p = 0.048$). The GUSTO IIb study showed that primary PTCA, as compared with t-PA, resulted in no difference in mortality (5.7% vs 7.0%, $p = 0.37$) and lower incidences of reinfarction and disabling cerebral infarction (9.6% vs 13.1%, $p = 0.033$). However, in a community setting, Every et al.[10] reported that there was no difference between the 2 recanaliza-

tion strategies.

Efficacy of primary angioplasty for acute myocardial infarction in the elderly

Motomiya *et al.*[11] reported that the long-term life expectancy was better in patients with AMI ≥ 70 years old who had undergone successful primary PTCA than in those without recanalization therapy. However, comparison of thrombolysis with primary PTCA showed no difference in mortality, reinfarction or severe angina. On the other hand, Laster *et al.*[2] reported that primary PTCA performed in patients ≥ 80 years old achieved a success rate of 96%, an in-hospital mortality of 16%, and a 2-year survival rate of 67%, thus demonstrating better results than thrombolytic therapy or medical treatment. They also emphasized that the predictor of the in-hospital mortality was ejection fraction of the left ventricle and cardiogenic shock. Daida *et al.*[12] reported that only 26% of patients ≥ 80 years old were underwent PTCA and the 2-year survival rate was 52%. In our study, cardiogenic shock devel-

oped as a complication in 2 (10.0%) of the 20 elderly patients undergoing primary PTCA, but none died during hospitalization and the 2-year survival rate (82.5%) was better than the 2 previous studies. Because primary PTCA is effective against AMI complicated by cardiogenic shock, this therapy seems to improve the prognosis of the elderly patients with AMI complicated by cardiogenic shock. However, the possibility remains that the patients treated with primary PTCA were younger than the patients treated with conservative therapy in our study.

Study limitations

This study was conducted retrospectively in a small group of patients. Only 47.7% of the patients with AMI ≥ 80 years old who presented within 24 hours after onset underwent emergency CAG. This suggests a treatment bias during the decision for emergency CAG. Therefore, the efficacy of primary PTCA for the elderly remains to be clarified in a prospective larger scale trial.

──────── 要　　約 ────────

80歳以上の高齢者急性心筋梗塞症に対するPrimary経皮的冠動脈形成術の有効性

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80歳以上の高齢者急性心筋梗塞患者に対するprimary経皮的冠動脈形成術(PTCA)の有効性を検討した．対象は1994年1月-1997年7月に聖マリアンナ医科大学ハートセンターに入院した80歳以上の症例44例のうち，発症24時間以内でprimary PTCAを施行された20例(年齢81-92歳，平均年齢84±3歳；高齢者群)である．また，同期間にprimary PTCAを施行された80歳未満の194例(若年者群)を対照とし，初期成功率，院内予後および長期予後について後ろ向きに比較検討した．

緊急冠動脈造影は44例中21例(47.7%)に施行され，このうち20例(45.5%)にprimary PTCAが施行された．Primary PTCAの成功率は，高齢者群95.0%，若年者群87.8%で，両群間に有意差は認められなかった．高齢者群では若年者群に比べて，入院中の重大合併症(心原性ショック，重症心不全，完全房室ブロック)と輸血を要した出血性合併症の発生率が高率であった．院内死亡率は高齢者群5.0%，若年者群4.1%で，両群間に有意差はなかった．高齢者群の退院後2年間の累積生存率は82.5±9.3%であり，これまでの報告に比べて良好であった．

以上より，高齢者群においてもprimary PTCAが施行可能な症例の成功率は若年群と同等であり，primary PTCAの施行により高齢者群の院内死亡率を若年群と同程度まで低下させ，長期予後にも影響を与える可能性が示唆された．しかしながら，今回の検討は対象症例が20例と少ないため，primary PTCAの有効性を裏付けるためには，より多数例での前向きの検討が必要である．

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