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Acute Myocardial Infarction in Elderly Patients: Feasibility of Transradial Intervention and Rapid Mobilization

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Abstract

Objectives. Rapid mobilization and discharge following rapid acute phase reperfusion are recommended for elderly patients with acute myocardial infarction to achieve a better outcome and performance. The safety and efficacy of new and old treatment protocols were retrospectively compared for patients with acute myocardial infarction.

Methods. The new protocol used transradial intervention, encouraged stent implantation, β-blocker administration, and rapid mobilization for rapid discharge(10−14 day hospital stay). The previous protocol used transfemoral intervention, bed rest and late mobilization, and discouraged stent implantation and β-blocker supplementation. High risk patients with cardiogenic shock, left main disease, malignant arrhythmia and impending myocardial rupture were excluded from the study.

Results. Thirty-two patients were treated by the new protocol, and 57 patients by the old protocol. The former included more elderly patients($p < 0.05$). The prevalence of β-blocker use(63.3% vs 18.8%, $p < 0.001$)and stent implantation(43.8% vs 3.5%, $p < 0.05$)were higher in the new protocol group. Hospital stay(23.6 ± 9.5 vs 13.3 ± 5.9 days, $p < 0.001$)and intensive care unit stay(4.4 ± 3.0 vs 2.4 ± 1.2 days, $p < 0.001$)were shorter in the new protocol than in the old protocol group. Rates of in-hospital death, cardiac events, systemic complications and left ventricular function(left ventricular ejection fraction and left ventricular end-diastolic volume index at admission and discharge)were not significantly different between the 2 groups. The prevalence of systemic complications(including delirium)among patients older than 70 years was lower in the new protocol group(4.7% vs 11.7%, $p < 0.05$)

Conclusions. The new protocol can shorten hospital stay with no increase in in-hospital death or cardiac events, or decline of left ventricular function. Moreover, the new protocol is potentially effective for reducing systemic complications among elderly patients. Therefore, this protocol can be recommended for elderly patients with acute myocardial infarction.

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Key Words

■ **Myocardial infarction, treatment** ■ **Angioplasty(transradial intervention)**
■ **Beta-adrenergic receptor blockers** ■ **Elderly**

INTRODUCTION

The number of elderly patients with acute myocardial infarction(AMI)is growing rapidly[1]. The beneficial effects for the short and long-term prognosis of early reperfusion in AMI patients treated using acute phase interventional therapy, especially coronary angioplasty, are now well established. However, in the clinical setting, there is evidence that acute intervention is often less aggressively applied in elderly patients than in younger patients because of concerns about the risks of cerebral hemorrhage caused by thrombolytic agents or other complications of invasive treat-

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ment[2–6]. However, acute phase interventional therapy has been recommended for elderly AMI patients with evidence of favorable outcome[7,8]. Therefore, the optimal treatment strategy has not been established.

Recently, we reported some characteristics of elderly patients with AMI[9]. Acute intervention was performed less frequently, so the incidence of in-hospital death, pulmonary edema, cardiogenic shock and pneumonia were higher. About one-third of elderly patients were not good candidates for intensive treatment because of delirium. Of those treated, 28.9% were considered likely to be bed-ridden because of a pre-existing physical disability prior to hospitalization. In addition, many elderly patients had a poor support system. Therefore, self-help in daily life was considered a fundamental goal for most elderly patients[9].

These findings suggest that rapid and simple acute phase reperfusion, subsequent immediate mobilization and early discharge are recommended for elderly patients with AMI. Here, I describe a new protocol and investigation of its efficacy and safety.

METHODS

Study protocol

The object of the new protocol is immediate mobilization and early discharge. Except for delirious or completely bed-ridden patients, acute phase transradial intervention was performed on all elderly patients with AMI regardless of age. For suboptimal results, stent implantation was encouraged. At the beginning of interventional therapy, a dose of 10,000 U of heparin was supplied intravenously, followed by continuous drip infusion to maintain the activated coagulation time at about 150 sec for 2 or 3 days. All guiding catheters were 6 F size, and the guiding sheaths were removed immediately after successful revascularization. Angiotensin converting enzyme inhibitors (ACE-I) were supplied to all patients, and supplementation with β-blocking agents was encouraged. An indwelling catheter was not inserted. On the day of reperfusion, patients were allowed to sit on their bed immediately after sheath removal, compressing the puncture site with bandage. On the following day, they were allowed to use a commode, on the third hospital day, walking in the ward was allowed, and on the fifth day, the patients were permitted to walk around the hospital. Patients stayed in the intensive care unit until they were permitted to use a commode. Thereafter, discharge within 2 weeks was encouraged. The exclusion criteria were as follows: use of intraaortic balloon pumping, cardiogenic shock, left main trunk stenosis, suspected myocardial free wall rupture (pericardial effusion was evident on echocardiography), life-threatening malignant arrhythmias (ventricular tachycardia, ventricular fibrillation, advanced atrioventricular block), Killip's class II or worse, and more significant stenosis ($\geq$ 90% of American Heart Association classification) other than the infarction-related lesion. Any patient fulfilling one or more of these criteria was immediately excluded from the protocol.

Study patients

I retrospectively reviewed a series of 310 patients suffering from AMI admitted to Komoro Kosei General Hospital between January 1991 and December 1998. The new protocol was introduced in 1998 and applied in 32 cases (new protocol group). Among 47 patients with AMI during this year, acute phase reperfusion was not performed for 8 patients. Direct percutaneous transluminal coronary angioplasty was performed for 34 patients, although 2 patients were excluded because of cardiogenic shock. Five patients received other reperfusional therapy (systemic thrombolysis for 2, intracoronary thrombolysis for 2 or surgical reperfusion for 1). The new protocol group included the remaining 32 cases. Among 263 patients with AMI between 1991 and 1997, I excluded 91 patients with no reperfusion therapy or with reperfusion therapy other than successful direct balloon angioplasty (69 cases of systemic thrombolysis, intracoronary thrombolysis or rescue angioplasty and 6 cases of surgical reperfusion). Thereafter, I also applied the same exclusion criteria as the new protocol. The remaining 57 patients formed the controls (previous protocol group). The treatment strategy for this group is widely applied for AMI patients in Japan, *i.e.* acute phase transfemoral angioplasty and stent implantation limited to cases of threatened closure. Supplementation of heparin was performed as for the new protocol. All guiding catheters were 8 F size except 9 cases of 6 F and 2 cases of 7 F size. Sheaths were removed 6 to 12 hours after completion of interventional therapy, when the efficacy of bolus injected heparin was reduced. After manual compression, the puncture site was kept compressed by bandages for 4 (6 F) to

6(8 F)hours to establish hemostasis. Patients were encouraged to remain in bed completely for these hours. ACE-I supplement was recommended but the use of β-blocker was limited because of negative inotropic effects. Patients were encouraged to take rest and to mobilize themselves slowly during the 3 or 4 weeks of hospitalization. An indwelling catheter was inserted. On the day of reperfusion, patients were kept in bed even after hemostasis of the puncture site. On the second or third hospital day, they were allowed to sit, on the fourth or fifth hospital day, they were permitted to use a commode. Then they were moved out of the intensive care unit, and on the seventh hospital day, walking around the ward was allowed.

I retrospectively compared the following characteristics between the groups with reference to medical and nursing records: Left ventricular function evaluated using the Swan-Ganz method immediately after revascularization and left ventriculography both after revascularization and before discharge, in-hospital death, hospital stay, intensive care unit stay, in-hospital cardiac events(cardiac rupture, pulmonary edema, new cardiogenic shock, new intraaortic balloon pumping use, ventricular tachycardia or fibrillation, post infarction angina), and systemic complications(pneumonia, tracheal intubation, cerebrovascular disease, gastrointestinal bleeding, puncture site complication, blood transfusion, rehabilitation and delirium). The criteria for myocardial infarction were chest pain, electrocardiographic changes suggestive of infarction and/or ischemia, accompanied by an increase in myocardial escaped enzymes to at least twice the upper limit of the normal value. The patients were considered delirious when they required injection of tranquilizers for sedation.

Comparisons were made of all patients, and of only patients older than 70 years between the groups.

Statistical analysis

Variables are expressed as mean ± standard deviation. Categorical variables and frequency distribution patterns between the groups were compared using chi-square analysis. The distribution of continuous variables was examined by the unpaired *t*-test. $p < 0.05$ was considered significant.

RESULTS

Patient characteristics

Table 1 shows the demographic findings of the 2 groups. Patients in the new protocol group were older than those in the previous protocol group (69.4 ± 11.2 vs 63.6 ± 10.8 years old, $p < 0.05$), and the number of patients 70 years old or greater was higher in the new protocol group(50.0% vs 26.3%). Regarding coronary risk factors, the incidence of hypertension or smoking were higher in the previous protocol group($p < 0.05$, $p < 0.001$, respectively), and diabetes was more frequent in the new protocol group($p < 0.05$). The incidence of previous myocardial infarction and previous cerebrovascular disease, site of index infarction and number of diseased vessels were not different between the groups. The infarction-related artery was the left anterior descending artery more frequently in the previous protocol group. Time to revascularization, Killip's classification on admission and the incidence of subacute phase revascularization for lesions other than infarction-related lesions were not significantly different. The incidence of β-blocker use and stent deployment were higher in the new protocol group due to the regulations of the protocol. The β-blockers used were oral carvedilol, oral metprolol or intravenous propranolol. ACE-I, enalapril, captopril or temocapril were administered orally.

New protocol and in-hospital outcome

Table 2 shows the in-hospital outcome of both groups. There were no differences between the acute phase left ventricular function of both groups according to Forrester's subset, left ventricular ejection fraction, or left ventricular end-diastolic volume index. Peak value of creatine kinase and C-reactive protein on admission were not different between the groups.

Hospital stay was shorter in the new protocol group than in the previous protocol group(13.3 ± 5.9 vs 23.6 ± 9.5 days, $p < 0.001$). In addition, intensive care unit stay was shorter in the new protocol group(2.4 ± 1.2 vs 4.4 ± 3.0 days, $p < 0.001$).

There were 2 in-hospital deaths in the new protocol group(6.3%)and 4 in the previous protocol group(7.5%). The incidence was not significantly different. The 2 patients from the new protocol group who died were over 70 years old. One patient

Table 1 Comparison of clinical characteristics between the new protocol group and previous protocol group

	New protocol (n=32)	Previous protocol (n=57)	p value
Age (yr)	69.4±11.2	63.6±10.8	<0.05
Gender (male/female)	23/9	41/23	NS
Aged (≥70 years)	16 (50.0)	15 (26.3)	<0.05
Coronary risk factors			
Hypercholesterolemia	12 (37.5)	14 (24.6)	NS
Hypertriglyceridemia	11 (34.4)	14 (24.6)	NS
Low high-density lipoprotein	14 (45.2, n=31)	24 (54.5, n=44)	NS
Diabetes mellitus	17 (56.7, n=30)	19 (34.5, n=55)	<0.05
Hypertension	10 (33.3, n=30)	32 (56.1)	<0.05
Smoking	9 (30.3, n=30)	34 (61.8, n=55)	<0.001
Previous myocardial infarction	1 (3.1)	4 (7.0)	NS
Previous cerebrovascular disease	1 (3.1)	4 (7.0)	NS
Site of infarction			NS
Anterior, anteroseptal	10 (31.3)	31 (54.4)	
Broad anterior	1 (3.1)	3 (5.3)	
Inferior, inferoposterior	16 (50.0)	13 (28.1)	
Posterior, lateral	5 (15.6)	7 (12.2)	
Number of diseased vessels			NS
1	20 (62.5)	45 (78.9)	
2	12 (37.5)	7 (12.3)	
3	0	5 (8.8)	
Infarction-related artery			<0.05
LAD	11 (34.4)	36 (63.2)	
RCA	15 (46.8)	17 (29.8)	
LCX	6 (18.8)	3 (5.3)	
SVG	0	1 (1.7)	
Time to revascularization (min)	335.8±283.7	272.4±252.5	NS
Killip's classification			NS
Ⅰ	31 (96.9)	56 (98.2)	
Ⅱ	1 (3.1)	1 (1.8)	
Ⅲ	0	0	
Ⅳ	0	0	
Subacute phase revascularization	3 (9.4)	3 (5.3)	NS
Medication	n=30	n=48	
Diuretics	4 (13.3)	8 (16.7)	NS
Nitrates	29 (96.7)	48 (100)	NS
ACE-I	26 (86.7)	42 (87.5)	NS
Calcium-antagonists	6 (20.0)	11 (22.9)	NS
Beta-blockers	19 (63.3)	9 (18.8)	<0.001
Digitalis	2 (6.7)	2 (4.2)	NS
Antiplatelets	29 (96.7)	48 (100)	NS
Stent deployment	14 (43.8)	2 (3.5)	<0.05

Continuous values are mean±SD. ( ) : %.
LAD=left anterior descending artery; RCA=right coronary artery; LCX=left circumflex artery; SVG=saphenous vein graft; ACE-I=angiotensin converting enzyme inhibitor.

Table 2 Comparison of outcome between the new protocol group and previous protocol group

	New protocol (*n*=32)	Previous protocol (*n*=57)	*p* value
Forrester's classification	*n*=23	*n*=53	NS
Ⅰ	18(78.3)	41(77.4)	
Ⅱ	2(8.7)	5(9.4)	
Ⅲ	2(8.7)	6(11.3)	
Ⅳ	1(4.3)	1(1.9)	
LVEF			
Acute phase(%)	52.7±16.0(*n*=10)	53.0±14.3(*n*=23)	NS
At discharge(%)	54.0± 9.9(*n*=10)	54.6±12.1(*n*=23)	NS
LVEDVI			
Acute phase(m*l*/m²)	122.7±22.3(*n*=10)	152.2±46.3(*n*=23)	NS
At discharge(m*l*/m²)	152.2±46.3(*n*=10)	151.2±42.4(*n*=23)	NS
CRP on admission(mg/d*l*)	0.4±0.6	0.9±2.7	NS
Peak CK value(IU)	2,479.4±2,388.7	3,187.1±2,475.8	NS
Hospital stay(days)	13.3±5.9	23.6±9.5	<0.001
ICU stay(days)	2.4±1.2	4.4±3.0	<0.001
In-hospital death	2(6.3)	4(7.5)	NS
Cardiac events			
IABP use	2(6.3)	9(15.8)	NS
Cardiac rupture	0	0	NS
Pulmonary edema	2(6.3)	3(5.3)	NS
Shock	0	1(1.8)	NS
VT, Vf	2(6.3)	5(8.8)	NS
Post infarction angina	2(6.3)	5(8.8)	NS
Total (mean incidence)	8(4.2)	23(6.7)	NS
Systemic complication			
Pneumonia	1(3.1)	4(7.0)	NS
Tracheal intubation	1(3.1)	3(5.3)	NS
New CVD	0	0	NS
Gastrointestinal bleeding	0	1(1.8)	NS
Puncture site complication	1(3.1)	1(1.8)	NS
Blood transfusion	0	1(1.8)	NS
Rehabilitation	0	1(1.8)	NS
Delirium	4(12.5)	6(10.5)	NS
Total (mean incidence)	7(2.7)	17(3.7)	NS

Continuous values are mean±SD. ( ): %.
LVEF=left ventricular ejection fraction; LVEDVI=left ventricular end-diastolic volume index; CRP=C-reactive protein; CK=creatine kinase; ICU=intensive care unit; IABP=intraaortic balloon pumping; VT=ventricular tachycardia; Vf=ventricular fibrillation; CVD=cerebrovascular events.

suddenly developed electromechanical dissociation and died 4 days after stenting for broad anterior acute myocardial infarction. The other patient died from ventricular fibrillation 10 days after stenting for anteroseptal infarction. Since neither autopsy nor coronary angiography were performed, the exact cause of death was not clarified, especially concerning stent thrombosis or myocardial rupture.

Among the 4 patients from the previous protocol group who died, 3 were older than 70 years old. All died of intractable pneumonia. The first patient with broad anterior infarction developed pulmonary edema after successful angioplasty. She was complicated by prerenal renal failure and pneumonia,

then died of respiratory failure, gastrointestinal hemorrhage or disseminated intravascular coagulation. The second patient suffered from coughing and sputum during bed rest after angioplasty for anteroseptal infarction. Pneumonia caused by methicillin-resistant *Staphylococcus aureus* developed. The third patient with previous cerebral infarction suffered from aspiration pneumonia during bed rest after angioplasty for inferior infarction. The other patient was under 70 years old, and died from infectious bowel disease complicated by endotoxic shock, pneumonia and multi-organ failure.

Regarding cardiac events, the incidence of additional intraaortic balloon pumping in the previous protocol group was higher than in the new protocol group, but not statistically significant. No significant differences were observed between the incidence of other cardiac complications in both groups. There were no differences between left ventricular ejection fraction or left ventricular end-diastolic volume index in the acute phase and before discharge between the groups.

Although pneumonia tended to be more common in the previous protocol group, there were no differences between the incidence of systemic complications. In spite of early mobilization, the rate of delirium did not decrease in the new protocol group.

Comparison of elderly patients

There were 16 elderly patients($\geq$70 years old) in the new protocol group(50.0%)and 15 in the old protocol group(26.3%). Comparison of the 2 protocols in these patients only is shown in **Tables 3, 4**.

The incidence of diabetes was higher in the new protocol group, and the rate of hypertension was higher in the previous protocol group. The incidence of β-blocker use or stent deployment was higher in the new protocol group. Hospital stay and intensive care unit stay were shorter in the new protocol group. The rate of in-hospital death did not differ significantly. The incidence of cardiac events was similar in both groups. The rate of systemic complications tended to decrease in the new protocol group, although the differences were not significant. However, the mean of the incidence of systemic complications including delirium was smaller in the new protocol group(4.7% vs 11.7%)

DISCUSSION

The findings of this study indicate 2 important points. First, the new protocol allows shorter hospital stay and intensive care unit stay without increases in in-hospital death or cardiac events. In spite of early mobilization, harmful effects on the remodeling of the left ventricle, or enlargement of the cavity, can be avoided. Second, the new protocol may be effective for reducing the incidence of systemic complications in elderly patients.

Death from ischemic heart disease has been increasing. In 1996, 57.6 per hundred thousand people died from this disease in Japan and most were elderly[1)]. The elderly population is increasing rapidly and this increase is expected to become more pronounced. Thus, an optimal treatment strategy for elderly patients with AMI should be established without delay.

Historical perspectives

The efficacy and importance of acute phase interventional therapy are widely accepted as this treatment has improved the outcome of AMI. However, most megatrials did not include elderly patients. Even if they were not excluded, the efficacy of the acute intervention was considered to be limited because of the side effects of thrombolytic drugs. Moreover, the life expectancy of elderly patients is limited, and the complication rate of the invasive treatment is relatively high. Thus, acute interventional therapy has not been performed frequently in elderly patients with AMI[3−5)].

Some recent investigations indicate that the efficacy of acute phase reperfusion improves the prognosis for elderly and for relatively younger patients[10−14)]. Therefore, this infrequent use of acute phase interventional therapy for elderly AMI on account of old age alone is sometimes emphasized and unreasonable[4,6,10−14)]. Thus, the significance of acute reperfusion therapy for elderly patients with AMI should be reevaluated.

Physiological and social problems of elderly patients

Based on our experience, 32.9% of elderly AMI ($\geq$70 years old)are considered likely to be bedridden because they already had physical disabilities at admission[9)]. Longer bed rest, cardiac events or systemic complications accelerate this loss of activity. In addition, 30% of elderly patients suffer

Table 3 Comparison of clinical characteristics of the elderly patients（≥70 years）between the new protocol group and previous protocol group

	New protocol (*n*=16)	Previous protocol (*n*=15)	*p* value
Age（yr）	78.5±6.4	77.3±4.0	NS
Gender（male/female）	12/4	9/6	NS
Coronary risk factors			
Hypercholesterolemia	2（12.5）	2（13.3）	NS
Hypertriglyceridemia	5（31.3）	1（ 6.7）	NS
Low high-density lipoprotein	6（40.0, *n*=15）	6（54.5, *n*=11）	NS
Diabetes mellitus	9（60.0, *n*=15）	3（27.3, *n*=14）	＜0.05
Hypertension	3（21.4, *n*=14）	9（60.0）	＜0.05
Smoking	2（14.3, *n*=14）	5（33.3）	NS
Previous myocardial infarction	1（ 6.7）	2（15.4）	NS
Previous cerebrovascular disease	0	1（ 6.7）	NS
Site of infarction			NS
Anterior, anteroseptal	6（37.5）	6（40.0）	
Broad anterior	1（ 6.2）	1（ 6.7）	
Inferior, inferoposterior	7（43.8）	7（46.6）	
Posterior, lateral	2（12.5）	1（ 6.7）	
Number of diseased vessels			NS
1	10（62.5）	13（86.6）	
2	6（37.5）	1（ 6.7）	
3	0	1（ 6.7）	
Infarction-related artery			NS
LAD	7（43.8）	7（46.7）	
RCA	7（43.8）	7（46.7）	
LCX	1（ 6.2）	1（ 6.6）	
SVG	1（ 6.2）	0	
Time to revascularization（min）	319.7±244.9	353.2±345.0	NS
Killip's classification			NS
Ⅰ	15（93.8）	15（100）	
Ⅱ	1（ 6.2）	0	
Subacute phase revascularization	0	2（13.3）	NS
Medication	*n*=14	*n*=10	
Diuretics	1（ 7.1）	1（10.0）	NS
Nitrates	13（92.9）	10（100）	NS
ACE-I	12（ 8.7）	7（70.0）	NS
Calcium-antagonists	3（21.4）	3（30.0）	NS
Beta-blockers	7（50.0）	0	＜0.01
Digitalis	0	1（10）	NS
Antiplatelets	13（92.9）	10（100）	NS
Stent deployment	9（56.3）	1（ 6.7）	＜0.01

Continuous values are mean±SD. （ ）: %.
Abbreviations as in Table 1.

from delirium which occurred during the treatment process[9]. Insertion of intraaortic balloon pumping or indwelling catheter, venous cannulation, or use of physical restraints has been considered to exacerbate delirium[15].

Moreover, 8.4% of the elderly patients live alone, 21% with an elderly spouse, 30.1% are widows or widowers and 4.9% have a disabled

Table 4 Comparison of the outcome for elderly patients (≥70 years) between the new protocol group and previous protocol group

	New protocol (n=16)	Previous protocol (n=15)	p value
Forrester's classification	n=11	n=14	NS
Ⅰ	9(81.8)	8(57.1)	
Ⅱ	0	2(14.3)	
Ⅲ	1(9.1)	3(21.4)	
Ⅳ	1(9.1)	1(7.2)	
CRP on admission (mg/dl)	0.4±0.7	1.6±3.0	NS
Peak CK value (IU)	2,438.0±2,968.4	3,012.7±2,521.1	NS
Hospital stay (days)	12.3±5.4	25.0±12.2	<0.005
ICU stay (days)	2.9±1.4	5.7±3.9	<0.05
In-hospital death	2(12.5)	3(20.0)	NS
Cardiac events			
IABP use	2(12.5)	3(20.0)	NS
Cardiac rupture	0	0	NS
Pulmonary edema	2(12.5)	2(13.3)	NS
Shock	0	1(6.7)	NS
VT, Vf	2(12.5)	2(13.3)	NS
Post-infarction angina	1(6.3)	1(6.7)	NS
Total (mean incidence)	7(7.3)	9(10.0)	NS
Systemic complication			
Pneumonia	1(6.3)	3(20.0)	NS
Tracheal intubation	1(6.3)	2(13.3)	NS
New CVD	0	0	NS
Gastrointestinal bleeding	0	1(6.7)	NS
Puncture site complication	0	1(6.7)	NS
Blood transfusion	0	1(6.7)	NS
Rehabilitation	0	1(6.7)	NS
Delirium	4(25.0)	5(33.3)	NS
Total (mean incidence)	6(4.7)	14(11.7)	<0.05

Continuous values are mean±SD. ( ) : %.
Abbreviations as in Table 2.

spouse[9]. These patients constitute a considerable subgroup of patients with AMI, but receive poor support from outside the home and are compelled to be self-reliant. Thus, longer bed rest and hospital stay, which potentially makes the patients bedridden or aggravates their inactivity, should be avoided. Therefore, non-restrained treatment is desirable and efforts to maintain the performance status should be encouraged in managing elderly patients with AMI.

Concepts and devices of the new protocol

Based on these considerations, the new protocol was planned for immediate mobilization, early discharge and the maintenance of activity. To achieve this objective, a reduction of the risk of acute phase complication was important.

The efficacy of direct coronary angioplasty for AMI is now well established. For a wide spectrum of the disease, this treatment provides good patency of the infarction-related artery and improves the prognosis[16−20]. Stent implantation is encouraged for suboptimal results to confirm patency of the artery[21]. Recently, angioplasty and stent implantation have become safe and the success rate is acceptable[22]. Moreover, complications of thrombolytic agents such as cerebral hemorrhage[16−18,23,24] or increase of myocardial rupture[25−28] can be avoid-

ed by these treatments.

Early mobilization is potentially harmful because it increases cardiac work which could result in excess cardiac complications. Therefore, supplement of ACE-I and β-blocking agents are key points of this protocol. Inhibition of the renin-angiotensin system by ACE-I suppresses left ventricular remodeling after AMI and reduces the rate of heart failure[29,30]. The beneficial effect is the same for elderly patients[31−33]. β-blockers reduce the number of in-hospital deaths or reinfarctions[34]. However, supplementing these drugs has been discouraged for elderly patients because of the negative inotropic and chronotropic effects[3,5]. Some investigations indicated that this was one of the reasons for the poor prognosis in elderly AMI patients, and recommended the use of this drug routinely[35]. From this standpoint, we encourage β-blocker use in the new protocol.

Efficacy of transradial intervention

Transradial intervention, which was introduced by Kiemeneij *et al.*[36,37], has the same success rates as traditional transfemoral intervention[38]. Low puncture site complication rate, the absence of risk of injury to nerves or veins, and the convenience of hemostasis indicate the superiority of this method[38]. Moreover, transradial intervention is considered better than the transfemoral approach for elderly patients for early mobilization, because bed rest after sheath removal is not necessary. Long bed rest is considered to be one of the risk factors of immobility for elderly patients because it sometimes causes disuse muscle weakness, constriction of joints or reactive delirious state[39]. Moreover, as our cases of death in the previous protocol show, it sometimes results in aspiration, reduced vital capacity, and finally intractable pneumonia. Therefore, I think that transradial intervention is the most suitable catheter approach method for elderly AMI patients and I recommend it in the new protocol.

Problems of the protocol

In this study, the new protocol provided shorter hospital and intensive care unit stay. Although they are results from the rules of this protocol, it should be emphasized that no increase in in-hospital death, cardiac events or harmful effects on left ventricular remodeling was evident. Therefore, the new protocol is considered safe and effective for relatively low risk elderly patients suffering from AMI.

However, the new protocol was ineffective for avoiding systemic complications or delirium. The limited analysis of the elderly patients showed the mean rate of systemic complications including delirium was lower in the new protocol group. Thus, the protocol may be effective for avoiding systemic complications in the elderly. Further investigations should be performed. According to the report of Inouye *et al.*[40], delirium occurred in 9.9% of hospitalized elderly patients despite multicomponent strategy for its prevention. Therefore, it may be impossible to avoid delirium completely in the elderly.

Moreover, from the analysis of cases of death, it becomes clear that the prognosis remains difficult in severely complicated cases such as impaired left ventricular function or pneumonia. In addition, the risk of subacute stent thrombosis exists in the new protocol. The cause of death in the cases in the new protocol group may have resulted from this complication. Therefore, it should be emphasized that the new protocol has several limitations.

Study limitations

This investigation is not prospective, and the number of subjects was small. There are some differences between both protocols, not only in the style of intervention, but also the incidence of β-blocker use, mobilization schedule and the incidence of stent deployment. Therefore, it is difficult to point out the most important factor which provides the superiority of the new protocol. A prospective, controlled direct comparison should be performed. The new protocol was applied only for uncomplicated, low risk cases, so severely impaired cases requiring circulation support or mechanical ventilation were excluded. A strategy that enables immediate mobilization and early discharge of complicated patients has not been established.

Analysis from an economical standpoint was not performed in this study. However, previous investigations suggest the beneficial effect of transradial intervention or early mobilization to reduce costs[41,42]. The effect of the new protocol, which shortens hospital stay, is expected to result in a reduction of cost.

Future perspectives

Although the safety and efficacy of early discharge after direct coronary angioplasty for low

risk patients with AMI has already been reported[42], relatively slow mobilization and long hospital stay are still considered the standard therapy for AMI in Japan. For example, 78.7% of patients with AMI were hospitalized for more than 3 weeks despite acute phase interventional therapy in 1999[43]. However, from the findings of this study, early mobilization and early discharge within 2 weeks should be accepted as a safe and effective method for elderly patients. Some devices in the new protocol such as acute phase revascularization with transradial intervention or β-blocker supplements are recommended to achieve success.

CONCLUSIONS

I investigated the efficacy of the new protocol in which transradial intervention and immediate mobilization were recommended. According to this protocol, it was possible to shorten the hospital stay without an increase in in-hospital death, cardiac events or systemic complications. Moreover, the protocol is considered potentially effective for avoiding systemic complications in elderly patients. In conclusion, the protocol could be accepted as a standard treatment strategy for elderly patients with AMI.

要　　約

高齢者の急性心筋梗塞: 経橈骨動脈血行再建と早期離床の有用性

篭島　充

目　的: 高齢者の急性心筋梗塞の予後の改善と患者の活動性保持のためには，積極的な急性期血行再建と早期離床，早期退院が望ましい．今回，急性心筋梗塞自験例を対象に，新プロトコルを試み，その安全性と有用性に関して後ろ向き研究を行った．

方　法: 新プロトコルは経橈骨動脈インターベンション，積極的ステント留置，β遮断薬投与，早期離床，早期退院(10−14日までに退院)を主な内容とし，比較の対照は経大腿動脈インターベンション，安静臥床を主とし，ステント留置，β遮断薬投与に消極的立場をとる旧プロトコルで治療した症例である．心原性ショック，左冠動脈主幹部梗塞，悪性不整脈合併，切迫破裂などの高リスク症例は除外した．

結　果: 新プロトコルは32例，旧プロトコルは57例で，前者で年齢が高く($p<0.05$)，70歳以上の症例の割合が多かった($p<0.05$)．新プロトコルでβ遮断薬の使用例とステント留置例が多かった(それぞれ63.3% vs 18.8%，$p<0.001$; 43.8% vs 3.5%，$p<0.05$)．新プロトコルは入院日数を23.6±9.5から13.3±5.9日に短縮し($p<0.001$)，集中治療室在室日数を4.4±3.0から2.4±1.2日に短縮した($p<0.001$)．院内死亡率，心事故，全身合併症の発生率に差はなく，血行再建直後，および退院時の左室拡張末期容積，左室駆出率にも差がなかった．70歳以上の高齢者に限って検討すると，せん妄を含めた全身合併症発生率は新プロトコルで有意に低かった(4.7% vs 11.7%，$p<0.05$)．

結　論: 以上より，新プロトコルは低リスクの急性心筋梗塞症例に対して院内死亡や心事故を増やさず，心機能に悪影響を及ぼさずに入院期間を短縮できると考えられた．さらに高齢急性心筋梗塞症例に対しては，全身合併症を減少できる可能性がある点で新プロトコルのほうが優れており，積極的に用いるべき方法と考えられた．

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