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What is the optimal length of stay in hospital for ST elevation myocardial infarction treated with primary percutaneous coronary intervention?

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Abstract

Backgound: *The aim of this study was to evaluate the safety and practicality of very early (within 48 h) discharge with long-term follow-up results, and to define an optimal length of stay in hospital for patients with ST elevation myocardial infarction (STEMI) according to their demographic characteristics and risk assessment.*

Methods: *A total of 267 patients with STEMI successfully treated with primary coronary intervention were retrospectively analyzed. Patients was divided into four groups according to length of hospitalization: 24 hours, 48 hours, 72 hours, and more than 72 hours. The groups were compared in terms of the patients' demographic and clinical characteristics, short- and long-term follow-up results, mortality, revascularization and major adverse cardiac events (MACE).*

Results: *More than two thirds of the patients were discharged within 48 hours (68.9%). No difference was observed between groups in terms of one month and one year MACE and one year restenosis. However, one month restenosis was slightly higher in the fourth group. At the end of the first year, there had been only four deaths, and these were in the third and fourth groups. There were no deaths among patients discharged within 48 hours. Killip class, left ventricular ejection fraction, multi-vessel disease and diabetes were the major determinants of length of stay in hospital.*

Conclusions: *Very early discharge is safe and feasible and does not increase the mortality rate. Uncomplicated STEMI patients with single vessel disease could be discharged after 24 hours. Patients with multi-vessel disease classified in the low risk group could be discharged after 48 hours.* (Cardiol J 2011; 18, 4: 378–384)

Key words: myocardial infarction, primary intervention, early discharge

Introduction

Length of stay in hospital for acute ST elevation myocardial infarction (STEMI) has gradually shortened over the last 40 years [1]. However, there is no clear consensus or guidelines for the optimal length of hospital stay for patients with STEMI. The duration changes according to individual cardiology clinic or physician. Although average hospital stays range from two to ten days, several recent

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studies have shown the possibility of early discharge of low-risk acute myocardial infarction (MI) patients [1–4]. In this present study, we aim to evaluate early and late outcomes of very early discharge, so as to test the feasibility and safety of early discharge and define an optimal length of hospital stay according to risk assesment and clinical characteristics of STEMI patients.

Methods

Patient population

From December 2006 to September 2009, a total of 267 consecutive patients with acute STEMI treated by primary percutenous coronary intervention (PCI) were included. Patients were evaluated retrospectively and information was entered into a computer database. All the patients were followed up for a year, and their one month and one year control examinations were inspected.

Patient selection, procedure and protocol

All the patients with acute STEMI who had been successfully treated with primary PCI were included in our study. A percutaneous femoral approach with a 6 French arterial sheath was used in 94% of the patients, while a transradial artery approach with a 6 French arterial sheath was used in the other 6%. The radial artery sheath was immediately removed after the procedure. The femoral arterial sheath was removed six hours after the procedure to allow clotting time, with manual compression being performed subsequently. Heparin 120 IU/kg was administered before the primary PCI and 0.1 U/kg enoxaparine was adninistered twice a day for at least three days. Acetylsalicylic acid (300 mg) was given as initial therapy and continued for one month, whereupon the dosage was lowered to 100 mg. Clopidogrel was given to all patients at a 600 mg loading dose at the start of PCI and all the patients were maintained on clopidogrel 75 mg a day for at least two months. A drug-eluting stent was used in only seven patients, with clopidogrel being continued for a year in this group. Patients who received adjunctive tirofiban therapy were given continuous tirofiban infusion for 24 hours after a loading dose (the loading dose was given during PCI: 10 g/kg; maintenance dose: 0.15 g/min). Beta-blockers, ACE inhibitors and statins were also given to all patients, unless contraindicated.

Patients was divided into four groups according to length of stay in hospital: 24 hours, 48 hours, 72 hours, and more than 72 hours. Discharge within 48 hours (Groups 1 and 2) was defined as very early discharge. Group 1 patients were discharged directly from the coronary intensive care unit. Patients from other groups were discharged from the cardiology service. Our cardiac center has a policy of discharging uncomplicated acute STEMI patients within 48 hours. Although the patients were evaluated retrospectively, and a definitive early discharge protocol had not been proposed initially, more than half of the patients were in the 24 or 48 hours groups and our policy gives the opportunity to assess early discharge effectively. Patients who underwent immediate by-pass surgery were included in the more than 72 hours group. All the patients were followed up by three staff cardiologists working in collaboration. Thus, all the patients were given standardized medical therapy according to clinical guidelines during the follow-up period.

Definitions

Standard 12-lead electrocardiograms were performed for all patients. Acute STEMI was defined as typical chest pain lasting more than 30 min with ST-segment elevation > 1 mm in at least two consecutive precordial or inferior leads, or chest pain with new onset of complete left bundle branch block. Procedural success was defined as a reduction to residual stenosis of < 20% by balloon angioplasty and stent procedure followed by Thrombolysis in Myocardial Infarction (TIMI) grade 2–3 flow in the infarct related artery (IRA). Multi-vessel disease was defined as a stenosis of >50% of two major epicardial coronary arteries. Left ventricular ejection fraction was assessed by echocardiography which was performed after primary PCI in the coronary intensive care unit. Left ventricular ejection fraction (LVEF) was measured using Simpson's method and the Teicholtz formula with a GE Vivid 3 echocardiograpy device. All the patients were classified according to heart failure (HF) signs and blood pressure as being in Killip class 1, 2, 3 or 4 on initial examination. Killip class 1 patients had no evidence of HF; Killip class 2 patients had mild HF with rales involving one third or less of the posterior lung fields and systolic blood pressure of 90 mm Hg or higher; Killip class 3 patients had pulmonary edema with rales involving more than one third of the posterior lung fields and systolic blood pressure of 90 mm Hg or more; and Killip class 4 patients had cardiogenic shock with any rales and systolic blood pressure of less than 90 mm Hg. Mortality was defined as death of patient within the first year due to cardiac etiology, and also sudden death

of patient without contact with the healthcare system and with possible cardiac predisposition.

Study end-points

Death, reinfarction, and revascularization of infarct related artery were primary end-points. Defining an optimal length of stay in hospital according to a patient's demographic and clinical characteristics was a secondary end-point.

Outpatient care and follow-up

All patients were told to look for signs of recurrent ischemia, and seven days' rest was suggested. Patients were advised to call the clinic immediately in case of chest pain, palpitations, dyspnea or any adverse symptoms. Clopidogrel therapy was given to all patients for at least two months in whom a bare metal stent had been implanted. All the patients also recieved acetylsalicylic acid, beta-blockers, ACE inhibitors and/or angiotensin receptor blockers and statins unless absolutely contraindicated. An exercise stress test was performed for patients who defined chest pain at one month follow-up. Eventually this test was performed on 70% of the patients at the one year control examination, with only 10% of patients being evaluated by phone call. The other 20% of patients were evaluated via anamnesis and physical examination alone.

Statistical analysis and approval of study

Statistical analyses were performed using SPSS 15.0 (SPSS Inc., Chicago, IL, USA) software. Descriptives of the parameters are quoted as mean ± SD and 95% confidence intervals (CI). The unpaired *t*-test was used for continuous variables between groups, while continuous variables were compared using the Student *t* test. The relationships between length of hospital stay and categorical factors were analyzed by the χ^2 test and Fisher's exact test, and Kruskal-Wallis test was used for the correlation between non-categorical variables and hospitalization interval. In addition, binary logistic regression analysis in the multivariate analysis was performed to detect independent factors predicting length of hospital stay. The early discharged group was compared to the other two groups in the multivariate regression analysis. Regression analysis was also performed to demonstrate predictors of mortality and major adverse cardiac events (MACE). All p values were two-sided in tests and p values of less than 0.05 were considered to be statistically significant.

The study was approved by the Ethics Committee of our hospital.

Table 1. Baseline demographic characteristics, clinical features, length of hospital stay and follow-up results of patients (n = 267).

Age (years)	54.8 ± 11.3
Range (years)	26–88
Male	230 (86.1%)
Female	37 (13.9%)
Diabetes mellitus	67 (25.1%)
Hypertension	139 (52.1%)
Previous MI	25 (9.4%)
Previous stroke	1 (0.4%)
Dyslipidemia	129 (48.3%)
Current smoking	185 (69.3%)
Family history	45 (16.9%)
Killip classification:	
1	219 (82%)
2	34 (12.7%)
3	13 (4.9%)
4	1 (0.4%)
Ejection fraction (%)	52.4 ± 8.7
Infarct related artery:	
LAD	123 (46.1%)
CX	52 (19.5%)
RCA	90 (33.7%)
DX	2 (0.7%)
Hospital stay:	
24 hours	90 (33.7%)
48 hours	94 (35.2%)
72 hours	46 (17.2%)
> 72 hours	37 (13.9%)
Multi-vessel disease	154 (57.7%)
Pseudoaneurysm	1 (0.4%)
Acute thrombosis	1 (0.4%)
Restenosis at one month	8 (3%)
Angiography at one month	30 (11.2%)
Restenosis at one year	27 (10.1%)
Angiography at one year	47 (17.6%)
CABG related to restenosis	10 (3.7%)
Mortality	4 (1.5%)

MI — myocardial infarction; LAD — left anterior descending artery; CX — circumflex artery; RCA — right coronary artery; DX — diagonal artery; CABG — coronary artery by-pass graft surgery

Results

Baseline demographic and clinical characteristics of patients are summarized in Table 1. The mean age was 54.8 ± 11.3 years, ranging from 26 to 88, and 206 (86.1%) of the patients were male. Although the great majority of patients (90.6%) had no history of coronary heart disease, half of them

Table 2. Demographic characteristics of patients according to length of hospital stay.

	24 h (n = 90)	48 h (n = 94)	72 h (n = 46)	> 72 h (n = 37)	P
Age (years)	52.6	55.4	57.2	55.8	NS
Male	84 (93.3%)	83 (88.3%)	37 (80.4%)	26 (70.3%)	NS
Female	6 (6.7%)	11 (11.7%)	9 (19.6%)	11 (29.7%)	0.02
Diabetes mellitus	9 (10%)	21 (22.3%)	15 (32.6%)	22 (59.5%)	< 0.001
Hypertension	36 (40%)	47 (50%)	29 (63%)	27 (73%)	0.03
Previous MI	8 (8.9%)	10 (10.6%)	4 (8.7%)	3 (8.1%)	NS
Previous stroke	0%	0%	0%	1 (2.4%)	NS
Current smoking	69 (76.7%)	63 (67%)	29 (63%)	24 (64.9%)	NS
Dyslipidemia	47 (52.2%)	41 (43.6%)	25 (54.3%)	16 (43.2%)	NS
Family history	15 (16.7%)	15 (16%)	7 (15.2%)	8 (21.6%)	NS

NS — not significant; MI — myocardial infarction

had hypertension and dyslipidemia and 25% had diabetes mellitus (DM). Most of the patients were heavy smokers, and, in parallel, most were male. Left anterior descending artery (LAD) was the most frequently involved vessel,followed by right coronary artery (RCA) (46.1% *vs* 33.7%). Eighy two per cent of the patients were classified as Killip 1 at initial presentation and more than half of the patients had multi-vessel disease. The associations of hospital stay time to the follow-up characteristics of the patients are shown in Table 1. More than half of the patients (n = 184) were discharged within 48 hours of hospitalization. Only 13.7% of patients stayed in hospital for more than three days. There was no significant difference in the baseline characteristics in terms of age, sex, smoking, dyslipidemia or previously diagnosed coronary heart disease. Females tended to have a longer stay in hospital ($p = 0.02$). Patients with DM and hypertension also had longer hospitalizations ($p < 0.001$ and $p = 0.03$, respectively, Table 2).

The relationship between patients' clinico-demographic characteristics and hospital stay is shown in Table 3. In patients with 24-hours hospital stay, the rate of multi-vessel disease was significantly less than that of patients with long stays in hospital ($p < 0.001$).

In other words, when the rate of multi-vessel involvement increased, the patients more frequently stayed in hospital. Regarding the infarct related artery, LAD involvement was predominant, whereas circumflex artery (CX) involvement was found to be low in Group 4 patients. There was a borderline correlation between LAD and CX involvement and hospital stay ($p = 0.05$ and 0.05, respectively). The Killip class 2-3-4 patients were clustered in Group 4 (Table 3). A significant positive correlation was detected between Killip class 2-3 and length of hospital stay ($p = 0.001$ and $p < 0.001$, respectively), while there was a significant negative relationship between Killip class 1 and hospitalization interval ($p < 0.001$). In patients with a 72-hours hospital stay, LVEF was significantly lower than that of patients in the other groups ($p < 0.001$, Table 3). In addition, patients with longer hospital stays tended to take tirofiban infusions more frequently. Logistic regression analysis showed that Killip classification ($p < 0.001$), LVEF ($p < 0.001$), multi-vessel disease ($p = 0.002$), and DM ($p = 0.001$) were all independent determinants of length of hospital stay. There was also a strong correlation between Killip classification and LVEF ($p < 0.001$). All patients with Killip class 3-4, and 52% of Killip class 2 patients, had decreased LVEF (less than 45%). In 87% of Killip class 1 patients, LVEF was found to be more than 45%. There was no significant difference between length of hospitalization groups in terms of first year restenosis ($p > 0.05$). However, significant differences were found regarding restenosis at one month ($p = 0.03$), with one month restenosis higher in Groups 3 and 4 than in Groups 1 and 2.

MACE at one month and at one year were similar in all groups. Only four deaths had occurred after one year, and they were in Group 3 (one death) and Group 4 (three deaths). No mortality was seen in patients discharged within 48 hours. This difference was statistically significant ($p = 0.03$, Table 4). Binary logistic regression analysis for mortality indicated that Killip classification ($p < 0.001$), LVEF ($p = 0.03$), hospital stay time ($p = 0.04$) and age ($p = 0.03$) were the major prognostic indicators predicting mortality (Table 5). Multivariate binary logistic regression analysis for

Table 3. Clinical characteristics of patients according to length of hospital stay.

	24 h (n = 90)	48 h (n = 94)	72 h (n = 46)	> 72 h (n = 37)	P
Infarct related artery:					
LAD	34 (37.8%)	43 (45.7%)	23 (50%)	23 (62.2%)	0.05
CX	27 (30%)	16 (17%)	6 (13%)	3 (8.1%)	0.05
RCA	29 (32.2%)	33 (35.1%)	17 (37%)	11 (29.7%)	NS
DX	0%	2 (2.1%)	0%	0%	NS
Multi-vessel disease	35 (38.9%)	60 (63.8%)	32 (69.6%)	27 (73%)	< 0.001
Elective CABG	1 (1.1%)	5 (5.3%)	2 (4.3%)	6 (16.2%)	NS
Acute thrombosis	0%	0%	0%	1 (2.7%)	NS
Pseudoaneurysm	0%	0%	0%	1 (2.7%)	NS
Tirofiban infusion	22 (24.4%)	43 (45.7%)	30 (65.2%)	27 (73%)	0.001
Ejection fraction (%)	56.8	52.9	51.3	41.4	< 0.001
Killip classification:					
1	90 (100%)	91 (96.8%)	32 (69.6%)	6 (16.2%)	< 0.001
2	0%	3 (3.2%)	14 (30.4%)	17 (45.9%)	0.001
3	0%	0%	0%	13 (35.1%)	< 0.001
4	0%	0%	0%	1 (2.7%)	NS

LAD — left anterior descending artery; CX — circumflex artery; RCA — right coronary artery; DX — diagonal artery; CABG — coronary artery bypass grafting; NS — not significant

Table 4. Mortality and major adverse cardiac events results of patients according to length of hospital stay.

	24 h (n = 90)	48 h (n = 94)	72 h (n = 46)	> 72 h (n = 37)	P
One month restenosis	0%	1 (1.1%)	3 (6.5%)	4 (10.8%)	0.03
One year restenosis	3 (4.7%)	13 (16.5%)	7 (19.4%)	4 (12.5%)	NS
CABG related to restenosis	1 (1.1%)	4 (4.3%)	4 (8.7%)	1 (2.7%)	NS
Mortality	0%	0%	1 (2.2%)	3 (8.1%)	0.03
Control angiograpy:					
One month	6 (6.7%)	13 (13.8%)	5 (10.9%)	6 (16.2%)	NS
One year	11 (12.2%)	22 (23.4%)	7 (15.2%)	7 (18.9%)	NS

NS — not significant; CABG — coronary artery bypass grafting

Table 5. Binary logistic regression analysis for mortality.

Variables	Odds ratio	P
Age	1.029	0.034
Sex	1.081	0.777
Diabetes mellitus	1.042	0.078
Hypertension	0.501	0.083
Previous MI	0.648	0.617
Dyslipidemia	1.505	0.367
Current smoking	0.334	0.924
Family history	0.944	0.445
Killip classification	3.080	< 0.001
Ejection fraction	0.992	0.370
Infarct related artery	1.524	0.667
Hospital stay	1.496	0.049
Multi-vessel disease	1.411	0.667

$p < 0.05$ is regarded as significant; MI — myocardial infarction

MACE showed that hospital stay, multi-vessel disease and Killip classification were the major independent predictors ($p < 0.001$, $p = 0.012$ and $p = 0.01$, respectively, Table 6).

Discussion

Early discharge for patients with STEMI is still a controversial issue among physicians. There is no clear consensus or guidelines for length of hospital stay for acute STEMI patients. This duration varies according to cardiology departments, even according to physicians in the same clinic [3, 5]. Hospital stay is still longer than ten days in some centers, especially those performing thrombolytic therapy [6]. Primary PCI is replacing thrombolytic therapy for STEMI in most cardiac centers. The superiority of primary PCI to thrombolytic therapy has been

Table 6. Binary logistic regression analysis for major adverse cardiac events within the first year.

Variables	Odds ratio	P
Age	1.044	0.179
Sex	0.299	0.332
Diabetes mellitus	1.114	0.178
Hypertension	1.186	0.313
Previous MI	0.209	0.156
Dyslipidemia	0.845	0.974
Current smoking	1.448	0.492
Family history	3.945	0.133
Killip classification	1.104	0.010
Ejection fraction	1.028	0.114
Infarct related artery	2.089	0.810
Hospital stay	1.863	< 0.001
Multi-vessel disease	2.089	0.012

$p < 0.05$ is regarded as significant; MI — myocardial infarction

demonstrated regarding morbidity and mortality [7, 8]. When compared to thrombolysis, primary PCI allows both immediate revascularization and identification of additional relevant stenosis, meaning that subsequently no further risk stratification should be necessary, and hospital stay thereby shortened. However, it has been observed that length of hospital stay for patients treated with primary PCI remains similar to that for patients treated with thrombolytics [9]. Patients with STEMI treated with primary PCI are often hospitalized for five to seven days to allow monitoring of possible complications [10].

In most cardiology centers, the average length of stay in hospital is 4–5 days [11]. Although some trials have demonstrated the safety of early discharge of patients, most physicians are yet to change their habitual management strategy. Recent trials have shown that 20–30% of patients are discharged later, as decided by their physicians, although they were in fact compatible with early discharge [3, 5]. Longer stays in hospital can damage patients' psychiatric status, besides increasing the cost of therapy [10]. Economics are important where a patient does not belong to a private or government-supported insurance system. In our study group, 17 patients had requested early discharge, although their risk classification did not allow early discharge. These patients were discharged on the second and third days and their follow-up was uneventful at one month. Therefore, physicians should consider economic conditions when planning treatment. Especially within the last ten years, studies have been investigating early discharge strategy, but they have not reached a consensus with respect to optimal length of hospital stay. In most studies, patients classified as low risk have been discharged within four days. Early discharge is defined as within four days in such studies [2, 12]. Apart from these studies, only a few trials have looked at very early discharge. Jirmar et al. [1] investigated the easibility of next day discharge. Although they worked with a small patient group, their results at one month were uneventful for early discharged patients [1]. But, they were unable to follow up in the long term.

In the present study, we evaluated the safety and practicality of very early discharge (within 48 h) and we also defined the optimal length of hospital stay according to the characteristics and risk stratification of patients. We made risk classifications according to physical examination, Killip class at the initial admission, coronary angiography results, echocardiography and 24-hour ECG monitoring. Killip classification was found to be a strong factor for both length of hospital stay and mortality by logistic regression analysis. All the patients discharged after 24 hours were Killip class 1 and only 3.2% of patients who were Killip class 2 were discharged within 48 hours. This group comprised only three patients who wanted to be discharged earlier for financial reasons.

Patients hospitalized more than three days were usually in the Killip class > 1 and only 16.2% of the patients in Group 4 were Killip class 1. The remaining cases were Killip class 2–4 patients, which proves the importance of Killip classification.

LVEF was another important prognostic factor for risk stratification. Post-procedure LVEF was much lower in patients whose hospital stay exceeded three days. Multi-vessel disease and the presence of DM were detected as the other important indicators affecting length of hospital stay. Most diabetic patients remained in hospital for three or more days. More than half of the patients had multivessel disease, but patients in Group 1 usually had no multi-vessel disease (63%). Seventy-three per cent of patients in Group 4 had multi-vessel disease. Although there were small numbers of cases featuring mortality and restenosis, these patients were clustered in Groups 3 and 4, which indicates efficient risk stratification. On the other hand, the patients at higher risk remained in hospital for longer and had a worse prognosis. Thus, our results are compatible with other trials [1, 3, 12].

Early discharged patients at low risk tended to have a better prognosis. There was no significant difference according to the rate of one year restenosis among all groups. Nearly 70% of the patients

were discharged within 48 hours. This may be explained by the patient characteristics. In other words, 90% of our patients had no history of coronary heart disease, and 82% of them was classified as Killip class 1. Our non-cardiac complications (post-procedure fever, stroke, vascular complications associated with catheterization) were noticably lower, something which could shorten the length of stay in hospital. In our study, the possible causes of the low rate of non-cardiac complications include physicans' experience and the closer follow-up and care of patients.

Limitations of the study

The major limitations of this study are the relatively small sample size and that the low mortality rate (only four cases) may have affected the mortality analysis. In addition, the retrospective nature of our study could be considered as another significant limitation. Change of physician could affect length of hospital stay, especially for Group 3 patients. Only 25% of patients underwent control angiography, and the rate of exact restenosis could be higher in asymptomatic single-vessel disease. Moreover, most of our patients were male, and female patients tend to have lengthier stays in hospital.

Conclusions

An early discharge strategy is very safe, and physicians should consider a longer follow-up period in AMI.

Uncomplicated patients with single-vessel disease could be discharged after 24 hours. Uncomplicated patients with multi-vessel disease could be discharged after 48 hours. Moreover, early discharged patients should be instructed in the possible signs of complications and recurrent ischemia, and their follow-up should be done more frequently to ensure patient compliance with medical therapy. Our study indicates that Killip classification and LVEF are two important prognostic factors predicting risk stratification. Multi-vessel disease and the presence of DM are the other determinants of risk stratification. However, prospective multi-center studies with large sample sizes are needed to reach a comprehensive consensus for physicians.

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References

1. Jirmar R, Widimsky P, Capek J, Hinomaz O, Goch L. Next day discharge after successful primary angioplasty for acute ST elevation myocardial infarction. An open randomized study "Prague-5". Int Heart J, 2008; 49: 653–659.
2. Kotowycz MA, Syal RP, Afzal R, Natarajan MK. Can we improve length of hospitalization in ST elevation myocardial infarction patients treated with primary percutanous coronary intervention? Can J Cardiol, 2009; 25: 585–588.
3. Yip HK, Wu CJ, Chang HW et al. The feasibility and safety of early discharge for low risk patients with acute myocardial infarction after successful direct percutanous coronary intervention. Jpn Heart J, 2003; 44: 41–49.
4. Kotowycz MA, Cosman TL, Tartaglia C, Afzal R, Syal RP, Natarajan MK. Safety and feasibility of early hospital discharge in ST-segment elevation myocardial infarction: A prospective and randomized trial in low-risk primary percutaneous coronary intervention patients (the Safe-Depart Trial). Am Heart J, 2010; 159: 117.e1–117.e6.
5. Grines CL, Marsalese DL, Brodie B et al. Safety and cost-effectiveness of early discharge after primary angioplasty in low risk patients with acute myocardial infarction. J Am Coll Cardiol, 1998; 31: 967–72.
6. Bajraktari G, Thaqi K, Pacolli S et al. In-hospital mortality following acute myocardial infarction in Kosovo: A single center study. Ann Saudi Med, 2008; 28: 430–434.
7. Weaver WD, Simes RJ, Betriu A et al. Comparision of primary coronary angioplasty and intravenous thrombolytic therapy for acute myocardial infarction: A quantitative review. JAMA, 1997; 278: 2093–2098.
8. Grygier M, Araszkiewicz A, Lesiak M, Grajek S. Acute myocardial infarction in an 80 year-old woman caused by left main occlusion with concomitant chronic total occlusions of right and left coronary artery: Successful treatment with percutaneous revascularization. Cardiol J, 2009; 16: 568–572.
9. Schaer BA, Osswald S, Zellweger MJ, Jegge S, Sticherling C, Pfisterer M. Impact of contemporary emergency percutanous coronary angioplasty for acute myocardial infarction on length of hospital stay. Swiss Med Wkly, 2007; 137: 363–367.
10. Bramkamp M, Radovanovic D, Erne P, Szucs TD. Determinants of cost and the length of stay in acute coronary syndromes: A real life analysis of more than 10,000 patients. Cardiovasc Drugs Ther, 2007; 21: 389–398.
11. Heggunje PS, Harjai KJ, Stone GW et al. Procedural success versus clinical risk status in determining discharge of patients after primary angioplasty for acute myocardial infarction. J Am Coll Cardiol, 2004; 44: 1400–1407.
12. Branca G, Capodanno D, Capranzano P et al. Early discharge in acute myocardial infarction after clinical and angiographic risk assessment. J Cardiovasc Med (Hagerstown), 2008; 9: 858–861.