


# Early Coronary Artery Bypass Grafting Following Life-Saving Percutaneous Coronary Intervention

# Hayat Kurtarıcı Perkütan Koroner Girişim Sonrası Koroner Arter Baypas Cerrahisi

Stent İşlemi Sonrası Koroner Baypas / Coronary Bypass Following Stent Procedure

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**Özet**

Amaç: Uygun koroner arterlerde acil ve ciddi koroner aterosklerozun tedavisinde ilk tedavi seçeneği perkütan koroner girişimdir. Biz bu çalışmada hayat kurtarıcı stent girişimi sonrası koroner arter baypas cerrahisi yapılan hastalardaki klinik sonuçlar, morbidite, mortalite ve stentlerin açık kalma oranlarını araştırmayı planladık. Gereç ve Yöntem: Ocak 2005 ve Aralık 2008 tarihleri arasında akut miyokardiyal enfarktüs nedeniyle sorumlu artere perkütan girişim yapılmış ve sonrasında koroner arter baypas cerrahisine alınmış 23 hasta çalışmaya dahil edilmiştir. Stent patensisini göstermek amacıyla erken postoperatif koroner anjiyografi yapılmıştır. Bulgular: Hastane-içi mortalite beş hastada görüldü (%21.7). Diğer hastaların yapılan kontrol koroner anjiyografilerinde 20 stentin 16'sında ciddi lezyon veya tam oklüzyon saptandı (%80). Stent patensisi açısından değerlendirildiğinde perkütan koroner girişim ve koroner arter baypas cerrahisi arasındaki süre istatistiksel olarak anlamlı bulunmuştur (p=0.007). Tartışma: Perkütan koroner girişim sonrası anjiyografik bulgular normal olsa dahi stent konmuş olan koroner artere baypas greft uygulaması düşünülebilir, çünkü operasyon sırasındaki kardiyak manipülasyon ve kardiyopulmoner baypasın sistemik etkileri nedeniyle stent deformitesi veya oklüzyon meydana gelebilir.

**Anahtar Kelimeler**

Koroner Arter Baypas Cerrahisi; Stentler; Perkütan Transluminal Anjiyoplasti

**Abstract**

Aim: Percutaneous coronary intervention is usually the initial treatment option for treatment of emergent and severe coronary atherosclerosis with suitable coronary arteries. We aimed to investigate the clinical features, morbidity and mortality rates of coronary artery bypass grafting performed following life-saving stent procedures and patency rates of these stents. Material and Method: Between January 2005 and December 2008, we performed coronary artery bypass grafting on 23 patients who had previous percutaneous coronary intervention to the culprit artery for acute myocardial infarction. Early postoperative coronary angiography was obtained for evaluation of stent patency. Results: In-hospital mortality occurred in five patients (21.7%). Coronary angiographic examination of the remaining patients revealed severe stenosis or occlusion at 16 out 20 stents (80%). The mean time interval between percutaneous coronary intervention and coronary artery bypass grafting was found to be statistically significant regarding stent patency (p=0.007). Discussion: Bypass grafting to a previously stented coronary artery may be the relevant approach even if the angiographic findings are normal, because intraoperative manipulation and systemic effects of cardiopulmonary bypass if used will result in deformity or occlusion of the stent.

**Keywords**

Coronary Artery Bypass Grafting; Stents; Percutaneous Transluminal Angioplasty

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## Introduction

Percutaneous coronary intervention (PCI) is getting more popular as the number of available medical centers increases and biomedical technology improves [1]. So cardiac surgeons are faced to a new concept; coronary artery bypass grafting (CABG) to stented coronary vessels. Patients undergoing CABG, with the previously stented coronary vessels have higher morbidity and mortality rates [2]. Besides, during CABG, open coronary artery stent- is a dilemma and controversy exists for intervention. Nevertheless, due to increased number of PCI procedures performed prior to CABG, a new attitude; the staged hybrid therapy arose. Staged therapy for coronary artery disease means consecutive PCI-CABG or CABG-PCI interventions [3].

Another critical staged therapy for coronary artery disease is early CABG for complete revascularization following a life-saving primary PCI procedure to responsible vessel for acute myocardial infarction. Percutenous intervention is usually the initial treatment option for treatment of emergent and severe coronary atherosclerosis with suitable coronary arteries. This is a high risk condition due to recent acute cardiac event and also fresh stented coronary vessels which require special surgical strategy.

In this study, we aimed primarily to investigate the patency rates of stented vessels (emergent life-saving PCI) prior to CABG and morbidity and mortality rates.

## Material and Method

Between January 2005 and December 2008, 23 coronary artery bypass procedures were performed on patients with previous PCI procedures to the responsible artery for acute myocardial infarction (26 PCI's). The patients were followed-up prospectively.The study was approved by the local institutional review board. Informed consent was obtained from every patient. This study complies with the Decleration of Helsinki.

Bare-metal coronary stents, Ephesos® (Nemed Corporation, Turkey) were used in emergent PCI procedures. Stented vessels were right coronary artery in 17 cases, circumflex artery in eight cases and intermediate artery in one case. The target vessels were responsible for the acute MI. Before the primary PCI procedure clopidogrel, 600 mg of loading dose was administered to all patients. Following the procedure, all patients were given dual antiplatelet therapy; clopidogrel, 75 mg/day and acetylsalicylic acid, 300 mg/day. In five patients clopidogrel was stopped five days prior to the operation. The other 18 patients were on clopidogrel therapy until the operation. All patients received acetylsalicylic acid therapy until the operation. Postoperatively, clopidogrel and acetylsalicylic acid regimen were given immediately following the extubation and continued for at least one year. Previously stented vessels were assumed patent, because of the brief time period from PCI to surgery, absence of angina within this period, absence of acute electrocardiographical changes regarding ischemia, decrease in the cardiac enzymes and absence of additional clinical features. Therefore, coronary angiography prior to CABG was not performed. All operations were conducted with cardiopulmonary bypass (CPB). Systemic 300-500 U/kg intravenous bolus heparin was administered and activated clotting time over 400 seconds was maintained. Neutralization of heparin was provided by protamine, 1 mg/100 U heparin.

Left internal mammary artery (LIMA) was anastomozed to left anterior descending artery (LAD) and saphenous vein grafts were used for the remaining coronary lesions. Only in three patients, stented vessels were bypassed with vein grafts due to surgeon's preference.

Medical records were prospectively collected. Postoperative coronary angiography was performed in all patients and the mean time interval between surgery and angiography was 3,5 ± 1,7 months (min:1, max:6 months).

### *Statiscal Analysis*

Statistical analyses were performed using SPSS software for Windows (version 17.0, Statistical Package for the Social Sciences Inc, Chicago, IL, USA). Continuous variables were expressed as 'mean values ± standard deviation (SD)'. Categorical variables were expressed as numbers and percentages. Relation between the variables and the stent patency were examined by Mann-Whitney U test for continuous variables and Fisher's exact test for categorical variables. Statistical significance was set as 'p< 0.05'.

## Results

The mean age of the patients was 63,3±12,1 years (min:46, max:72). There were five (21.7%) male patients. The mean interval between emergent PCI procedure and surgery was 13,6±7,9 days (min:7, max:30 days).

Perioperative variables of the patients are shown in Table 1. Inotropes were required in nine patients, but only low-dose dopamin in six patients. Re-exploration in the early postoperative period was performed in two patients, one for bleeding and one for occurrence of refractory ventricular tachycardia .

There were five in-hospital mortalities (21.7%). The etiology was refractory ventricular tachycardia in one, intraoperative low-cardiac output in two, cerebrovascular accident in two and

Table 1. Perioperative characteristics of patients

| Factor | Mean ± SD |
|---|---|
| Age | 3.03 ± 1.04 |
| Ejection Fraction | 54.61 ± 18.60 |
| EuroSCORE additive | 7.6 ± 5.0 |
| EuroSCORE logistic (%) | 18.2 ±23.1 |
| Time interval between PCI and CABG (days) | 13,6 ± 7,9 |
| Intensive care unit stay (days) | 1,2 ± 0,4 |
| Hospital length of stay (days) | 6,5 ± 1,7 |
| Chest tube drainage (ml) | 1100 ± 555 |
| Gender | n (%) |
| Male | 5 (21.7) |
| Female | 18 (78.3) |
| Hypertension | 6 (26.0) |
| Diabetes Mellitus | 6 (26.0) |
| Smoking | 6 (26.0) |
| Extracardiac Arteriopathy | 5 (21.7) |
| Chronic Obstructive Pulmonary Disease | 5 (21.7) |
| Renal Failure | 5 (21.7) |
| Neurologic Dysfunction | 3 (13.0) |

PCI: percutaneous coronary intervention
CABG: coronary artery bypass grafting

resistant pneumonia and resultant pulmonary failure in one. They were all on clopidogrel therapy until the operation.

During the follow-up, coronary angiography was performed to remaining 18 patients. Sixteen out of 20 stents (80%) revealed severe stenosis or occlusion. Four stents were patent; three belonged to patients whom clopidogrel was stopped five days prior to the operation. Four out of six diabetic patients had occluded stents. Six patients who were smoking had occluded stents. In the view of surgical revascularization; 17 LIMA and 21 venous grafts were patent whereas only one LIMA-LAD and one saphenous vein to cirumflex artery grafts were occluded. Seven patients underwent additional PCI procedure and 11 patients were followed-up with medical therapy. The patient with occluded LIMA graft also had an occluded stent, so PCI procedure was performed. The stents of the patients who had surgical revascularization on their stented vessels were occluded and the grafts to the stented vessels were patent. There was no mortality and significant morbidity of these patients.

Regarding the stent patency; as the period between PCI and CABG increased, patency rate has decreased (p=0.007). Other factors such as age, gender, hypertension, diabetes mellitus, chronic obstructive pulmonary disease and smoking did not have any effect on occurrence of stent stenosis and occlusion.

**Discussion**

Percutaneous coronary interventions are being performed on more regular basis to patients with acute myocardial infarction due to availability of coronary stents and decreased mortality of the procedure [1]. Moreover, carefully selected patients with rescue PCI procedures are more frequently directed to early surgical revascularization. But, the surgical risk is higher for operations following myocardial infarction. Recent myocardial infarction (<90 days) is an important risk factor in euroSCORE system defining mortality [4]. In our study all the patients underwent surgery 7 to 30 days following emergent PCI procedure.

The most important topic in such cases is whether the stented vessel should be bypassed. Acute coronary stent thrombosis after surgery remains an uncommon yet serious complication [5, 6].

Intracoronary stents have reduced restenosis rates as compared to balloon angioplasty. However, in-stent restenosis remains to be an important clinical problem. Reocclusion rates of primary stents was found as 3.2% in 30 days [7]. Soon, drug-eluting stents have resulted in decreased restenosis rates in treatment of de novo coronary stenosis [8, 9]. Diabetes mellitus and smoking were demonstrated as predictors of stent thrombosis [10]. In our study, four out of six diabetic patients had occluded stents, also there were six smokers and they all had occluded stents. But, there were not statistically significant differences regarding these parameters. This may be due to the limited number of the patients. Our study revealed that as the period between PCI and CABG increases, the patency of the stents were decreased significantly.

It is known that all major operations induce a prothrombotic diathesis. The contact of blood components with non-biological surfaces such as the pump tubing, oxygenator membranes and altered propulsion by the roller pumps in CPB is a significant factor in amplifying the inflammatory effects. On the other hand, in off-pump coronary surgery unlike CABG with CPB, platelet numbers and function remain preserved, but still a prothrombotic effect partly attributed to increased platelet reactivity has been demonstrated [11]. Acetylsalicylic acid and clopidogrel may be continued until the operation and may be begun immediately after while bringing the risks of bleeding.

While avoiding problems of coagulation, there is one more issue concerning the stented vessel; the trauma caused by surgical manipulation. Retraction of the heart results in deformity of nearly all stents. However, direct pressure over the stented epicardial arteries (enough to retract the heart) resulted in complete obliteration of every intracoronary stent. Direct surgical trauma to coronary stents causing stent thrombosis has been reported in CABG with CPB [12]. Such trauma could also occur during cardiac manipulation in off-pump coronary surgery. In reoperations, stented venous can also be deformed during normal manipulation [13, 14].

If planned, any graft may be used to bypass the stented vessel. Removal of the stent may also be considered concomitantly. Previously, it was reported that stent removal with coronary endarterectomy with on-lay LIMA patch is safe and effective in patients with in-stent stenosis [15].

In a study evaluating the effect of preoperative PCI as a risk factor for symptom recurrence, adverse cardiovascular events and mortality, it was demonstrated that patients with previous PCI were more likely to develop symptom recurrence and adverse cardiovascular events following CABG [16]. Similarly, in another study, it was shown that patients with diabetes mellitus and history of percutaneous coronary stenting before CABG were found to have increased risk of operative death and perioperative complications, and decreased age-adjusted survival at 2 years follow-up [17].

In our study, we demonstrated that 80% of stented vessels were occluded. We think that bypass grafting to a previously stented coronary artery may be the relevant approach even if the angiographic findings are normal, because manipulation during operation and systemic effects of CPB results in deformity or occlusion of the stent.

*Competing interests*

The authors declare that they have no competing interests.

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