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Outcome after coronary bypass grafting for coronary complications following coronary angiography

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ABSTRACT

Background: Coronary complications during coronary angiography or intervention (percutaneous coronary intervention [PCI]) are uncommon. However, PCI-related coronary artery perforation, dissection, or acute occlusion frequently result in myocardial ischemia followed by hemodynamic instability and need of urgent coronary artery bypass grafting (coronary artery bypass grafting [CABG]). This single-center study aimed to investigate clinical outcomes of patients undergoing urgent CABG after life-threatening PCI complications.

Materials and methods: Data were retrospectively obtained using our institutional patient database. All patients admitted for urgent CABG following PCI-related complications from April 2010 to June 2015 were included into this study. Univariate analysis was performed to identify possible predictors for cardiac mortality.

Results: From a total of 821 urgent CABG patients, 52 patients (6.3%, 66.4 ± 9.4 years) underwent CABG for coronary complication following PCI. Logistic EuroSCORE was 21.8 ± 15.0%. At admission, 22 of 52 (42%) presented in cardiogenic shock, and 24 of 52 (46%) had significant ECG alterations indicating ST-elevation myocardial infarction (STEMI). Surgical revascularization was performed by targeting the injured coronary vessel with additional revascularization of other compromised vessels as indicated (mean number of grafts 2.4 ± 0.8). In-hospital cardiac mortality of the patient cohort was 13.5% (7/52) with 15.4% (8/52) in-hospital all-cause mortality. Preoperative resuscitation, cardiogenic shock, and STEMI were predictors for in-hospital cardiac mortality ($P < 0.05$) in univariate analysis. In contrast, noncardiac comorbidities, type of PCI complication, and localization of the culprit lesion were not associated to increased mortality.

Conclusions: Emergent or urgent CABG for treatment of acute coronary complications following PCI is feasible and has acceptable clinical results that worsen in the presence of STEMI, cardiogenic shock, or resuscitation. Because preoperative status is crucial for clinical outcomes in these patients, immediate transfer to cardiac surgery is necessary.

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Introduction

Coronary angiography is the standard procedure for diagnosis of coronary artery disease (CAD) and identification of significant stenosis. This procedure allows concomitant intervention of coronary stenosis by balloon angioplasty and stent implantation. In emergency situations with persistent myocardial ischemia, that is, ST-elevation myocardial infarction (STEMI), percutaneous coronary intervention (PCI) leads to rapid restoration of coronary blood flow and is therefore recommended as the first-line therapy by current guidelines.[1]

Due to its less invasive nature, PCI is rarely accompanied with serious complications requiring emergency coronary artery bypass grafting (CABG). The rate of emergency CABG after failed PCI decreased over the past years from over 2% to significantly below 1%.[2-4] Complications involving the treated coronary vessels are rare but frequently result in myocardial ischemia followed by hemodynamic instability. Major coronary complications include acute coronary occlusion, coronary artery dissection, and even coronary perforation. These complications occur in about 1% of all PCI cases.[5] Commonly, these major coronary complications lead to life-threatening situations requiring immediate treatment. Cessation of coronary blood flow may result in acute ischemia with deterioration of ventricular function leading to cardiogenic shock. Recognition of the aforementioned complications by the interventionalist and immediate coronary reintervention of the culprit lesion is mandatory to restore coronary blood flow. Further measures like initiation of dual antiplatelet therapy or drainage of a pericardial tamponade in case of coronary perforation may be necessary to stabilize the patients. Nonetheless, failure to stabilize the patient or to restore sufficient coronary flow by the interventionalist occurs in 0.1%-0.3%,[2,3,5] and patients urgently have to be transferred to a cardiac surgery unit for emergent surgical myocardial revascularization with an increased risk of perioperative morbidity and mortality.

The aim of this retrospective single-center analysis is to determine clinical outcomes of patients referred to urgent or emergent CABG following major complications after PCI and to identify potential predictors for in-hospital cardiac mortality.

Methods

A retrospective analysis was performed of all consecutive patients admitted for urgent CABG due to major coronary complications after coronary angiography or intervention from April 2010 to June 2015. Data of these patients were prospectively recorded during hospital stay in our institutional database and were analyzed retrospectively. A total of 821 urgent or emergent CABG procedures performed in the aforementioned period. In this patient cohort, 52 patients (6.3%) were identified that underwent emergent or urgent CABG for major coronary complications including coronary occlusion, dissection or perforation after coronary angiography or PCI.

Three types of major coronary complications defined by the interventional cardiologist were identified: (1) acute coronary occlusion with new onset abrupt occlusion of a previously patent coronary vessel; (2) a coronary dissection was defined as an injury of the media resulting in intramural hemorrhage and a tissue flap formation with persistent blood flow as observed by a perivascular contrast-flow and formation of a dissection membrane. When a coronary dissection induced subacute occlusion of the coronary vessel, the lesion was classified as acute coronary occlusion; and (3) complete rupture or perforation of the vessel resulting in a contrast-flow into the perivascular/pericardial tissue and followed by pericardial effusion was defined as coronary artery perforation.

Patients undergoing CABG due to residual stenosis following PCI or failed PCI of chronic coronary occlusions were excluded.

Urgency of the underlying PCI procedure was determined by the medical report of the attending cardiologist. We subdivided PCI indications into emergent, urgent, or elective. An emergent indication was defined as immediate PCI for acute myocardial infarction with ST-elevation and/or cardiogenic shock, whereas an acute coronary syndrome without ST-elevation (e.g., NSTEMI, unstable angina) and not requiring immediate PCI was defined as urgent PCI indication. Elective PCI indication included all planned PCI such as scheduled PCI for known coronary stenosis or control angiography for possible CAD followed by subsequent PCI.

Our department covered surgical treatment of PCI complications for on-site PCI procedures as well as for surrounding hospitals without on-site cardiac surgery. In case of on-site PCI complications, a senior cardiac surgeon was consulted, and decision for further procedure was made in the catheterization laboratory. For other hospitals and catheterization laboratories, we had a 24-hour phone hotline to the cardiac surgeon on duty. Many of the surrounding catheterization laboratories had an online connection to our angiography database, so the angiographic data of the PCI procedure could be transferred and reviewed by the cardiac surgeon immediately. Development of transfer pathways to our department was in the responsibility of the referring hospital. Only for unstable patients, not allowing safe transfer to our Q7 department, we offered ECMO-based pickup since 2014; but this was not used in any of the patients in this analysis.

All patients accepted for CABG were transferred to our institution and admitted on the intensive care unit. The attending cardiac surgery team was responsible for determination of the urgency and timing of CABG. In general, the operative procedure included bypass grafting of the affected coronary artery downstream to the lesion and additional bypass grafting of additional significant coronary stenosis. Further operative procedures were performed depending on the identified injury of the affected coronary vessel.

This study was approved by our institutional review board. Individual informed consent was waived due to retrospective analysis of existing patient data.

Data acquisition and outcome measures

All preoperative, intraoperative, and postoperative clinical variables of the patients were extracted from our institutional database retrospectively.