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Normal angiogram in acute coronary syndrome—preangiographic risk stratification, angiographic findings and follow-up ☆

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Abstract

Background: Coronary angiographies performed during acute coronary syndrome show different coronary morphologies—vessel occlusions, thrombi and various types of stenoses. In a few cases of acute coronary syndrome, angiography reveals normal coronary arteries. It is the purpose of this study to analyze this specific subset of patients who presented with an acute coronary syndrome but had a normal coronary angiogram with respect to the preangiographic diagnostics, risk stratification and clinical follow-up.
Methods and results: A total of 897 coronary angiographies were performed as an emergency procedure in our institution. The majority of patients (n=821) presented with coronary artery disease and the majority was treated by mechanical revascularization (86.3%). In 76 patients (8.5%), no coronary artery stenosis was documented. However, according to the preangiographic risk stratification, coronary artery disease was expected in these patients. Observations documented angiographically included coronary spasms (6.6%) and muscle bridges (5.3%). During a mean follow-up of 11.2±6.4 months, one patient developed an acute myocardial infarction requiring coronary intervention. All other patients were free of any cardiac event.
Conclusions: In summary, we have to consider that coronary angiography may not always detect the cause of myocardial ischemia in every patient. There is a small group of patients with normal coronary angiograms during acute coronary syndrome. Additional diagnostic procedures like intravascular ultrasound (IVUS) or the assessment of intracoronary physiological parameters may increase the diagnostic value of angiography.

Keywords: Angiogram; Acute coronary syndrome; Preangiographic risk stratification

1. Introduction

Acute coronary syndrome comprises different manifestations of coronary artery disease. Unstable angina, non-ST-elevation myocardial infarction and ST-elevation myocardial infarction are differentiated by clinical symptoms, electrocardiographic findings and laboratory markers [1]. The adequate therapy depends on a standardized risk stratification [2–4]. Patients with acute ST-elevation myocardial infarction should be treated immediately by percutaneous coronary intervention. In case of unstable angina or non-ST-elevation myocardial infarction, an antithrombotic pharmacological treatment with glycoprotein IIb/IIIa-inhibitors should be administered followed by invasive procedures. The goal of all therapeutic regimen is the rapid recovery of coronary blood flow.

Angiograms performed at the time of an acute coronary syndrome may present with different coronary morphologies. In many cases, there are acute vessel occlusions, ruptured atherosclerotic plaques or thrombotic lesions that

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require reperfusion therapy. However, occasionally, no coronary artery stenoses are seen. In these cases, many differential diagnoses may explain the unexpected angiographic findings.

It is the purpose of this study to analyze this specific subset of patients who presented with an acute coronary syndrome but had a normal coronary angiogram with respect to the preangiographic diagnostics, risk stratification and clinical follow-up.

2. Materials and methods

Between 1996 and 2000, a total of 897 coronary angiographies were performed as an emergency procedure due to suspected acute coronary syndrome in our institution. Interventions were performed by five different experienced interventional cardiologists.

Acute coronary syndromes were defined according to the standard risk stratifications combining electrocardiography (ST-segment elevation ≥1 mm in two or more contiguous leads, ST-segment depression of at least 0.5 mm in two or more contiguous leads, T-wave inversion of at least 1 mm), elevated troponin T (cTnT, quantitatively >0.10 μg/l) and clinical symptoms [3,4]. However, guideline-oriented risk stratification changed over the period patients were included in this analysis; cTnT could only be determined qualitatively by bed-side test until 1997 and was not available as a routine quantitative marker until 1998 in our institution. Normal coronary arteries were defined as the absence of coronary lesions with diameters stenosis >50% and with a normal perfusion (TIMI III) [5].

We analyzed the preangiographic diagnostic findings, risk stratification, initial therapy, angiographic findings and clinical follow-up in patients with normal angiogram. During follow-up, patients without coronary artery disease were assessed by questionnaire, by phone or at the hospital when readmitted for any reason. Follow-up data consisted of assessment of clinical symptoms (angina, dyspnoea), history of coronary events (acute myocardial infarction, sudden cardiac death) and information on re-angiographies or revascularization therapies.

3. Results

3.1. Preangiographic risk stratification

Patients assessment was done clinically and by risk stratification. Patients were categorized into two groups with unstable angina and acute myocardial infarction. Coronary artery disease was found in 821 patients (91.5%), whereas no coronary artery disease was documented in 76 patients (8.5%) (53±13.9 years, 71.1% male) (Table 1). The group with normal angiogram was characterized as unstable angina (66, 86.8%) and acute ST-elevation myocardial infarction (10, 13.2%). The patient group with coronary artery disease had unstable angina (445, 54.2%) and ST-elevation myocardial infarction (376, 45.8%) (Table 2).

Table 1
Clinical baseline characteristics

	No coronary artery disease	Coronary artery disease
n	8.5% (*n*=76)	91.5% (*n*=821)
Male	71.1% (*n*=54)	73.8% (*n*=607)
Age (years)	53.01±13.88	62.57±11.47
Arterial hypertension	60.5% (*n*=46)	80.3% (*n*=659)
Diabetes mellitus	11.8% (*n*=9)	27.8% (*n*=228)
Dyslipidemia	67.1% (*n*=51)	86.1% (*n*=707)
Smoking	57.9% (*n*=44)	69.8% (*n*=573)

According to the risk stratification, all patients were managed as an acute coronary syndrome and a coronary artery disease was expected. In the group of patients with normal angiogram (*n*=76), troponin was positive in 30.3%, and creatine phosphokinase was elevated in 21.1% prior to angiography. A total of 36/76 patients (47.3%) presented with signs of ischemia in the electrocardiogram, of these eight patients had significant ST-elevations. In comparison, 64.8% of the patients with coronary artery disease had signs of ischemia on the electrocardiogram, blood markers of ischemia were seen in 56.2%.

In the group with normal angiogram, we found with respect to the risk stratification parameters electrocardiography, blood markers of ischemia and typical clinical symptoms 38.1% with one positive parameter, 48.7% with two positive parameters and 13.2% with all three parameters positive for risk stratification of acute coronary syndrome. In the group with coronary arteries, the majority had all three parameters positive (79.4%) (Table 3).

3.2. Preangiographic therapy

A total of 73/76 patients (96.1%) without coronary artery disease were admitted to the intensive care unit before angiography was performed. The following antithrombotic medical treatment was initiated prior to angiography (Table 4): low-molecular-weight heparin (88.2%), glycoprotein IIb/IIIa-inhibitors (11.8%), acetylsalicylacid (73.7%) and clopidogrel (5.3%). Thrombolysis therapy was administered in six patients (7.9%). Due to hemodynamic instability, catecholamines were given in four patients (5.3%), a cardio-pulmonary rescuscitation was necessary in two patients (4.2%).

3.3. Coronary angiography

A total of 821 patients presented with coronary artery disease, 29.4% (*n*=242) had one-vessel disease, 31.3% (*n*=257) two-vessel disease and 39.2% (*n*=322) three-vessel disease. Normal coronary arteries were seen in 76 patients. The following observations were documented in this group: coronary spasms (5, 6.6%), muscle bridges (4, 5.3%),