treatment of choice in patients with severe LM narrowing.[2] One problem in selecting patients for surgery is clear visualization of the distal LC and the difficulty in knowing whether these vessels are suitable for insertion of grafts. Percutaneous transluminal coronary angioplasty has been performed in LM stenosis, but a high rate of complications has been reported.[3] After wide experience with angioplasty in patients with unstable angina[4] and successful recanalization of occluded vessels in our laboratory,[1] recanalization of the occluded LM was carried out with success.

Although surgery is the treatment of choice in patients with significant LM coronary stenosis or occlusion, in patients with unstable conditions and evolving myocardial infarction, recanalization using balloon catheters is an alternative approach. Subsequent bypass grafting can be performed.

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Thrombolysis of Acute Total Occlusion of the Left Main Coronary Artery in Evolving Myocardial Infarction

PIM J. de FEYTER, MD
PATRICK W. SERRUYS, MD
On behalf of the Dutch Survey of Thrombolysis in Evolving Myocardial Infarction

The finding of a total occlusion of the left main (LM) coronary artery in patients undergoing coronary angiography is rare. The Coronary Artery Surgery Study[1] reported 12 of 20,197 patients (0.06%) with a total occlusion without prior coronary surgery. Ward et al[2] found 5 of 11,900 patients (0.04%) with complete occlusion who underwent angiography before surgery. In patients with class III or IV angina pectoris or unstable angina pectoris, the frequency was 0.42%.[3] Acute total obstruction of the LM coronary artery should be lethal because of its association with a massive myocardial infarction (MI). However, recently the natural history of 1 case has been described in which the patient survived an acute complete occlusion.[4] Percutaneous transluminal coronary recanalization with thrombolytic agents is a new therapeutic approach to the treatment of acute MI,[5] and recently a case was described of a totally occluded LM coronary artery which was reperfused with this technique.[6] In this report we describe the occurrence and clinical, hemodynamic and angiographic findings from 4 patients with acute complete occlusion of the LM coronary artery associated with acute MI. All 4 patients were treated with intracoronary infusion of fibrinolytic agents.

In June 1983, we carried out a survey in the Netherlands to collect data about patients with an acute evolving MI who had been treated with intracoronary fibrinolytic agents. Fifteen centers responded to the survey. In most centers the inclusion criteria for acute intracoronary thrombolysis were: age younger than 65 years, admission within 3 to 4 hours of onset of chest pain, ST-segment elevations ≥0.2 mV and no pathologic Q waves (≥0.04 second) in corresponding leads, and no contraindication for thrombolytic therapy. Six hundred eighty-eight patients have been included in the survey.

The coronary angiograms and left ventriculograms were reviewed in detail. The ejection fraction and left ventricular volume were calculated from the left ventriculogram in a 30° right anterior oblique projection using the area-length method. The infarct-related area of the left ventricle, expressed as percentage of abnormally contracting segment, was determined from the angiograms by the method Feild et al.[7] Abnormal contraction was defined as akinesia or dyskinesia.

The incidence of a total occlusion of the LM coronary artery was 4 of 688 patients (0.6%) with evolving MI. All 4 patients were men, 2 of whom had angina pectoris previously (Table I). At admission, all patients had chest pain and showed ST-segment elevation in the anterolateral leads (I, aVL and V_1 to V_6). All 4 patients had a systolic systemic arterial pressure of 80 mm Hg or lower. One patient underwent intraaortic balloon pumping before thrombolysis and 1 patient immediately after successful recanalization until a few days after acute surgery. Thrombolysis was successful in 3 patients (Fig. 1). The duration from onset of symptoms to successful recanalization was less than 3 hours in these survivors. The total dose of streptokinase ranged from 200,000 to 320,000 IU. One patient died with refractory cardiogenic shock during the attempted thrombolysis. Immediately after recanalization 1 patient underwent emergency coronary artery bypass grafting. Peak CK levels varied from 3,640 to 14,000 IU. The high CK value was in the patient who underwent acute surgery. Abnormal Q waves developed in the anterolateral leads in all patients. After recanalization a severe residual stenosis of the LM coronary artery was

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Address for reprints: Pim J. de Feyter, MD, Catheterization Laboratory, Erasmus University and University Hospital Dijkzigt, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands.

TABLE I Clinical and Angiographic Findings in Patients with an Acute Occlusion of the Left Main Coronary Artery

Pt	Systolic Systemic Arterial Pressure (mm Hg) on Admission	Interval (hr), Onset of Symptoms to Recanalization	Emergency Procedures	Peak CK (IU/l)	Residual LM Obstruction (% Diameter Reduction)
1	70	3	IABP	4820	23
2	80	2½	IABP	14,000	76
3	70	Died 1.5 hr after onset of symptoms	CABG	...	...
4	60	1½	...	3640	16

CABG = coronary artery bypass grafting; IABP = intraaortic balloon pumping; LM = left main.

FIGURE 1. Successful recanalization of a total occlusion of the left main coronary artery (LCMA). **Left,** left coronary angiogram in right anterior oblique projection. Total occlusion in distal part of the LCMA. **Right,** same projection; 45 minutes after treatment with intracoronary streptokinase. There is almost complete lysis of thrombus. Residual obstruction in the LCMA is 16%.

present in 1 patient, whereas in 2 other patients the stenosis was less than 50% diameter reduction. Two patients had coexisting lesions in the other coronary arteries. All survivors had a dominant right coronary artery. In survivors the ejection fraction in the chronic phase (6 weeks to 3 months) varied from 0.19 to 0.32 and the left ventricular end-diastolic pressure from 15 to 22 mm Hg (Table II). The end-diastolic and end-systolic volumes were enlarged. All patients were symptomatic during follow-up (New York Heart Association class II to III).

Reports of complete occlusion of the LM coronary artery may be rare because most patients with this lesion die before cardiac catheterization can be performed. Another explanation may be that lesions of the LM coronary artery are accompanied by lesions in the other coronary arteries, which lead to symptoms and presentation before complete occlusion occurs. Recently, the feasibility of rapid dissolution of intracoronary thrombi in acute evolving MI by selective infusion of thrombolytic agents was shown.[5,8–10] Selective infusion necessitates acute coronary angiography, which results in increased knowledge about the coronary anatomy in evolving MI. The incidence of an acute total occlusion of the LM coronary artery in patients with an acute evolving MI and who reached the hospital alive was 0.6%. Acute LM coronary artery occlusion is a serious condition. Indeed, all 4 patients reported herein

TABLE II Hemodynamic Findings in Survivors of Acute Occlusion Left Main Coronary Artery

Pt	ESVI (ml/m²)	EDVI (ml/m²)	EF (%)	LVEDP (mm Hg)	ACS (%)
1	70	97	27	15	38
2	...	...	19	...	...
4	60	88	32	22	28

ACS = percent abnormally contracting segment; EDVI = end-diastolic volume index; EF = ejection fraction; ESVI = end-systolic volume index; LVEDP = left ventricular end-diastolic pressure.

presented with signs of an evolving cardiogenic shock, which was reversed by successful thrombolysis in conjunction with other supportive procedures such as intraaortic balloon pumping. In the 3 survivors, the right coronary artery was dominant and may have contributed to survival.

Thus, intracoronary thrombolysis of an acute occlusion of the LM coronary artery in patients with a first evolving MI is feasible within the first hours after onset of symptoms. This treatment may reverse the outcome of this life-threatening event. In survivors the left ventricular damage is severe and patients remain symptomatic during follow-up.

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