Total Occlusion of the Left Main Coronary Artery: Report of Seven Cases From 5312 Cardiac Catheterizations and Review of the Literature

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Of the 5312 cardiac catheterizations performed at the Clayton Foundation for Research Cardiovascular Laboratories from 1974 to early 1981, seven patients (0.13%) had total occlusion of the left main coronary artery. All seven had a history of myocardial infarction, and were markedly symptomatic (New York Heart Association, Classes III and IV), with anginal pain that had existed from 2 to 13 years. Left ventricular end-diastolic pressure was notably elevated in all patients, and ejection fractions ranged from 16% to 69%. In all patients, there was significant collateral circulatory flow to the left coronary system from the right coronary artery and its branches. Six underwent coronary artery bypass at our institution, and one was operated on at another hospital. The six patients operated on in our institution were markedly improved after the operation.

Our results support previously reported findings about patients with total occlusion of the left main coronary artery in that (1) no definitive clinical pattern leads to simple diagnosis, (2) the anomaly is rarely encountered during cardiac catheterization, and (3) myocardial revascularization alleviates symptoms and prolongs life.

THERE ARE few recorded cases of total occlusion of the left main coronary artery (LMCA), and a review of the literature reveals only 36 cases reported.[1-12] The condition is rare because of the high mortality before angiography is possible.

We describe seven cases of total occlusion of the LMCA encountered in our laboratory during a 7-year period.

Materials and Methods

From January 1974 to early July 1981, a total of 5312 cardiac catheterizations were performed at the Clayton Foundation for Research Cardiovascular Laboratories. Among these, seven patients (0.13%) had total occlusion of the LMCA. All seven underwent cardiac catheterization because of

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angina pectoris, congestive heart failure, and the potential for coronary artery bypass. The clinical, angiographic, postoperative, and follow-up data of these patients were analyzed.

Results

Clinical Characteristics

The clinical profiles of the seven patients are presented in Table I. All patients had markedly severe symptoms: two were in the New York Heart Association Functional Class III, and five were in Class IV. The average duration of angina, from onset to time of cardiac catheterization, was 6 years, ranging from 2 to 13 years. All patients had a history of myocardial infarction (MI), and in five cases, there was electrocardiographic evidence of infarction. Two patients with histories of MI (Nos. 1 and 2) had no electrocardiographic evidence of infarction.

TABLE I. Clinical Characteristics of Six Patients with Total Occlusion of the Left Main Coronary Artery

Patient Number	Age/Sex	Functional Class	History of Myocardial Infarction	Myocardial Infarction by Echocardiography
1	56/M	IV	+	
2	65/M	IV	+	Anteroseptal
3	61/M	IV	+	Anteroseptal
4	66/M	IV	+	Anteroseptal
5	58/M	IV	+	Infero-posterior lateral
6	59/M	III	+	
7	58/M	III	+	

TABLE II. Hemodynamic and Angiographic Data in Seven Patients with Total Occlusion of the Left Main Coronary Artery

Patient Number	Cardiac Index	Left Ventricular End-Diastolic Pressure (mm Hg)	Ejection Fraction (%)	Wall Motion
1	1.55	15	23	Diffuse akinesia
2	2.30	16	29	Lateral and apical akinesia
3	2.16	14	44	Anterior hypokinesia
4	2.16	13	55	Anterolateral and apical hypokinesia
5	1.76	16	23	Generalized hypokinesia
6	3.66	16	16	Generalized hypokinesia
7	2.8	12	69	Anterolateral and apical hypokinesia

Hemodynamic and Angiographic Data (Table II)

The cardiac index was within normal range in two patients (Nos. 6 and 7). These patients were in functional Class III, with elevated left ventricular end-diastolic pressure (LVEDP). Two patients (Nos. 5 and 6) had generalized hypokinesis of the left ventricle and significant stenosis of the right coronary artery (RCA), left anterior descending (LAD), and circumflex (Cx) coronary arteries. Patient No. 7 had anterolateral and apical hypokinesis with mitral regurgitation, 40% stenosis of the RCA, and apparently normal LAD and Cx arteries. The LVEDP was markedly elevated in all seven patients. The ejection fraction was mildly impaired in patient No. 4, moderately impaired in No. 3, severely impaired in Nos. 1, 2, 5, and 6, and normal in No. 7.

Selective coronary arteriography clearly showed total occlusion of the LMCA in all seven patients (Figs. 1 and 2). Three pa-

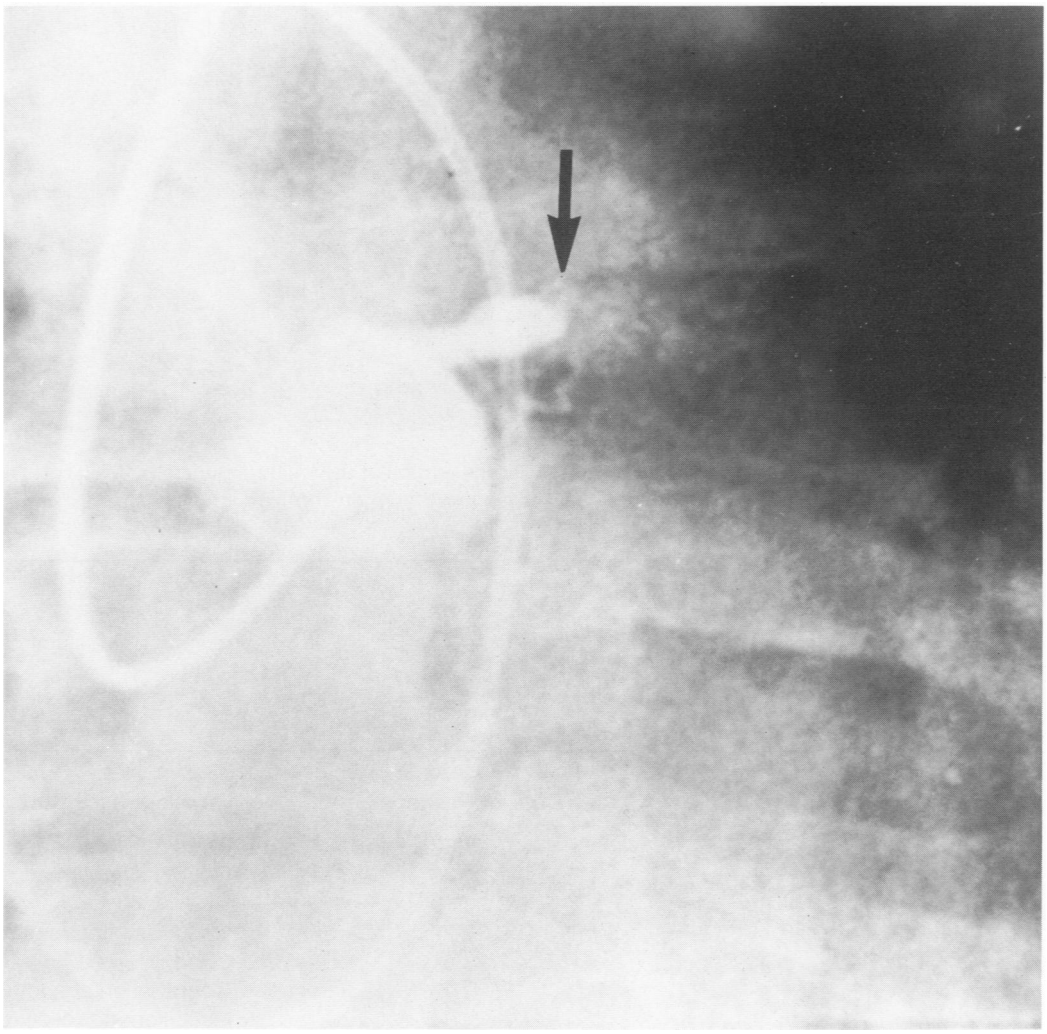

Fig. 1 Selective injection of the left coronary artery shows opacified stump (arrow) of the totally occluded left main coronary artery.

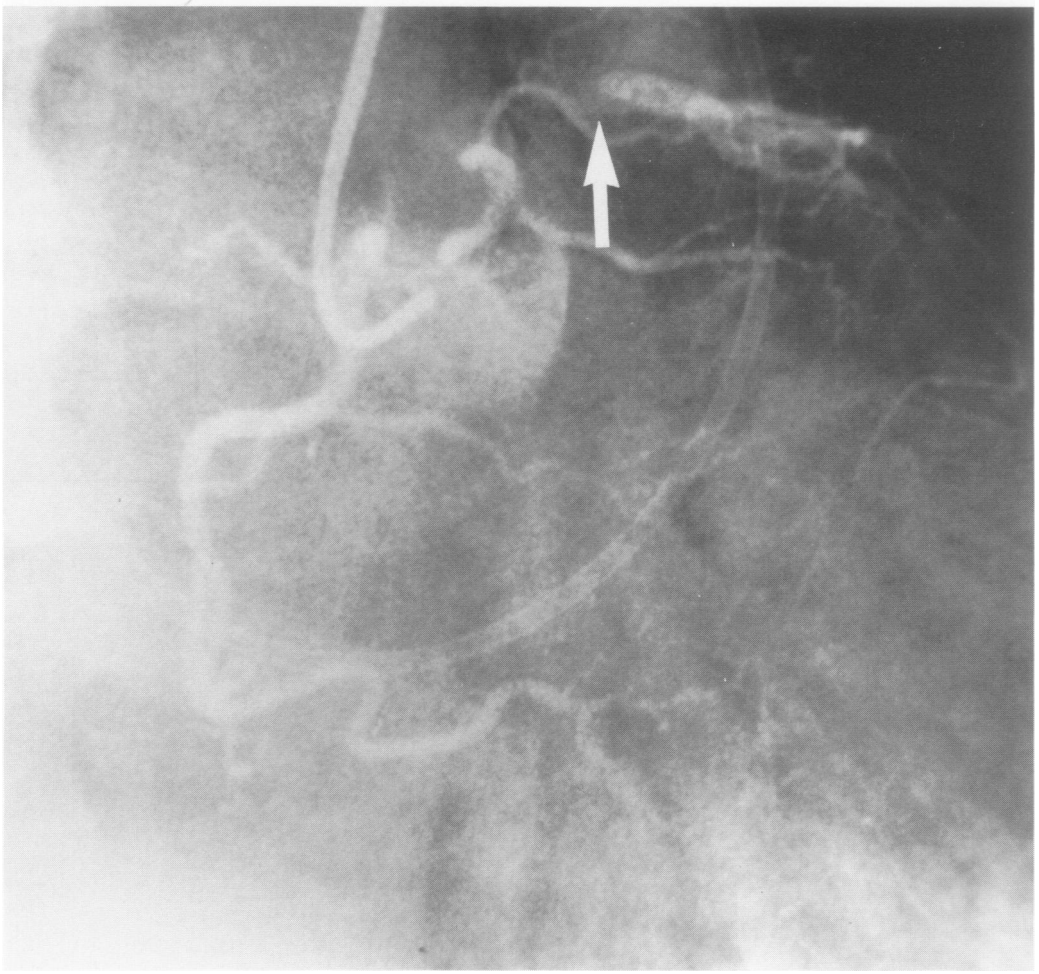

Fig. 2 Selective injection of the right coronary artery. The distal portion of the totally occluded left main coronary artery (arrow) is shown after retrograde filling from collaterals of the right coronary artery.

TABLE III. Surgical and Follow-up Data

Patient Number	No. of Bypasses	Date of Surgery	Follow-up Status
1	6	7/22/80	Good, asymptomatic
2	3	12/1/78	Good, asymptomatic
3	6	8/20/79	Good
4	4	9/27/77	Good, asymptomatic
5	4	7/23/81	Good
6	4	5/1/76	Operated on at another institution; no follow-up data
7	4	7/22/81	Good

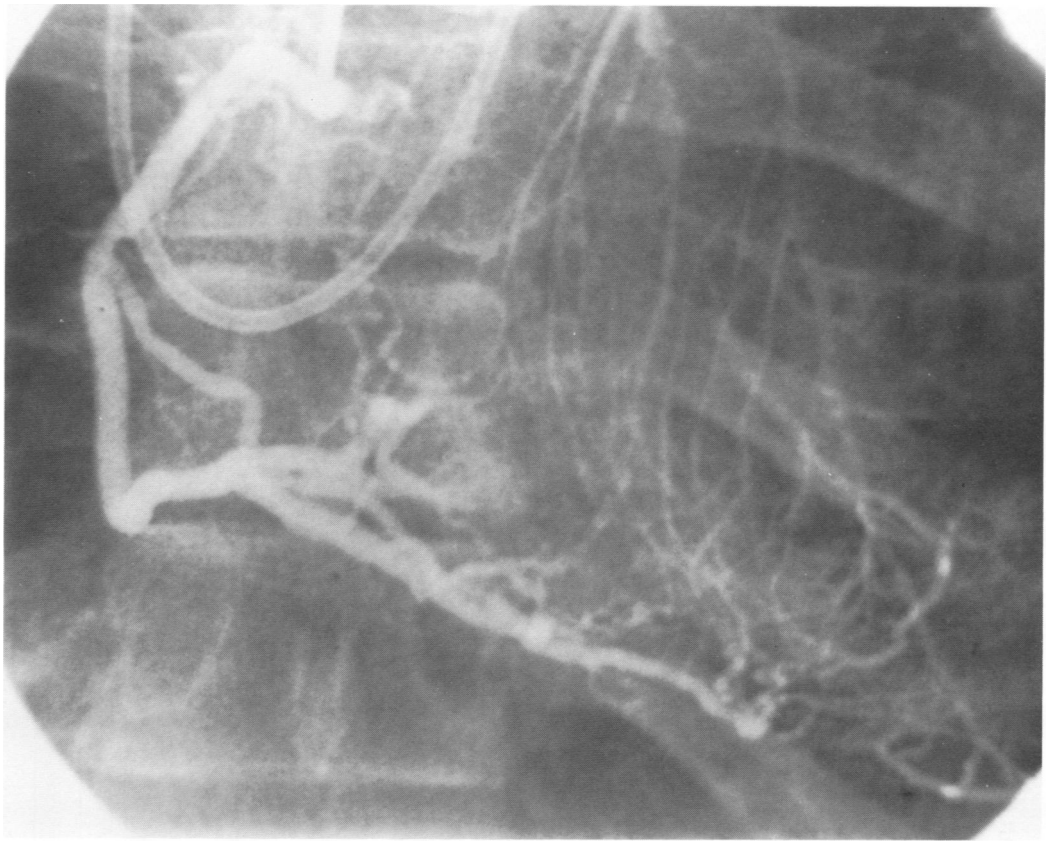

Fig. 3 Right anterior oblique projection of right coronary arteriogram shows early filling of left coronary artery through collaterals.

tients had significant stenosis (75%) of the RCA. In all patients, the left coronary artery system had demonstrable and significant circulatory flow from the RCA and its branches (Fig. 3).

There was marked hypokinesis of the left ventricular wall motion in five patients, and there was marked akinesis in two.

Surgery

Six of the seven patients underwent coronary artery bypass (CAB) at the Texas Heart Institute/St. Luke's Episcopal Hospital, and patient No. 6 was operated on at another institution (Table III).

The six patients who underwent operation at our institution did remarkably well during the postoperative period. A total of 27 saphenous vein grafts were implanted. According to electrocardiographic, enzymatic or radionuclide studies, no patient sustained a perioperative infarction. One patient experienced atrial fibrillation and responded to treatment with digoxin. Another patient who had a staphylococcal infection that resulted in sternal dehiscence responded to antibiotic treatment and also underwent reoperation for sternal rewiring.

Since surgery, the average follow-up has been 21.7 months, with a range of 3 to 49 months. All six patients who underwent operation at our institution were alive as of October, 1981.

Discussion

The gravity of total occlusion of the LMCA is evident by the poor prognosis and

TABLE IV. Summary of all Cases of Total Occlusion of the Left Main Coronary Artery Reported in the Literature

Author	Year Reported	Number of Patients	Management	Comments
Sutherland et al[1]	1979	1	CAB	Asymptomatic 22 mos postop
Nili et al[2]	1977	1	CAB	Asymptomatic 1.5 mos postop
Goldberg et al[3]	1978	6	4 CAB	2 asymptomatic 66 & 3 mos; postop; in Class III, 68 mos postop; and 1 died 3rd day postop
			2 medical treatment	1 asymptomatic 4 mos post-cath; 1 with mild angina 40 mos post-cath
Valle et al[4]	1979	4	CAB	3 have no angina and resumed work; 1 died 3 mos postop
Crosby et al[5]	1979	4	CAB	All 4 asymptomatic 38,30,13 & 9 mos postop
Frye et al[6]	1977	4	Medical treatment	All four alive when reported, one in Class II 54 mos post-cath and another with moderate angina 18 mos post-cath
Greenspan et al[7]	1979	5	4 CAB	All 4 were asymptomatic at time of report; 1 died on the 6th day post-cath while awaiting surgery
Lim et al[8]	1975	3	Medical treatment	2 were known dead; 1 was alive when reported
Kershbaum et al[9]	1973	1		Died 6 hours after cath
Reul et al[10]	1971	2	CAB	No follow-up data
Trnka et al[11]	1980	3	CAB	All asymptomatic, Class I
Hamby et al[12]	1976	2		

clinical course of patients with this form of coronary artery disease. Overall, there were 36 reported cases of total occlusion of the LMCA (Table IV). Goldberg[3] reported six patients whose symptoms ranged from Class I through Class IV. Of these, four underwent CAB with good results, but one died on the third day after operation. Valle[4] reported four patients in Classes III and IV, all of whom underwent CAB with good results. Of these four, one required concomitant left ventricular aneurysmectomy and died 2 months after surgery. Three cases of total occlusion of the LMCA were reported by the Cleveland Clinic in 1975;[8] however, Valle[4] in 1979 cited a total of 14 cases seen at that institution. Greenspan[7] reported five patients with total occlusion of the LMCA. Four underwent CAB with good results, but the fifth patient died on the sixth day after catheterization while awaiting surgery. Crosby[5] reported four cases, all of whom were receiving medical treatment. Trnka[11] reported three patients who underwent CAB with good results. Other cases were reported by Reul,[10] Hamby,[12] Kershbaum,[9] Nili,[2] and Sutherland.[1] Sutherland, however, reported the only patient who had associated congenital stenosis of the pulmonary valve.

Our series of patients is similar to previously reported cases. All were markedly symptomatic and had significant impairment of left ventricular function. Timely myocardial revascularization contributed to the prolongation of life and alleviation of symptoms.

Survival among patients with total occlusion of the LMCA could be correlated with the rate at which the occlusion of the vessel occurred. Gradual occlusion could have allowed adequate time for a functionally significant collateral circulation to develop. One study of 50 patients with left main coronary artery stenosis,[13] however, failed to indicate any protective effect of the collateral vessels upon left ventricular function. In contrast, Valle[4] reported the functionally significant role of the collateral circulation in his series of patients with total occlusion of the LMCA. The same functional significance of the collateral vessels in both patient survival and maintenance of global function of the left ventricle was reported by Goldberg,[3] Frye,[6] Greenspan,[7] and Trnka.[11] In our series, the relatively preserved ventricular function was associated with a well-developed collateral circulation.

Total occlusion of the left main coronary artery generally elicits a grim prognosis; however, the theoretically poor clinical presentation may vary, as noted among all the cases reported in the literature. There is no doubt, however, that coronary revascularization is associated with prolongation of life and alleviation of symptoms in this group of patients.

Summary

The clinical, hemodynamic, angiographic, surgical and follow-up data of seven patients with total occlusion of the left main coronary artery are reported. This rare form of coronary artery disease was seen in seven of the 5312 patients who underwent cardiac catheterization in our laboratory. All seven had coronary artery bypass. The six patients who underwent operation at our institution experienced good results.

In the literature, there are 36 previously reported cases of total occlusion of the left main coronary artery. Of these, 21 patients underwent coronary artery bypass, with apparently good results in 19. Two died—one immediately after operation, and the other 2 months thereafter.

When possible, coronary artery bypass aids in prolonging life and alleviating symptoms of patients with total occlusion of the left main coronary artery.

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