

# Emergency Surgical Treatment for Total Left Main Coronary Artery Occlusion

A Report of 2 Cases

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*Treatment of total left main coronary artery occlusion is rarely reported (84 chronic and acute cases in the world literature), due to the high mortality rate from massive myocardial infarction. Acute occlusions have been treated with intracoronary streptokinase, with percutaneous transluminal coronary angioplasty, or with both. To date, there has been no report of successful surgical revascularization in an acute case. We present 2 cases of surgically treated patients who survived total left main coronary artery occlusion that appears to have been acute, or acutely evolving. Both patients had an 80% or greater stenosis of the right coronary artery, yet have remained in New York Heart Association functional class I or II postoperatively. We attribute this not only to the aggressive surgical approach, which enabled reperfusion to be achieved within 2 hours of total occlusion, but to the protective effect in these patients of right coronary-to-left anterior descending collaterals. (Texas Heart Institute Journal 1993;20:55-9)*

**T**otal left main coronary artery (LMCA) occlusion is rare, with reported occurrence rates of about 0.04% to 0.42%<sup>1</sup> at coronary angiography. The Coronary Artery Surgery Study<sup>2</sup> reported 12 cases of total LMCA occlusion out of 20,197 patients. Goldberg and colleagues<sup>3</sup> reported 6 cases among 2,200 patients studied arteriographically, and Mora and associates<sup>4</sup> reported 6 cases among 9,000 patients similarly investigated. To our knowledge, only 84 cases (excluding those discovered at autopsy) have been reported in the world literature.<sup>2,5,6</sup> Most of these have been instances of chronic complete occlusion.

Acute total LMCA occlusion is a common cause of sudden death because of its association with massive anterior myocardial infarction. We found 5 reports describing 8 patients with sudden total obstruction of the LMCA who were treated with intracoronary streptokinase, with percutaneous transluminal coronary angioplasty, or with both.<sup>1,7-10</sup>

The present report describes 2 cases of myocardial salvage and reversal of cardiogenic shock after surgical reperfusion.

**Key words:** Arterial occlusive diseases/left main coronary artery; coronary arteriosclerosis; coronary artery bypass; shock, cardiogenic

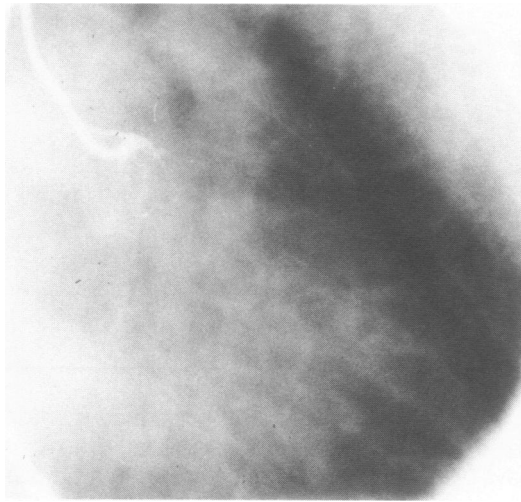
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## Case Reports

### Patient 1

A 66-year-old man was admitted to our coronary care unit 4 hours after an anterior myocardial infarction. Intravenous thrombolysis was immediately instituted. In spite of medical treatment, several episodes of angina at rest occurred during the days that followed. An echocardiogram showed dyskinesia of the apex and intraventricular thrombus. Seven days after admission, during transfer to our catheterization laboratory, a severe clinical deterioration occurred, with recurrence of crescendo angina, ST-segment elevation in the anterior leads, and cardiogenic shock. Systolic arterial pressure was less than 50 mmHg, despite a full intravenous inotropic regimen. Coronary angiography, performed immediately using the Judkins technique, demonstrated a total occlusion of the LMCA (Fig. 1). Selective infusion of nitroglycerin (0.4 mg) and urokinase (300,000 U) directly into the LMCA was unsuccessful. Aortic root angiography showed a wide, dominant right



**Fig. 1** Left coronary arteriogram: complete occlusion of the left main coronary artery (case 1).

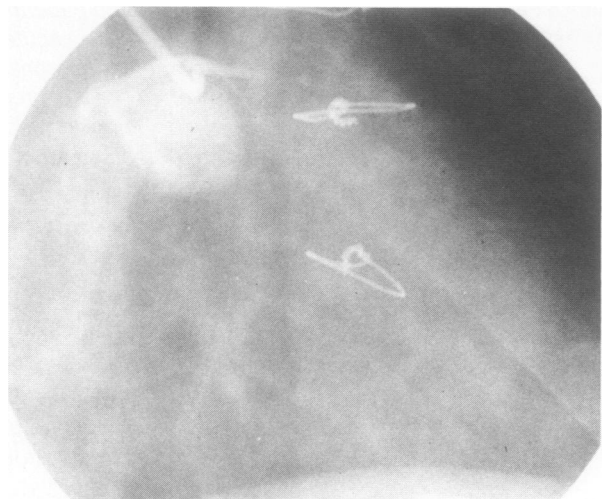
coronary artery, with 85% stenosis in the mid portion (Fig. 2). The distal left anterior descending (LAD) coronary artery and marginal branch of the circumflex coronary artery were filled from the right coronary artery system. In the meanwhile, despite infusion of both dopamine and dobutamine, there was no clinical and hemodynamic improvement, so we decided an emergency surgical revascularization was necessary. Cardiopulmonary bypass was started 2 hours after the onset of symptoms. Vein grafts were anastomosed to the LAD artery, to the obtuse marginal and posterolateral branches of the circumflex, and to the posterior descending branch of the right coronary artery.

The postoperative course was uneventful, and a rise in serum enzymes was noted, without evidence

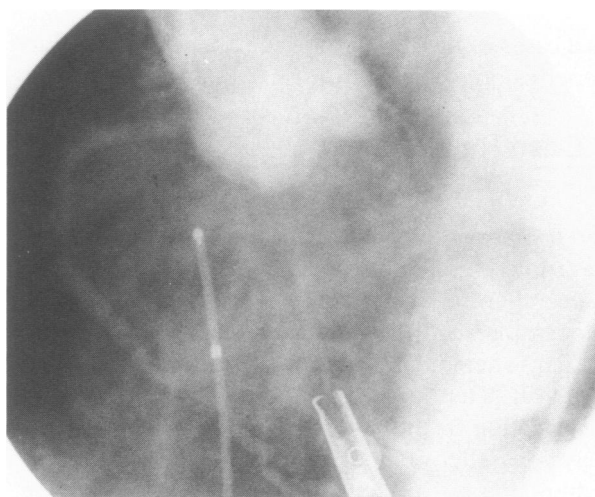
of new Q waves. The patient was discharged on the 14th postoperative day. Six months later, left ventriculography revealed apical dyskinesia, with an ejection fraction of 42%; and coronary arteriography confirmed total occlusion of the LMCA and patency of the vein grafts (Figs. 3 through 5). Three years after surgery, the patient remains stable and in New York Heart Association (NYHA) functional class II.

## Patient 2

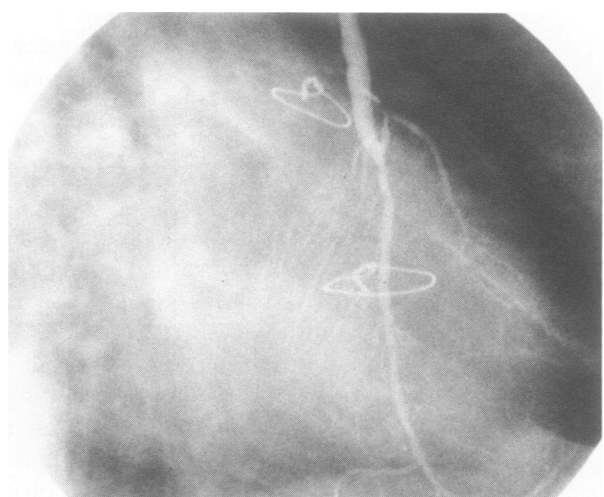
A 60-year-old man was admitted to our coronary care unit in severe pain due possibly to a myocardial infarction. Twelve years earlier, he had sustained an uncomplicated inferior myocardial infarction, and he had a 2-year history of typical exertional angina. In-



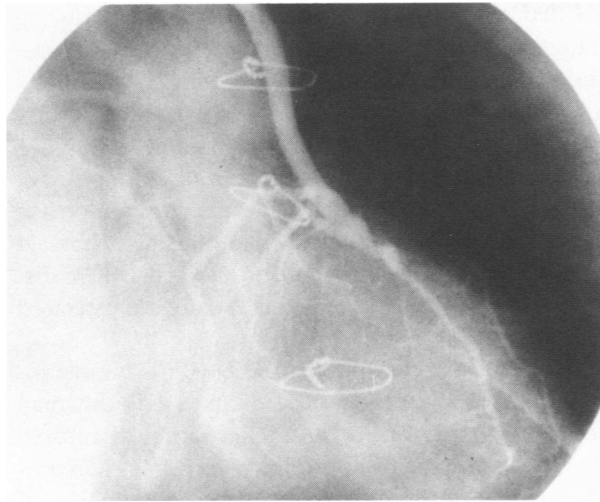
**Fig. 3** Postoperative left coronary arteriogram confirming total occlusion of left main coronary artery (case 1).



**Fig. 2** Aortic root angiography reveals a dominant right coronary artery with 85% stenosis in the mid portion (case 1).



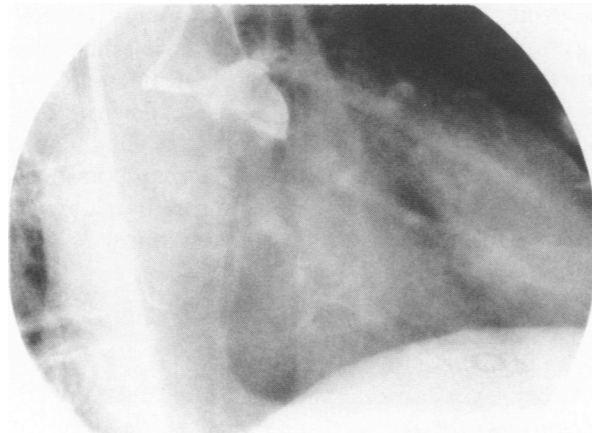
**Fig. 4** Postoperative coronary arteriogram: patency of the vein graft to the left anterior descending coronary artery (case 1).



**Fig. 5** Postoperative coronary arteriogram: patency of the vein graft to the circumflex (case 1).

travenous nitroglycerin infusion was begun immediately. Physical examination was unremarkable. The electrocardiogram showed normal sinus rhythm, left-axis deviation, and nonspecific ST-T wave changes.

Myocardial enzyme levels were measured every 4 hours on the 1st day, and once daily thereafter. The maximum creatine kinase level was 923 IU/L, with an MB fraction of 8.5%. Fourteen days after admission, the patient developed acute and heavy precordial pain; electrocardiography showed new ST-segment depressions (3 mm), without Q waves, in leads I, aVL, and  $V_2$  to  $V_6$ . At this time, he had sinus tachycardia and a blood pressure of 80/50 mmHg. Intravenous administration of nitroglycerin was unsuccessful, and coronary arteriography was performed immediately. The ostium and the LMCA were totally occluded (Fig. 6), and the right coronary artery had an 80% stenosis. The distal left anterior de-



**Fig. 6** Left coronary arteriogram: complete occlusion of the left main coronary artery (case 2).

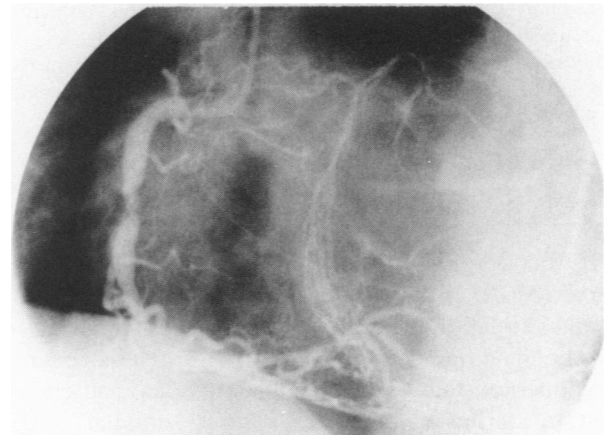
scending and circumflex arteries were visualized via collaterals from the right coronary artery (Fig. 7). Left ventriculography showed an enlarged ventricle with severe diffuse hypokinesia. The ejection fraction was 23%. The patient was referred for immediate revascularization. Saphenous vein grafts were placed to the right posterior descending, left anterior descending, 1st diagonal, and 1st circumflex marginal arteries. One year after surgery, the patient is in New York Heart Association functional class I.

## Discussion

Treatment of total acute LMCA occlusion is rarely reported because of the low survival rate: it is usually associated with a massive myocardial infarction, and patients are, of necessity, dependent upon collateral circulation from the right coronary artery.

Our review of published reports shows that all 8 survivors of acute occlusion of the LMCA suffered acute myocardial infarction with an important reduction in ejection fraction. Six of these patients were treated with intracoronary streptokinase,<sup>1,7-10</sup> 1 with percutaneous coronary angioplasty,<sup>9</sup> and 1 with aortic counterpulsation.<sup>8</sup> We have found no report describing survival after surgical treatment of acute, complete occlusion of the LMCA. We cannot be certain that occlusion in our 2 patients was acute, since the available evidence is circumstantial; yet we feel that emergency surgical intervention, without medical therapy or mechanical ventricular assistance, saves time in cases of acute, total LMCA occlusion and enables myocardial salvage.

Both our patients had an 80% or greater stenosis of the right coronary artery, yet their postoperative functional class upon long-term follow-up has been NYHA I or II. We attribute this not only to the ag-



**Fig. 7** Selective right coronary arteriogram: dominant right coronary artery with 80% stenosis in the mid portion. The left coronary tree is filled with collaterals (case 2).

gressive surgical approach, but to the protective effect of right coronary-to-LAD collaterals in these 2 patients with right coronary artery dominance (although their collateral circulation was insufficient to prevent cardiogenic shock). Two other factors contributed to the success: no life-threatening arrhythmias occurred in either patient; and the total LMCA occlusions occurred during working hours in the catheter laboratory and the coronary care unit, so proper therapy was started immediately, while a surgical team was on standby. Surgical reperfusion was achieved within 2 hours of occlusion.

## References

1. De Feyter PJ, Serruys PW. Thrombolysis of acute total occlusion of the left main coronary artery in evolving myocardial infarction. *Am J Cardiol* 1984;53:1727-8.
2. Zimmermann SH, Rogers WJ, Bream PR, et al. Total occlusion of the left main coronary artery: the Coronary Artery Surgery Study (CASS) experience. *Am J Cardiol* 1982;49:2003-10.
3. Goldberg S, Grossman W, Markis JE, Cohen MV, Baltaxe HA, Levin DC. Total occlusion of the left main coronary artery: a clinical, hemodynamic and angiographic profile. *Am J Med* 1978;64:3-8.
4. Mora B, Douard H, Colle JP, Ohayon J, Choussat A, Broustet JP. Complete obstruction of the left main coronary artery: ergometric, hemodynamic and angiographic data [in French]. *Arch Mal Coeur* 1987;80:310-7.
5. Shahian DM, Butterly JR, Malacoff RF. Total obstruction of the left main coronary artery. *Ann Thorac Surg* 1988;46:317-20.
6. Topaz O, Disciascio G, Cowley MJ, et al. Complete left main coronary artery occlusion: angiographic evaluation of collateral vessel patterns and assessment of hemodynamic correlates. *Am Heart J* 1991;121:450-6.
7. Lew AS, Weiss AT, Shah PK, Fishbein MC, Berman DS, Maddahi J. Extensive myocardial salvage and reversal of cardiogenic shock after reperfusion of the left main artery by intravenous streptokinase. *Am J Cardiol* 1984;54:450-2.
8. Flugelman MY, Shalit M, Shefer A, Hasin Y, Gotsman MS. Survival after sudden obstruction of the left main coronary artery. *Am J Cardiol* 1983;51:900-1.
9. Von Essen R, Lambertz H, Schmidt W, Rustige J, Uebis R, Effert S. Successful recanalization of a left main coronary artery occlusion. *Am J Cardiol* 1984;53:356-7.
10. Salvi A, Klugmann S, Della Grazia E, Maras P, Camerini F. Myocardial reperfusion after acute occlusion of the left main coronary artery. *Am J Cardiol* 1983;51:1791.

## Editorial Comment

Obstruction or stenosis of the left main coronary artery (LMCA) is a very serious problem, and acute total obstruction is usually a catastrophic event. This has been recognized for a long time, and it has been documented that even diagnostic cardiac catheterization studies can lead to serious sequelae and death in the presence of left main coronary stenosis—most likely due to transient aggravation of pre-existing flow limitations and myocardial ischemia. In our own catheterization laboratories, we docu-

mented the risk of serious complications during catheterization in the presence of left main disease, and we made suggestions to minimize that risk.<sup>1</sup> Analysis of cardiac-catheterization-related mortality has repeatedly revealed that severe left main disease is the predominant contributing factor. The Coronary Artery Surgery Study (CASS)<sup>2</sup> noted a 7-fold increase in risk of death, in the presence of LMCA disease; and other investigators<sup>3-5</sup> have detected LMCA disease in 46% to 75% of cardiac-catheterization-related deaths.

Acute total obstruction of the LMCA is almost invariably fatal, since the myocardium in jeopardy may be 70% to 95% of the entire left ventricular muscle mass, depending on the dominance of the circumflex artery's distribution. However, if obstruction of the left main coronary artery occurs chronically, allowing time for collateral-flow channels to develop, survival after total occlusion is indeed possible. In 5,312 consecutive patients undergoing cardiac catheterization studies in the Clayton Cardiovascular Laboratory at our institution, 7 patients were found to have total obstruction of the left main, with the entire myocardial blood flow coming from the right coronary artery and its branches collateral to the LCMA.<sup>6</sup> All of these patients were highly symptomatic, but improved dramatically upon surgical revascularization.

In the above article, Lijoi and colleagues present 2 cases wherein successful salvage was accomplished in the presence of total obstruction of the left main coronary artery. The authors present strong circumstantial evidence supporting their contention that LMCA obstruction became total in the hours preceding the angiographic study. Unfortunately, definitive evidence of the time frame in which obstruction becomes total is possible only when patients undergo 2 angiographic studies: the 1st performed anywhere from a few hours to a day or so before the acute event, and the 2nd performed after the event. I suspect that during the minutes preceding angiographic demonstration of total left main obstruction, the myocardium escaped necrosis by means of blood flow through collaterals from the right coronary artery, or through a very small compromised lumen of the LMCA itself. The authors must be lauded, however, for their prompt action and for 2 successful outcomes in the face of almost certain fatality.

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## References

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1. Mathur VS, Salem BI, Garcia E, Hall RJ, de Castro C. Uneventful catheterization in left main coronary disease: value of monitoring ventricular filling pressure in 114 patients. *Circulation* 1979;58(Suppl II):27.
2. Davis K, Kennedy JW, Kemp HG, et al. Complications of coronary arteriography from the collaborative study of coronary artery surgery (CASS). *Circulation* 1979;59:1105.
3. Adams DF, Fraser DB, Abrams HL. The complications of coronary arteriography. *Circulation* 1973;48:609.
4. Bourassa MG, Noble J. Complication rate of coronary arteriography: a review of 5,250 cases studied by a percutaneous femoral technique. *Circulation* 1976;53:106.
5. Kennedy JW. Complications associated with cardiac catheterization and angiography (From the Registry Committee of the Society for Cardiac Angiography). *Cathet Cardiovasc Diag* 1982;8:5.
6. Elayda MA, Mathur VS, Hall RJ, Garcia EG, De Castro CM, Massumi GA. Total occlusion of the left main coronary artery: report of seven cases from 5312 cardiac catheterizations and review of the literature. *Tex Heart Inst J* 1982;9:11-8.