

## Percutaneous transluminal coronary angioplasty of the very proximal left anterior descending coronary artery lesions

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### Abstrak

Untuk menilai hasil angioplasti koroner transluminal perkutan (PTCA) pada segmen yang amat proksimal dari pembuluh left anterior descending coronary artery (LAD) dilakukan analisis dari 153 penderita yang menjalani PTCA pada pembuluh tersebut. Jarak lesi dari ostium pembuluh LAD diukur pada proyeksi angiogram right anterior oblique. Duapuluh penderita (kelompok I) mempunyai lesi amat proksimal (0,5 cm dari ostium), 39 penderita (kelompok II) mempunyai lesi intermediate proximal (0,5 cm dari ostium, tetapi sebelum cabang septal pertama) dan 92 penderita (kelompok III) mempunyai lesi lebih distal. Lesi berangkai (tandem lesions) yang harus ditiup balon berkali-kali ditemui pada 9 (40,9%) penderita dari kelompok I, 11 (28,2%) penderita dari kelompok II (tidak termasuk penderita yang sudah dimasukkan dalam kelompok I dan II) dan 23 (25%) penderita dari kelompok III (tidak termasuk penderita yang sudah dimasukkan dalam kelompok I dan II). Angka keberhasilan adalah 20 (90,9%); 38 (97,4%) dan 82 (89,1%), masing-masing pada kelompok I, II dan III. Perbedaan antar kelompok tidak bermakna. Luas penyakit, derajat serta beratnya kelainan morfologik tidak mempengaruhi keberhasilan. Tidak ditemui komplikasi pada penderita kelompok I. Diseksi pembuluh left main stem tidak pernah terjadi. Seorang penderita kelompok III mengalami infark dan seorang penderita dari kelompok III meninggal. Pada 2; 1 dari 9 penderita dari kelompok I, II dan III oklusi total pembuluh tidak dapat dilewati. PTCA pada pembuluh LAD yang mata proksimal dapat dilakukan secara aman dengan angka keberhasilan yang tinggi.

### Abstract

To assess the result of percutaneous transluminal coronary angioplasty (PTCA) of the very proximal left anterior descending (LAD) lesions, 153 consecutive patients undergoing PTCA of LAD were analyzed. The distance of the lesion from the origin of LAD was measured in the right anterior oblique angiogram. Twenty-two patients (group I) had very proximal lesion (0.5 cm from the origin), 39 patients (group II) had intermediate proximal lesion (0.5 cm from the origin, but still before the first septal branch) and 92 patients (group III) had more distal lesion. Tandem lesions necessitating multiple balloon inflation were observed in 9 (40.9%) patients of group I, 11 (28.2%) patients of group II (excluding those already included in group I) and 23 (25%) patients of group III (excluding those already included in groups I and II). Success rates were 20 (90.9%); 38 (97.4%) and 82 (89.1%) respectively, in group I, II and III. Differences were statistically not significant. Extent of disease as well as degree and morphologic severity did not influence success. No complications occurred in any patient of group I. Dissection of the main stem has not observed. One patient of group III developed acute infarction and one patient of group III died. We failed to cross chronic total occlusion in, respectively; 2, 1 and 9 patients of group I, II and III. PTCA of the very proximal LAD can be performed safely with a high success rate.

**Keywords :** PTCA, left anterior descending coronary artery.

### INTRODUCTION

Proximal left anterior descending (LAD) coronary artery disease is generally considered as a high risk lesion associated with an increased rates of death and myocardial infarction. However, treatment of such lesion has remained controversial. Compared to medical therapy, coronary artery bypass surgery has not been conclusively demonstrated to improve survival or prevent myocardial infarction in this setting.<sup>1-3</sup> The dilemmas are renewed by the increasing use of internal

mammary bypass grafting, which long term patency and low perioperative infarction and mortality has made the procedure an effective therapy.<sup>4-7</sup>

The recent advent of percutaneous transluminal coronary angioplasty (PTCA) and particularly the ever increasing angioplasty operator experience and continued improvement in methods and equipment have changed the approach substantially. Currently PTCA has emerged as an alternative effective treatment for proximal LAD disease with a high success rate, low incidence of procedural complication and excellent long term result.<sup>8-12</sup> However, the risk of PTCA of a lesion in a very close proximity to the left main coronary artery is less well defined.<sup>12</sup>

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This study was undertaken to determine the immediate success rate and procedural complication of PTCA of the very proximal LAD lesion.

## METHODS

### Patients

The study groups included 153 consecutive patients undergoing PTCA of the LAD. Their ages ranged from 31 to 72 years and 118 were male. A history of prior myocardial infarction was noted in 37 (24.2%) patients. The left ventricular function, as assessed by contrast ventriculography was normal (EF 55%) in 101 (66.0%) patients, impaired (EF >30-55 %) in 43 (28.1 %) patients and poor (EF < 30% ) in 9 (5.9 %) patients. Patients who had angioplasty for treatment of an acute evolving myocardial infarction were excluded.

The distance of the lesion from the origin of LAD was measured in the right anterior oblique angiogram. The proximal LAD lesion was defined as extending from the vessel origin to the take-off of the anatomic first septal perforator branch.

The patients were divided into 3 groups depending on the site of the LAD stenosis. Group I comprised of patients with very proximal lesion, that was less than 0.5 cm from the vessel origin but still before the first septal branch. Group II consisted of patients with proximal lesion of greater than 0.5 cm from the origin. Group III had more distal lesion. Patients with tandem lesions were classified according to their proximal stenosis.

### Definitions

Extent of coronary artery disease was defined as the number of epicardial vessel (or major branches) with  $\geq 70\%$  stenosis by visual estimation. Single vessel disease referred to  $\geq 70\%$  stenosis of the LAD.

Severity of lesion was classified as type A, B, or C according to the recommendation of the American College of Cardiology/American Heart Association Task Force.

Successful coronary dilatation was defined as less than 50% residual stenosis with  $\geq 20\%$  reduction of the original stenosis in the absence of infarction, urgent bypass surgery or death.

### Angioplasty Procedure

Unless contraindicated, medications given before PTCA usually consisted of nitrates, calcium channel

blocker, aspirin and ticlopidine. Angioplasty was attempted first to dilate the most severely diseased vessel supplying the greatest amount of jeopardized myocardium. If this primary target vessel was the LAD and the lesion were multiple, PTCA was started from the most distal vessel upstream. During balloon inflation, care was taken not to obstruct the left main coronary artery. However, to achieve an optimal result occasionally dilatation had to be performed with part of the balloon in the left main coronary artery; an attempt that was only possible if the size of the left main coronary artery was big enough to allow unhindered flow to the left circumflex coronary artery. A good flow to the left circumflex coronary artery after contrast injection in the absence of a sudden drop of blood pressure secured that this artery was not compromised. In no instance was a double guide wire technique used. During the procedure, intravenous heparin and intracoronary nitrates were used. After PTCA patients were maintained on heparin for  $\leq 24$  hours, and continued to receive nitrates for  $\geq 24$  hours, a calcium channel blocker for  $\geq 6$  months and antiplatelet indefinitely. No stents, lasers or atherectomy devices were used in this study.

### Statistical Analysis

Univariate analyses between groups were performed by using the t-test.

## RESULTS

Twenty-two patients belonged to group I, 39 patients to group II and 92 patients to group III. Tandem lesions necessitating multiple balloon inflations were observed in 9 (40.9%) patients of group I, 11 (28.2%) patients of group II (excluding those already included in group I) and 23 (25%) patients of group III (excluding those already included in group I and II).

All groups of patients were similar with respect to the extent and degree or morphologic severity of coronary artery disease (Table 1).

Success rates were 90.9% ; 97.4% and 89.1% in, respectively, group I, II and III. No complications occurred in any patients of group I. Dissection of the left main coronary artery was not noted. One patient of group III developed an acute infarction and one patient of group III died. None required emergency bypass grafting and no patient experienced a stroke. We failed to cross chronic total occlusions in, respectively, 2, 1 and 9 patients of group I, II and III.

Table 1. Extent and morphologic severity.

	Group I	Group II	Group III
<b>Vessels involved</b>			
Single (LAD)	16 (72.73 %)	27 (69.23 %)	66 (71.74 %)
Double	5 (22.73 %)	11 (28.21 %)	22 (23.91 %)
Triple	1 (4.54 %)	1 (2.56 %)	4 (4.35 %)
<b>Stenosis severity</b>			
Type A	7 (31.82 %)	15 (38.46 %)	37 (40.22 %)
Type B	12 (54.54 %)	20 (51.28 %)	44 (47.83 %)
Type C	3 (13.64 %)	4 (10.26 %)	11 (11.95 %)
Success	20 (90.9 %)	38 (97.4 %)	82 (89.1 %)

## DISCUSSION

A proximal LAD stenosis is respected by cardiologists and cardiac surgeon because of its distinctive negative influence on morbidity and mortality. The LAD supplies the anterior part of the interventricular septum and the anterior wall of the left ventricle. This constitutes 40% of the left ventricular myocardium.<sup>14</sup> LAD disease is a common finding in autopsy studies of patients who die of acute myocardial infarction. Proximal LAD stenosis occurred in 21% of patients who died of non cardiac causes<sup>15</sup> and 23% of patients who died of acute myocardial infarction.<sup>16</sup> In contrast, acute thrombotic coronary events in the proximal LAD accounted for 61 % of fatal myocardial infarction, in comparison with 8 % of acute lesions occurring in the mid or distal segments. Also, the incidence of acute thrombotic events in other coronary arteries was much lower, being 6 % in the left circumflex, 7 % in the left main and 18 % in the right coronary artery.<sup>16</sup>

In survivors of myocardial infarction, the mortality rate at 30 months was 27 % in patients with proximal LAD and only 4 % in those without proximal LAD disease.<sup>17</sup> In another study of survivors of myocardial infarction, it has been shown that at 3 year, the mortality rate from cardiac causes and the incidence of recurrent myocardial infarction in patients with LAD disease was similar to that in patients with multivessel disease.<sup>18</sup>

Because of these reason, another alternatives to medical treatment are chosen. These are coronary artery bypass surgery and PTCA or related procedures such as stenting, atherectomy and lasers. The Coronary Artery Surgery Study reported a 10-year survival advantage in operated patients with proximal LAD coronary stenosis  $\geq 70$  % and an ejection fraction of  $<0.50$ .<sup>19</sup> Although PTCA is another alternative for

coronary revascularization, randomized trial comparing bypass grafting and PTCA is lacking. Furthermore the results of a non matched patient series in which heterogeneous patient groups undergo PTCA or bypass surgery based on physician and patient preference are not conclusive.<sup>10</sup> In a randomized trial comparing PTCA and medical therapy in the treatment of single vessel disease, PTCA is reported to offer earlier and more complete relief of angina than medical therapy and is associated with better performance on the exercise test. However PTCA treatment involves a small immediate risk of acute myocardial infarction and acute coronary occlusion leading to bypass surgery and a later need for redilatation to treat restenosis.<sup>20</sup> The relatively small number of patients recruited in this trial does not allow analysis to be done on the impact of PTCA on the LAD.

Earlier studies of PTCA for LAD stenosis reported clinical success rates of only 84.5 %<sup>8</sup> to 90.6 %, <sup>9</sup> whereas the incidence of myocardial infarction was higher (5.7 %)<sup>8</sup> and a greater proportion of patients required in hospital bypass surgery (7.7 % to 8.3 %).<sup>8,9</sup> The lower success rates and the greater number of in-hospital events reflect the time period of the studies. In both studies no particular attention was paid on lesion in the very proximal part of the LAD. Recent studies showed that a higher success rate (around 95%) and a lower procedural complication (less than 3%) can be achieved.<sup>11,12</sup>

In the present study we specifically analyzed the results of PTCA of the very proximal LAD lesions, which may carry a higher risk if the procedure result in occlusive dissection with involvement of the mainstem. Regardless of number of vessels involved and the degree or morphologic severity of the lesion, the success rate of in patients with very proximal stenosis did not differ with those having more distal narrowing (s). In this small series of patients we did not observe any complication including dissection of the left main stem. Comparison with other recent reports yields similar findings.<sup>11,12</sup> Technical improvements with stents, lasers, atherectomy (DCA, rotablator, TEC device) may offer better results for specific lesions, i.e. DCA appears well suited for stenosis which are eccentric, ulcerative or contain small-moderate amounts of thrombus. The rotablator may be of benefit when moderate angulation or calcification is present, but should be avoided when clot is evident.<sup>21</sup>

There has been considerable discussion regarding the relatively high restenosis rate (up to 40 %) of the proximal LAD, in comparison with other locations in



the same vessel or in the other vessels.<sup>11,22</sup> However, such as rate is based on incomplete angiographic follow up and reflects the higher probability of restudy in symptomatic patients. The number of patients requiring a second revascularization procedure is also a clinically relevant measure of long term success. In one study it was reported to be 19%.<sup>11</sup> In our study many of the patients did not undergo repeat cardiac catheterization, so no data can be provided regarding long term results.

The available data in the literature suggest that both PTCA and bypass surgery can provide excellent long term results with low risk of cardiac death and myocardial infarction. Regardless of the initial revascularization strategy employed, it appears that the 5-year survival rate without cardiac death or myocardial infarction has an upper limit that borders on 95%.<sup>8,9,11</sup>

In conclusion, in most patients with very proximal lesion of the LAD, PTCA can be performed with a very high overall success rate and low risk. However, the procedure has to be performed with the full understanding that a second revascularization procedure may be required for recurrence.

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#### REFERENCES

1. European Coronary Artery Bypass Surgery Study Group. Prospective randomized study of coronary artery bypass surgery in stable angina pectoris. *Lancet* 1980;2:491-5.
2. Mock MB, Ringqvist I, Fisher LD et al. Survival of medically treated patients in the Coronary Artery Surgery Study (CASS) registry. *Circulation* 1982;66:562-8.
3. Murphy ML, Hultgreen HN, Detre K, Thomsen J, Takaro T. Treatment of chronic stable angina : a preliminary report of the survival data of the randomized Veterans Administration Cooperative Study. *N Engl J Med* 1977;297:621-7.
4. Sing RN, Sosa JA, Green GE. Long term fate of internal mammary artery and saphenous vein grafts. *J Thorac Cardiovasc Surg* 1983;86:369-63.
5. Okies JE, Page US, Bigelow JC, Kraude AH, Salomon NW. The left internal mammary artery : the graft of choice. *Circulation* 1989;7- (suppl.I): I.213-21.
6. Tector AJ, Schmah TM, Canino VR, Kallies JR, Sanfilippo D. The role of the sequential internal mammary artery graft in the coronary surgery. *Circulation* 1984 70 (suppl.I):I.225-5.
7. Lytle BW, Loop FD, Cosgrove DM, Ratliff NB, Easley K, Taylor PC. Long term (two to 12 years) serial studies of internal mammary artery and saphenous vein coronary bypass grafts. *J Thorac Cardiovasc Surg* 1985;89:248-58.
8. Talley JD, Hurst JW, King SB III et al. Clinical outcome 5 years after attempted percutaneous transluminal coronary angioplasty in 247 patients. *Circulation* 1988;77:820-9.
9. Kramer JR, Proudfit WL, Loop FD et al. Late follow-up of 781 patients undergoing percutaneous transluminal coronary angioplasty or coronary bypass grafting for an isolated obstruction in the left anterior descending coronary artery. *Am Heart J* 1989;118:1144-53.
10. Ellis SG, Fischer L, Dushman-Ellis, et al. Comparison of coronary angioplasty with medical treatment for single and double vessel coronary disease with left anterior descending coronary involvement : long-term outcome based on an Emory-CASS registry study. *Am Heart J* 1989;118:208-20.
11. Frierson JH, Dimas AP, Whitlow P et al. Angioplasty of the proximal left anterior descending coronary artery : initial success and long-term follow-up. *J Am Coll Cardiol* 1992;19:745-51.
12. Piovaccari G, Fattori R, Marzocchi A et al. Percutaneous transluminal coronary angioplasty of the very proximal left anterior descending coronary artery lesions : immediate results and follow-up. *Int J Cardiol* 1991;30:151-5.
13. ACC/AHA Task Force Report. Guidelines for percutaneous transluminal coronary angioplasty. *J Am Coll Cardiol* 1988;12:529-45.
14. Edwards WD, Tajik AJ, Seward JB. Standardized nomenclature and anatomic basis for regional tomographic analysis of the heart. *Mayo Clin Proc* 1981;56:479-97.
15. Vlodaver Z, Edward JE. Pathology of coronary atherosclerosis. *Prog Cardiovasc Dis* 1971;14:250-73.
16. Schuster EH, Griffith LSC, Buckley BH. Preponderance of acute proximal left anterior descending coronary arterial lesions in fatal myocardial infarction : A clinicopathologic study. *Am J Cardiol* 1981;47:1189-96.
17. Taylor GJ, Humphries JO, Mellits ED et al. Predictors of clinical course, coronary anatomy and left ventricular function after recovery from acute myocardial infarction *Circulation* 1980;62:960-70.
18. De Feyter PJ, VanEenlge MJ, Dighton DH et al. Prognostic value of exercise testing, coronary angiography, and left ventriculography 6-8 weeks after myocardial infarction. *Circulation* 1982;66:527-36.
19. Chaitman BR, Ryan TJ, Kronmal RA, Foster ED, Frommer PL, Killip T and the Cass investigators : Coronary Artery Surgery (CASS) : Comparability of 10 year survival in randomized and randomizable patients. *J Am Coll Cardiol* 1990;16:1071-8.
20. Parisi AF, Folland ED, Hartigan PH, on behalf of the Veterans Affairs ACME Investigators. A comparison of single vessel coronary artery disease. *N Engl J Med* 1992;326:10-6.
21. Freed MS. Osital stenosis, in : *Manual of Interventional Cardiology* ; Freed M, Grines C (eds), Birmingham, Michigan : Physician's Press : 1992, 11, 128-34.
22. Rubin GS, King SB, Douglas JJ. Restenosis after percutaneous transluminal coronary angioplasty. The Emory University Hospital experience. *Am J Cardiol* 1987;39B-43B.