Percutaneous transluminal coronary angioplasty; two years' experience

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Since September 1977,[1,2] 82 patients (July 1979) with various lesions have undergone percutaneous transluminal coronary angioplasty. The age range was 31 to 68 years. Forty-five patients had single-vessel disease (no other major artery involved with more than 50% obstruction), eight had status after aortocoronary bypass operation with recurrent stenosis and symptoms, and the remainder had double- or triple-vessel involvement.

Patients have been studied by clinical status, exercise tests, and coronary angiography before and after percutaneous transluminal coronary angioplasty, including follow-up every 3 months for the first year and angiography repeated 6 to 9 months thereafter.

In 68 patients (83%) we were able to pass the lesion with the dilatation catheter. In this group the mean duration of angina pectoris since the onset of chest pain had been 9 months (range, 1 to 108 months).

In 60 cases anatomical and hemodynamic success could be noted, which led to significant improvement in clinical parameters, e.g., reduction of coronary narrowing of the transluminal diameter from 82% ± 11% (mean ± 1 SD) to 34% ± 16% ($p < 0.001$). The stenosis is calculated as a mean of at least three oblique projections.

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The mean pressure gradient across the stenosis was measured through the main lumen of the double lumen dilatation catheter. As a result of dilatation the mean pressure gradient across the lesion was reduced from 56 ± 15 mm Hg to 19 ± 12 mm Hg ($p < 0.001$).

The improvement of anatomy and distal coronary pressure led to an increase of submaximal working capacity consistent with steady state from 77 ± 46 watts to 120 ± 39 watts and normalization of thallium-201 perfusion scintigram in patients with single-vessel disease.

Of the 60 anatomic successes, four patients had CPK-MB elevation, of whom three showed electrocardiographic evidence of either transmural (Q-wave criteria) (one patient) or nontransmural (two patients) infarction in the hospitalization period. Despite this, clinical improvement could be noted and operation was not considered to be necessary.

Eight patients had either no anatomical improvement (two patients) or sudden reclosure of the dilated segment with clinical symptoms of impending infarction (six patients) and required aortocoronary bypass either within 24 hours (seven patients) or thereafter (one patient), of whom three had CPK-MB-elevation, but only one electrocardiographic evidence of myocardial infarction at discharge.

We were unable to reach or pass the stenosis in 14 patients (18%). In these subjects, the mean duration of angina pectoris had been 20 months (range, 1 to 192 months). The failures were mainly due to anatomic factors, such as tortuosity of the vessel, sharp-angled takeoff of the left anterior descending artery, tightness and eccentricity of the stenosis. In the meantime, all of these patients had aortocoronary-bypass operation, four within 24 hours after the attempt of dilatation, one of whom had CPK-MB-elevation with electrocardiographic evidence of myocardial infarction.

In the 82 attempts there were no deaths, no evidence of embolization, no central nervous system deficits, and two femoral hematomas requiring evacuation.

Forty-two patients of the 60 primary successes had at least one follow-up examination with a mean follow-up time of 9 months (range, 3 to 18 months). Improvement of functional class was maintained in 28 patients; five showed further improvement, whereas seven recurrences showed deterioration to a lower working capacity. Two patients have died. One death was unrelated to percutaneous transluminal coronary angioplasty, the second was a sudden death and occurred unexpectedly in a 45-year-old man with extensive hypertrophy of the medial smooth muscle cells of the left main stem. The extent of stenosis had been underestimated and the vessel was therefore incompletely dilated. Autopsy showed no occlusion or dissection and no infarction. The cause of death was not clear.

Until June 1979, follow-up angiograms 6 to 9 months after percutaneous transluminal coronary angioplasty were available in 21 of the 33 patients showing consistent clinical improvement. The vessel remained widely patent. There was even improvement in vessel patency and wall smoothness.

By July 1979, seven recurrences had been observed in the 60 patients with primary successes, angiograms were obtained in all cases. There were three recurrences in five patients in whom stenoses of the saphenous vein grafts

have been dilated. Two patients were treated medically and one patient had repeated dilatation with at least initial success. The other recurrences were in patients with dilatation of left anterior descending artery stenosis. Two had repeated percutaneous transluminal coronary angioplasty, again with at least initial success and two had uneventful aortocoronary bypasses.

From the clinical results reported the following conclusions can be drawn:

1. We emphasize that the results are preliminary and much more information and follow-up data are necessary to accept percutaneous transluminal coronary angioplasty as a new treatment in coronary heart disease.
2. Cooperation with cardiac surgery is mandatory to treat complications aggressively with no time delay in order to avoid infarction.
3. Best indications are patients with a short history of disabling chest pain and single-vessel disease.
4. Stenosis of saphenous vein bypass grafts can be dilated but the recurrence rate seems to be high.

References

1. Grüntzig A: Transluminal dilatation of coronary-artery stenosis. Lancet 1: 263, 1978.
2. Grüntzig AR, Senning A, Siegenthaler WE: Nonoperative dilatation of coronary-artery stenosis: percutaneous transluminal coronary angioplasty. N Engl J Med **301:** 61–68, 1979.