A comparison of coronary artery stenting with angioplasty for isolated stenosis of the proximal left anterior descending coronary artery: five year clinical follow up

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Background: Stent implantation for isolated stenosis of the proximal left anterior descending coronary artery (LAD) with preserved left ventricular function has been found to have a better clinical and angiographic outcome at one year than balloon angioplasty (PTCA).

Objective: To establish whether those results are maintained at five year follow up.

Methods: Patients were followed at least every six months. For those who died during follow up, data were obtained from medical records.

Main outcome measures: Freedom from death, non-fatal myocardial infarction, cerebrovascular accident, and repeated target lesion revascularisation. Secondary end points were revascularisation in a remote region and freedom from angina.

Results: Follow up was complete in all patients. At five years, the primary end point was reached more often by patients randomised to stent implantation than to PTCA (80% vs 53%; odds ratio (OR) 0.29 (95% confidence interval (CI) 0.13 to 0.69); p = 0.0034). In the PTCA group, 35% of patients underwent target lesion revascularisation vs 15% in the stent group (OR 0.33, 95% CI 0.13 to 0.80; p = 0.014). There was a trend towards increased mortality in the PTCA group than in the stent group (17% vs 7%; OR 0.36, 95% CI 0.10 to 1.21; p = 0.098). No significant differences were found between PTCA and stent groups for non-fatal myocardial infarction (8% vs 5%; OR 0.58, 95% CI 0.13 to 2.54; p = 0.46) or cerebrovascular accident (2% vs 0%).

Conclusions: In patients with isolated stenosis of the proximal LAD, a five year clinical follow up confirmed a better outcome in those treated with stenting than with PTCA.
in a patient, only the first event was counted for survival analysis.

**Statistical analysis**

NORMALLY distributed variables are expressed as mean (SD) and were compared using the unpaired Student t test. A χ² test with continuity correction was used to compare proportions. All statistical tests were two tailed. Discrete variables are expressed as percentages and were compared in terms of odds ratio (OR) for stented lesions v balloon dilated lesions, including 95% confidence intervals (CI) calculated by the χ² method and Fisher’s exact test. Differences between the groups were considered significant when the probability value was p < 0.05. Time to first event-free survival after stent implantation or balloon angioplasty was determined by the Kaplan–Meier method and displayed as survival curves. Comparison between curves was carried out using the Cox proportional hazard regression analysis. All statistical analysis was done using Statview (version 5.0) for Windows (SAS Institute Inc).

**RESULTS**

In-hospital outcome and one year follow up

As previously reported,1 there were no significant differences in baseline clinical or angiographic characteristics between the two groups. Acute angiographic and procedural success rates were similar in the two groups (two patients in the PTCA group crossed over into the stent group because of a limiting dissection). There was no difference in the incidence of major clinical events between the groups during the hospital stay. No patient had cerebrovascular complications. At one year, a primary clinical end point was reached in 65% of the patients in the PTCA group compared with 85% of those in the stent group (OR 0.33, 95% CI 0.13 to 0.81; p = 0.0179).1 The rates of restenosis and target lesion revascularisation were increased in the PTCA group compared with the stent group (40% v 19%, p = 0.02; and 32% v 10%, p = 0.0053, respectively). No differences in mortality (2% v 2%) or non-fatal myocardial infarction (5% v 3%) were observed between the two groups.

**Five year follow up**

Primary and secondary clinical end points are detailed in tables 2, 3, and 4. All patients enrolled in the study completed the five year follow up. The prevalence of risk factors was similar in patients undergoing PTCA and stent implantation both at baseline and at the five year follow up. Furthermore, the use of β blockers, nitrates, and statins was similar between the groups. Of the 60 patients randomised to stent implantation, 48 (80%) were free of major adverse cardiac events, compared with 32 of the 60 patients (53%) randomised to PTCA (OR 0.29, 95% CI 0.13 to 0.69; p = 0.0034) (fig 1).

A trend towards a higher total and cardiac mortality was observed in patients treated with PTCA than in those treated with stenting (17% v 7%; OR 0.36, 95% CI 0.10 to 1.21, p = 0.098; and 13% v 5%; OR 0.34, 95% CI 0.08 to 1.36, p = 0.12, respectively). There were two additional cases of target lesion revascularisation in the PTCA group (3%) versus three (5%) in the stent group (p = 0.99) (fig 2). No angiographically significant new lesions in the LAD requiring interventional treatment were observed in our patients at follow up. At the five year follow up, 26 patients in the PTCA group (52%) v 41 (73%) in the stent group were free of angina (OR 0.32, 95% CI 0.14 to 0.75; p = 0.075). The need for new revascularisation in a remote region did not differ between groups (5 v 8%; p = 0.46); in particular, it was similar in the diabetic patients in the two groups: one in the stent group and two in the PTCA group (2% v 3%; p = 0.99).

**DISCUSSION**

Our findings indicate that in symptomatic patients with isolated proximal stenosis of the LAD and preserved left ventricular function, primary stent implantation resulted in a more favourable clinical outcome than PTCA at five years, confirming a persistent benefit of stent implantation over PTCA beyond the first 12 months.

| Table 1 Baseline angina characteristics of 120 patients included in intention to treat analysis, according to treatment group |
|---------------------------------------------------------------|
| | Angioplasty (n=60) | Stent (n=60) | p Value |
|---------------------------------------------------------------|
| Exertional angina | 49 (82) | 50 (83) | 0.79 |
| Class I | 5 (8) | 4 (7) | |
| Class II | 27 (45) | 22 (37) | |
| Class III | 11 (18) | 18 (30) | |
| Class IV | 6 (10) | 6 (10) | |
| Unstable angina | 11 (18) | 10 (17) | |
| Class IIb | 6 (10) | 5 (8) | |
| Class IIIb | 5 (8) | 5 (8) | |

Figure 1 Kaplan–Meier event-free survival curves (defined as freedom from death, myocardial infarction, cerebrovascular accident, and target lesion revascularisation) of the two study groups at the five year follow up. At one year, the primary clinical end point was reached in 85% of the patients randomised to stent implantation (solid line) and in 65% of the patients randomised to PTCA (dashed line). The difference in the overall incidence of the primary end point, which was significant at one year, remained its significance at five years (80% in the stent group v 53% in the PTCA group, p = 0.0034).

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So far the longest follow up of patients randomised to PTCA or stent implantation has been in the Benestent-I study. In that study, at the five year follow up there were significant differences between PTCA and stenting for the rate of target lesion revascularisation. Disease progression in non-stented vessels accounted for the majority of late revascularisations. In addition, in a four year follow up Betriu and colleagues showed that most of the repeated procedures (84%) were carried out in the first six months.

Long term follow up of non-randomised trials of patients treated with Palmaz-Schatz stents have confirmed that the progressive increase in repeated revascularisation over longer periods can be attributed to progression of coronary disease at other sites rather than to late impairment of the stented vessel.

In our study, in the time interval between 13 months and five years after the procedure, there were only two additional cases of target lesion revascularisation in the PTCA group (3%) and three (5%) in the stent group, suggesting that the advantage of coronary stenting over PTCA is limited to the first 12 months. Moreover, after the first year, the likelihood of the disease progressing is quite low, and similar between treated and remote coronary vessels.

In our trial we found that the incidence of total and cardiovascular mortality was similar to previous studies, including patients with proximal LAD stenosis undergoing

### Table 2 Primary clinical endpoints

| Event-free survival | Angioplasty (n = 60) | Stent (n = 60) | p Value | OR | 95% CI |
|---------------------|----------------------|---------------|---------|----|--------|
| 1 to 12 months      | 39 65                | 51 85         | 0.0179  | 0.33 | 0.13 to 0.81 |
| 13 to 60 months     | 32 53                | 48 80         | 0.0034  | 0.29 | 0.13 to 0.69 |

| All causes of death | Angioplasty (n = 60) | Stent (n = 60) | p Value | OR | 95% CI |
|---------------------|----------------------|---------------|---------|----|--------|
| 1 to 12 months      | 1 2                  | 1 2           | 0.99    |    |        |
| 13 to 60 months     | 9 15                 | 3 5           | 0.08    |    |        |

| Total               | 10 17                | 4 7           | 0.098   | 0.36 | 0.10 to 1.21 |

| Cardiac death       | Angioplasty (n = 60) | Stent (n = 60) | p Value | OR | 95% CI |
|---------------------|----------------------|---------------|---------|----|--------|
| 1 to 12 months      | 1 2                  | 1 2           | 0.99    |    |        |
| 13 to 60 months     | 7 12                 | 2 3           | 0.10    |    |        |

| Total               | 8 13                 | 3 5           | 0.12    | 0.34 | 0.08 to 1.36 |

| Non-cardiac death   | Angioplasty (n = 60) | Stent (n = 60) | p Value | OR | 95% CI |
|---------------------|----------------------|---------------|---------|----|--------|
| 1 to 12 months      | 2* 3                 | 1† 2          | 0.99    |    |        |
| 13 to 60 months     | 2 3                  | 1 2           | 0.99    |    |        |

| Total               | 5 8                  | 3 5           | 0.46    | 0.58 | 0.13 to 2.54 |

| CVA                 | Angioplasty (n = 60) | Stent (n = 60) | p Value | OR | 95% CI |
|---------------------|----------------------|---------------|---------|----|--------|
| 1 to 12 months      | 0 0                  | 0 0           | 0.99    |    |        |
| 13 to 60 months     | 1 2                  | 0 0           | 0.99    |    |        |

| Total               | 1 2                  | 0 0           | 0.99    |    |        |

| TLR                 | Angioplasty (n = 60) | Stent (n = 60) | p Value | OR | 95% CI |
|---------------------|----------------------|---------------|---------|----|--------|
| 1 to 12 months      | 19 32                | 6 10          | 0.0053  |    |        |
| 13 to 60 months     | 2 3                  | 3 5           | 0.99    |    |        |

| Total               | 21 35                | 9 15          | 0.014   | 0.33 | 0.13 to 0.80 |

*Mean (SD).

**Table 3 Secondary clinical endpoints (exertional angina class and drug treatments) and risk factors at the five year follow up**

| Angina class | Angioplasty (n = 50) | Stent (n = 56) | p Value | OR | 95% CI |
|--------------|----------------------|---------------|---------|----|--------|
| Asymptomatic | 26 52                | 41 73         | 0.075   | 0.32 | 0.14 to 0.75 |

**Exertional angina**

| Class | Angioplasty (n = 50) | Stent (n = 56) | p Value | OR | 95% CI |
|-------|----------------------|---------------|---------|----|--------|
| Class I | 13 26                | 6 11          | 0.13    |    |        |
| Class II | 4 8                  | 3 5           | 0.13    |    |        |
| Class III | 6 12                 | 5 9           | 0.13    |    |        |
| Class IV | 1 2                  | 1 2           | 0.13    |    |        |

**Unstable angina**

| Angina class | Angioplasty (n = 50) | Stent (n = 56) | p Value | OR | 95% CI |
|--------------|----------------------|---------------|---------|----|--------|
| Ejection fraction (%)* | 53 (10)              | 56 (9)        | 0.16    |    |        |

**Current drugs**

| Angina class | Angioplasty (n = 50) | Stent (n = 56) | p Value | OR | 95% CI |
|--------------|----------------------|---------------|---------|----|--------|
| Aspirin      | 48 96                | 53 95         | 0.11    |    |        |
| Ticlopidine  | 2 4                  | 3 5           | 0.11    |    |        |
| Calcium antagonists | 18 36               | 18 32         | 0.11    |    |        |
| Nitric oxide | 18 36                | 16 29         | 0.11    |    |        |
| HMG-CoA reductase | 22 44               | 24 43         | 0.11    |    |        |
| Diuretics    | 3 6                  | 4 7           | 0.11    |    |        |
| ACE inhibitors | 26 52               | 24 43         | 0.11    |    |        |
| Diabetes mellitus | 8 16                | 9 16          | 0.11    |    |        |
| Current smoking | 8 18                 | 8 14          | 0.11    |    |        |

*Mean (SD).

ACE, angiotensin converting enzyme; CI, confidence interval; HMG CoA, hydroxymethylglutaryl-coenzyme A reductase; LAD, left anterior descending coronary artery; OR, odds ratio.
of patients is mandatory, and a comparison of the results of such treatment with the best surgical treatment is now warranted.

ACKNOWLEDGEMENTS

We are indebted to Mrs Teresa Palumbo, Miss Paola D’Alessandro, Mr Alessandro Pesola, and Miss Fortuna Sciaudone for their competent nursing support.

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