Impact of an aggressive stenting strategy on initial and one-year follow-up costs in patients undergoing coronary angioplasty

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The health technologies examined in the study were two different stenting techniques in patients with coronary artery disease. Conventional stenting (stents were used as a bail-out device for acute or threatened closure during coronary angioplasty) was compared with aggressive stenting (stent deployment was attempted in all arteries larger than 2.5 mm with a sub-optimal angioplasty result, defined as a residual stenosis of more than 20% or the presence of a dissection).

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population was patients with symptomatic coronary artery diseases, eligible for coronary balloon angioplasty or stent deployment. No further inclusion criteria were reported.

Setting
The setting was a hospital. The economic study was carried out at the Prince of Wales Hospital, Sidney, Australia.

Dates to which data relate
Data concerning effectiveness evidence and the resources used were gathered in two periods: from June to December 1995 and from June to December 1996. The price year was 1997.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was undertaken prospectively on the same patient sample as that used in the effectiveness analysis.

Study sample
No sample size or power calculations were reported. All consecutive patients undergoing balloon angioplasty or stent deployment at the authors' institution in the study period were enrolled in the study. Overall, 347 patients with a mean age of 62 years (+/- 11 years) of whom 71% were male and 9% diabetic, presenting from June to December 1995 (when the conventional stenting approach was practised) were included in the 1995 group. 401 patients with a mean age of 63 years (+/- 10 years), of whom 76% were male and 5% diabetic, presenting from June to December 1996 (when
the aggressive stenting technique was performed) were included in the 1996 group. It appears that no subjects were excluded from the initial sample.

**Study design**

This was a case-control study with a before-and-after design, because the groups to be compared were selected before and after a critical year (the beginning of 1996) in which the new technology was introduced. The authors stated that there were no major changes in the interventional practice during the study periods. The study was carried out in a single centre. Patients were followed for one year by the referring cardiologist using a mailed questionnaire and telephone calls. Relevant hospital and laboratory databases were also examined to complete the follow-up records for each patient. After one year follow-up data were available for 95% of the patients in each group.

**Analysis of effectiveness**

It was not clear whether all patients included in the study were accounted for in the analysis, due to the loss to follow-up. It is thus difficult to judge whether the analysis was based on intention to treat or on treatment completers only. The primary health outcomes used in the analysis were procedure duration, number of guide catheters, number of balloons, number of stents, length of stay, incidence of major vascular access site complications (such as bleeding requiring transfusion, false aneurysm, and surgical vascular repair), and incidence of several procedures in the follow-up period, such as repeat angiogram, clinical restenosis, repeat coronary angioplasty, coronary bypass surgery, and target lesion revascularisation. Groups were shown to be similar in terms of demographics and clinical and lesion characteristics. Patients appeared to differ only in terms of the indication for the procedure, because a significantly higher number of patients in the 1996 group presented with unstable coronary syndromes (25% in 1995 group and 34% in the 1996 group, p=0.003) and a significantly higher number of patients in the 1995 group had stable angina (75% in 1995 group and 66% in 1996 group, p=0.003).

**Effectiveness results**

The procedure lasted 87.9 (+/- 32.7) minutes for the 1995 group and 92.3 (+/- 34.8) minutes for the 1996 group, (p=NS).

The mean number of guide catheters was 1.17 (+/- 0.47) in the 1995 group and 1.14 (+/- 0.390 in the 1996 group, (p=NS).

The mean number of number of balloons was 1.57 (+/- 0.82) in the 1995 group and 1.51 (+/- 0.75) in the 1996 group, (p=NS).

The number of stents was smaller in the 1995 group than in the 1996 group (0.27 +/- 0.60 versus 0.92 +/- 0.90, p<0.0001).

The mean length of stay was 1.88 (+/- 1.8) days in the 1995 group and 1.41 (+/- 0.98) in the 1996 group, (p<0.0001).

The incidence of major vascular access site complications was 3.5% in 1995 group and 1.5% in 1996 group, (p=NS).

In terms of the incidence of procedures in the follow-up period, repeat angiogram occurred in 31% of the patients in 1995 group and 16% of the patients in the 1996 group, (p<0.0001).

The incidence rate of clinical restenosis was 16.7% in 1995 group and 8.5% in 1996 group, (p=0.0006).

The incidence of repeat coronary angioplasty was 11.8% in 1995 group and 6.5% in 1996 group.

The occurrence of coronary bypass surgery was not statistically different (4.3% in 1995 group and 2.5% in 1996 group).

Finally, the incidence of target lesion revascularisation was 14.7% in 1995 group and 8.5% in 1996 group.
Clinical conclusions
The effectiveness analysis has indicated that aggressive stenting was associated with a shorter hospital stay and fewer repeated procedures in the follow-up period than conservative stenting. Only the number of stents used was greater in the 1996 group.

Measure of benefits used in the economic analysis
Health outcomes were left disaggregated and no summary benefit measure was used in the economic analysis, therefore a cost-consequences analysis was conducted.

Direct costs
Discounting was not relevant due to the short time frame of the analysis. Unit costs and quantities of resources used were not reported separately. The resource/cost boundary adopted was apparently that of the hospital, although the authors reported that the cost to society was assessed. The analysis of costs included catheterisation laboratory costs (all the disposable equipment and overheads and depreciation), personnel costs, hospital bed day costs (which included nursing salaries and superannuation, drugs, medical and surgical supplies, pathology and radiology costs, and overheads, such as administration, hotel services and depreciation), and medical costs during the 12-month follow-up period. The estimation of most of the costs was based on actual data, derived from the average costs at the authors’ institution. Some of the cost items (e.g. overheads for the catheterisation laboratory) were assumed to be the same in both study periods. The estimation of the resources consumed was based on the charts of the patients included in the study. The resources used were gathered in two periods: from June to December 1995 and from June to December 1996. The price year was 1997.

Statistical analysis of costs
Two-tailed t-tests, presented as mean +/- SD, were carried out.

Indirect Costs
Indirect costs were not included.

Currency
Australian dollars (Aus$).

Sensitivity analysis
No sensitivity analysis was carried out.

Estimated benefits used in the economic analysis
Please refer to the effectiveness results reported earlier.

Cost results
The mean catheterisation laboratory costs were Aus$3,255 (+/- 898) in the 1995 group and Aus$4,233 (+/- 1,345) in the 1996 group, (p<0.0001).

Mean hospital bed day costs were Aus$1,064 (+/- 66) in the 1995 group and Aus$898 (+/- 432) in the 1996 group, (p<0.0001).

Total costs for the initial procedure were Aus$4,319 (+/- 1,276) in the 1995 group and Aus$5,131 (+/- 1,491) in the 1996 group, (p<0.0001).
Repeat procedure costs (in the follow-up period) were Aus$1,656 (+/- 3,903) in the 1995 group and Aus$864 (+/- 2,984) in the 1996 group, \( p=0.0018 \).

Overall, costs for the initial procedure and follow-up were Aus$5,975 (+/- 4,143) in the 1995 group and Aus$5,994 (+/- 3,476) in the 1996 group, and the difference was not statistically significant.

**Synthesis of costs and benefits**

Not applicable.

**Authors' conclusions**

The authors concluded that aggressive stenting was more effective than conservative stenting in reducing the length of hospital stay and the incidence of complications. Despite the higher costs related to the initial procedure, aggressive stenting reduced the follow-up costs compared to conservative stenting, thus total costs were not statistically different in the two groups.

**CRD COMMENTARY - Selection of comparators**

The reason for the selection of the comparators was clear: aggressive stenting (the new stenting approach) was compared to the previous stenting technique used at the authors' institution. As the authors pointed out, the aim of the analysis was not to compare stenting to balloon angioplasty, but to assess whether a more aggressive approach to stenting could be cost-effective on the basis of the improvements in the stenting technique over time. You should assess whether these represent commonly used technologies in your own setting.

**Validity of estimate of measure of effectiveness**

The study design (before and after study) appeared appropriate for the study question. Power calculations were not performed to detect statistically significant differences in the outcomes but the sample size was quite large in both groups and appropriate statistical analyses were conducted to show the comparability of patient groups in terms of demographics and clinical characteristics. As a result, the groups appear to have been reasonably well matched. Since patients were not selected, the results were applicable to the general population of subjects requiring the interventions considered in the study.

**Validity of estimate of measure of benefit**

No summary benefit measure was used, therefore costs and benefits were not combined. It would have been helpful to have known the health impact of the intervention by using pure benefit measures (such as quality-adjusted life years) since the effectiveness measures estimated in the analysis were mainly used as indicators of the resources used rather than as health outcomes.

**Validity of estimate of costs**

Some cost items that occurred in the follow-up period were omitted, but the authors acknowledged that these costs were likely to be the same in both groups. Costs were treated stochastically but sensitivity analyses were not carried out. In addition, costs and quantities were not reported separately.

**Other issues**

The authors made some comparisons of their finding with those from other studies. It was noted that a possible limitation of the study could have been represented by the lack of angiographic follow-up on all patients. The generalisability to other settings was quite limited.

**Implications of the study**
Aggressive stenting proved to be a cost-effective approach in a population of unselected patients. However, the authors pointed out that the results of the analysis should be confirmed in studies based on randomised design comparing the different stenting techniques.

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