Double versus single stenting for coronary bifurcation lesions: a meta-analysis
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CRD summary
The review found that percutaneous coronary intervention for coronary bifurcation lesions using double stenting significantly increased the risk of myocardial infarction compared to single stenting. Limitations in the evidence available and uncertainties about study quality made the reliability of the authors’ conclusions unclear.

Authors' objectives
To evaluate the effectiveness and safety of percutaneous coronary intervention by either double or single stenting for coronary bifurcation lesions.

Searching
MEDLINE, Cochrane Central Register of Controlled Trials (CENTRAL) and ClinicalTrials.gov were searched to February 2009 for publications in English. Search terms were reported.

Study selection
Randomised controlled trials (RCTs) that compared the effectiveness of percutaneous coronary intervention (PCI) by either double stenting of the main vessel and side branch (complex strategy) or single stenting of the main vessel only (simple strategy) with any PCI technique for coronary bifurcation lesions were eligible for inclusion. Studies were included regardless of the locations of the bifurcation lesions in the coronary artery tree and regardless of clinical presentation (acute or stable). RCTs that compared percutaneous coronary balloon angioplasty only versus PCI of the main vessel with provisional stenting of the side branch were excluded, as were studies that compared different stenting techniques of both bifurcation branches. The major outcomes were: death from any cause; myocardial infarction (Q wave and non-Q wave); stent thrombosis; and target lesion revascularisation.

The most commonly used double stenting technique was the crush technique; other techniques used included culotte and T-stenting. Most studies used sirolimus-eluting stents; one study paclitaxel-eluting stents. Platelet glycoprotein IIb/IIIa receptor inhibitors were used in none or up to 59% patients and final kissing balloon inflation was generally used. Mean patient age ranged from 60 to 67 years. Mean percentage of males ranged from 77.2% to 80.2%. Where reported, there was a history of myocardial infarction in 19.8% to 40% patients, previous PCI in 25.4% to 48% patients, prior coronary artery bypass graft in 3.4% to 9.3% patients, stable/unstable angina in 70.9% to 100% patients and diabetes mellitus in 12% to 41% patients. Two thirds of the studies excluded patients who had myocardial infarctions within the previous 24 hours. One third of studies excluded patients with reduced left ventricular function (less than 35%). Where reported, percentage of true bifurcation lesions ranged from 68% to 94%. Follow-up ranged from 6.4 to 14 months.

Two independent reviewers performed the selection and a third reviewer commented on any discrepancies.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Two independent reviewers performed data extraction. Any discrepancies were resolved by a third reviewer. The number of events for each outcome was extracted. Categorical data was summarised as frequencies and percentages; continuous variables was summarised as means and standard deviations (SDs). An intention-to-treat (ITT) approach to analysis was used. Authors were contacted for additional data if no ITT analysis had been performed. Data from the longest period of follow-up were used. Details of the definitions of myocardial infarction used in each study were reported.

Methods of synthesis
Meta-analyses were performed as risk ratios (RRs) and risk differences using both a fixed-effect model and a random-effects model (DerSimonian and Laird). Between-study heterogeneity was determined using the Q statistic and $I^2$ statistic. For results that were significant using both the fixed-effect and random-effects models, sensitivity analyses for risk ratios were performed using Bayesian analysis.

**Results of the review**

Six relevant RCTs were identified (n=1,642, range 86 to 500). There was an overall crossover rate of 14% from single stenting to more than one stent, which was as high as 51.2% in one study.

All pooled analyses were performed for all six studies. Meta-analysis gave a significant increase in risk of myocardial infarction with double stenting compared to single stenting (RR 1.74, 95% CI 1.16 to 2.62, $I^2=20\%$). The Bayesian meta-analysis for risk of myocardial infarction was not significant. The risk difference estimation for myocardial infarction was significant and gave an increased risk for double stenting versus single stenting; there was significant heterogeneity ($I^2=62\%$). There was no significant difference in risk ratio or risk difference for double stenting versus single stenting for death, stent thrombosis or target lesion revascularisation; there was no evidence of heterogeneity ($I^2=0\%$ for all meta-analyses). The risk ratio for stent thrombosis showed an increased risk for double stenting versus single stenting (RR 1.85, 95% CI 0.73 to 4.67). This last result was not significant, which the authors presumed was related to the limited data available.

**Authors’ conclusions**

Stenting of both main vessel and side branch in bifurcation lesions may increase myocardial infarction and stent thrombosis risk compared with stenting of the main vessel only.

**CRD commentary**

The review addressed a well-defined question in terms of participants, interventions, study design and relevant outcomes. Some relevant databases were searched and unpublished studies were considered. Only studies published in English were included, so some relevant studies may have been missed. Publication bias was not assessed. Study quality was not formally assessed; some relevant criteria were considered but little relevant data was reported and it was not possible for the reader to assess quality effectively. Efforts were made to reduce error and bias in study selection and data extraction. Relevant study details were reported. Statistical heterogeneity was assessed. The statistical method used for meta-analysis seemed appropriate. Unfortunately, one of the authors’ conclusions was based on a statistically non-significant result. In view of uncertainties about the quality of the included studies, limited evidence available and the fact that one key result was not statistically significant, the authors’ conclusions should be treated with caution.

**Implications of the review for practice and research**

**Practice:** The authors suggested that double stenting of both main vessel and side branch vessel in bifurcation lesions should be avoided. Double stenting could be considered in cases of a very big bifurcation branch, such as main stem lesions or lesions that involved bifurcation branches with diameter almost as big as that of the main branch.

**Research:** The authors identified a need for further studies to define the optimum treatment of bifurcation lesions.

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