EDITORIAL COMMENT

Risk Score for Percutaneous Coronary Intervention: Forewarned Is Forearmed*

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Percutaneous coronary intervention (PCI) has evolved from a technique initially confined to the treatment of simple short lesions in large non-calcified vessels to a technique that is applicable to a wide range of complex lesions, including thrombotic, calcified, or ostial lesions; bifurcation lesions; chronic total occlusions; long lesions in small vessels with diffuse disease; and even left main stem disease. The type of patient treated by PCI also has dramatically changed. In the early days, only stable symptomatic patients were referred for PCI; nowadays, PCI has a major role in treating patients with either unstable angina or acute myocardial infarction (MI). Furthermore, PCI with stent implantation frequently is performed in asymptomatic patients after acute MI based on evidence that an open artery has favorable effects on left ventricular (LV) remodeling and may improve prognosis.

RISK SCORE FOR PCI

A risk score for PCI should fulfill the following criteria:

1. It should be derived from simple and easily obtainable variables that are available before the procedure.
2. It should predict not only mortality but all major procedural complications, including mortality, MI, stroke, and the need for urgent bypass surgery.
3. It should be validated internally and externally.
4. It should reflect modern PCI practice, which currently includes stent implantation, GP-IIb/IIIa blockers, and post-stent thienopyridine administration.

The Mayo Clinic risk score model for complications after PCI is published in this issue of the Journal (9). The model was first developed from a learning set of 5,463 procedures performed between January 1996 and December 1999 and was internally tested in a validation set of 1,781 PCI procedures performed in the year 2000 (10). Subsequently, the investigators validated their score in an external validation set using 3,264 patients undergoing PCI from the National Heart, Lung and Blood Institute Dynamic Registry during two enrollment periods (July 1997 to February 1998 and February to June 1999) with excellent results. Thus, the Mayo Clinic risk score is the first score that appears to fulfill all the above criteria. The risk score that appears to fulfill all the above criteria. The risk score that appears to fulfill all the above criteria.

The effectiveness of PCI in relieving angina and the relative safety, simplicity, and patient friendliness of the technique have increased its popularity to such an extent that, nowadays, in the U.S. and in most European countries, more patients are referred for PCI than for coronary artery bypass grafting.

Overall, the procedure is safe, but as a result of the expanding indications and of the increasing number of centers performing PCI, the risk of major irreversible procedural complications, including death, MI, stroke, and need for urgent bailout bypass surgery, may vary widely depending on the clinical setting, the lesion complexity, and probably on the experience of the operator.

The benefits of the procedure in patients referred for PCI should be weighed against the risks involved, taking into account alternative treatment strategies. This is particularly the case in patients who do not have invalidating symptoms. Always keep in mind: “do not harm your patient.” The treatment strategy with the optimal risk-benefit ratio should be chosen for every patient. To provide a rational framework for assessing risk, several risk scores have been proposed for predicting the occurrence of major procedural complications during PCI (1–8). Usually, these scores classify patients into low-, intermediate-, and high-risk groups. These scores help to assess the potential for benefit against the potential for harm and can provide an objective basis for discussion with patients and their families. Cardiologists and patients can then jointly make an informed decision regarding the most suitable treatment option: continued optimal medical treatment, coronary artery bypass grafting, or PCI.

In addition, these scores allow a fairer comparison of the performance of different institutions or operators than crude complication rates. Thus, they may provide data that are helpful in disclosing differences in performance of low- and high-volume institutions or operators. Finally, institutions or operators that accept a high-risk patient to undergo PCI should have back-up facilities such as intra-aortic balloon pumps, LV assist devices, and on-site surgical stand-by.

Table 1. Mayo Clinic Risk Score Variables

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<th>Clinical variables</th>
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<td>Serum creatinine &gt;265 µmol/l (&gt;3.5 mg/dl) (or history of chronic or end-stage renal disease)</td>
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<td>Urgent or emergent procedure New York Heart Association ≥3 heart failure (or congestive heart failure during index hospitalization)</td>
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<table>
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<th>Angiographic variables</th>
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<tr>
<td>Thrombus</td>
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<td>Left main disease</td>
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<td>Multi-vessel disease</td>
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score has eight simple clinical and angiographic variables (Table 1). Each of the seven binary variables was assigned a predetermined integer score proportional to its effects; age, the only continuous variable, was assigned an integer score on a continuous scale. Adding the scores assigned to each variable gives an overall score that allows the classification of patients into five risk categories ranging from very low to very high risk, with each category having its own predicted major procedural complication rate (Fig. 1).

The risk score was also tested in various clinical low- and high-risk subgroups and by and large the observed and predicted complication rates were consistent among groups. No risk score is perfect, and this score does not take into account the difference in outcome when PCI is performed in a low-volume center.

Yet, the Mayo risk score is the best score available and should be used for patient risk stratification at the time of initial presentation. The score provides factual information that is extremely helpful when discussing the procedure with the patient, his or her family, or his or her referring physician. Very high-risk PCI procedures are of course sometimes inevitable because of the inherent risks of the underlying disease. However, previous knowledge of a (very) high risk of major procedural complications should alert the investigator and should trigger measures to reduce the risk to the extent that this is possible. Selection of experienced operators, standby or preoperative insertion of an intra-aortic balloon pump, the use of a LV assist device where available, and assurance of immediate surgical backup are some potential safeguards. The safety of the patient is the pre-eminent concern, and efforts are continuing to develop even safer PCI devices and devices that improve procedural safety. For instance, simple effective distal protection devices to prevent distal embolization or LV assist devices that could be easily and quickly inserted in case of emergency would be invaluable in this setting. Intelligent use of the Mayo Clinic risk score should make percutaneous intervention procedures safer: forewarned is forearmed.

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REFERENCES