Calculating the overall risk of within-stent restenosis after multilesion percutaneous coronary intervention

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In-stent restenosis (ISR) is an adverse event of percutaneous coronary intervention (PCI) procedures [1]. Drug-eluting stents (DES) have been shown to reduce the incidence of ISR to around 5% in contrast to bare metal stents (BMS), which have a 25% incidence. Patients with ISR may present with recurrence of anginal symptoms or an acute ischemic event and may need further PCI or bypass surgery [2]. Patients commonly and rightly ask what their chances are of experiencing recurrence of symptoms as a result of restenosis following successful PCI. For a single lesion, studies have determined the likelihood of significant in-stent restenosis (> 50% of luminal diameter). When more than one lesion is stented, calculating the overall risk of restenosis may be more complex.

We propose a simple mathematical calculation for assessment of risk of in-stent restenosis, when more than one lesion is stented and different types of stents are used. Obviously the risk calculated will depend on other risk factors for restenosis and can be modified on the basis of different generations of stents used.

A 60-year-old man with angina and a positive exercise test underwent coronary angiography. This revealed severe coronary disease with a significant discrete atheromatous lesion in two of the major coronary arteries: the proximal left anterior descending (LAD) (Figure 1) and right coronary artery (RCA) (Figure 2). These were successfully dilated with a bare metal stent in the LAD, and a drug-eluting stent in the RCA. Although the individual risk of ISR is 25% and 5% respectively, the overall risk of in-stent restenosis for this patient is more complex.

The overall risk of ISR is calculated by examining all the possible outcome combinations (R = restenosis, NR = no restenosis) as shown in Table 1. The overall risk of restenosis is the sum of all outcome probabilities where restenosis occurs. These are outcomes 2, 3, and 4 and their sum is 0.238 + 0.013 + 0.038 = 0.288 or 28.8%.

If a third lesion (say in the OM artery) had been present and been stented with a drug-eluting stent with a restenosis risk of 5%, the overall risk of restenosis is calculated as shown in Table 2.

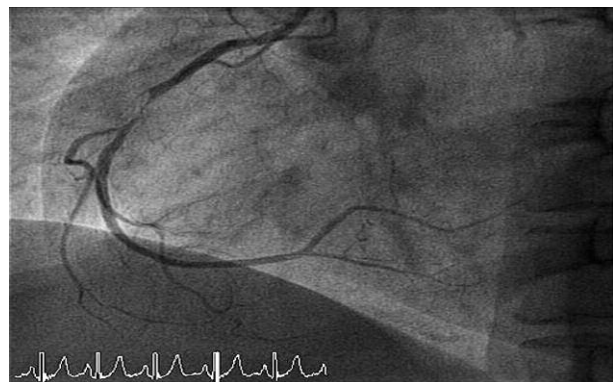**Fig. 1.** Left anterior descending artery showing lesion in proximal segment

Fig. 2. Right coronary artery showing lesion in proximal segment

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Table 1. Outcomes 2, 3, and 4; their sum is 0.238 + 0.013 + 0.038 = 0.288 or 28.8%

Outcome	LAD	RCA	Total
1	NR (0.75)	NR (0.95)	0.713
2	R (0.25)	NR (0.95)	0.238
3	R (0.25)	R (0.05)	0.013
4	NR (0.75)	R (0.05)	0.038

Table 2. Outcomes 2, 3, 4, 5, 6, 7 and 8; their sum is 0.226 + 0.012 + 0.001 + 0.036 + 0.36 + 0.012 + 0.002 = 0.32 or 32%

Outcome	LAD	OM	RCA	Total
1	NR (0.75)	NR (0.95)	NR (0.95)	0.677
2	R (0.25)	NR (0.95)	NR (0.95)	0.226
3	R (0.25)	R (0.05)	NR (0.95)	0.012
4	R (0.25)	R (0.05)	R (0.05)	0.001
5	NR (0.75)	NR (0.95)	R (0.05)	0.036
6	NR (0.75)	R (0.05)	NR (0.95)	0.036
7	R (0.25)	NR (0.95)	R (0.05)	0.012
8	NR (0.75)	R (0.05)	R (0.05)	0.002

The overall risk of restenosis is the sum of all outcome probabilities where restenosis occurs. These are outcomes 2, 3, 4, 5, 6 ,7 and 8 and their sum is 0.226 + 0.012 + 0.001 + 0.036 + 0.36 + 0.012 + 0.002 = 0.32 or 32%.

It is important to provide as accurate information to our patients as evidence affords us. This case demonstrates how practical application of a basic statistical method is useful in this regard and can give estimated risk of restenosis after multi-vessel PCI. Rates of restenosis can be different for different types of stents and this formula can be applicable to any group of patients undergoing multilesion PCI.

References

1. Forgos RN. Restenosis after angioplasty and stenting. August 2004.
2. Grech ED. Percutaneous coronary intervention. I: History and development. BMJ 2003; 326: 1080-1082.