Is rotational atherectomy here to stay?

Patrick L Whitlow

Rotational atherectomy was developed to ablate selectively inelastic atherosclerotic plaque, while deflecting normal arterial wall away from the rotating burr. Intravascular ultrasound (IVUS) studies have confirmed that rotation differentially removes even hard, calcified plaque without damaging normal arterial wall. Early in clinical experience, the ability to ablate previously undilatable lesions established rotational atherectomy as an essential tool in coronary intervention. More recently, rotational atherectomy was also confirmed to ablate differentially non-calcified lesions. Because of this unique ability to remove plaque without damaging normal arterial structures, the indications for rotational atherectomy have been extended beyond undilatable, calcified lesions in many centres.

Refinement of technique has established the Rotablator as a predictable device in both straightforward and complex lesions. Analysis of 6647 consecutive patients with elective percutaneous intervention at the Cleveland Clinic between January 1993 and July 1996 revealed that 1243 (19%) rotational atherectomy procedures were performed on 1787 lesions. Sixty six per cent of Rotablator procedures included at least one B2 or C lesion. Major complications occurred in 3% of non-Rotablator and 2.4% of Rotablator procedures. Despite a more complex lesion classification, rotational atherectomy had a reduced incidence of major complications by multivariable analysis, odds ratio (OR) 0.49 (P = 0.013). Restenotic lesion type was the only other variable associated with reduced risk (OR 0.55, P = 0.011), verifying the predictability of rotational atherectomy in experienced centres.

However, the acceptance and widespread use of rotational atherectomy has been hampered by several factors. The unpredictable occurrence of slow arterial flow and the rare but devastating complication of perforation made some laboratories reluctant to use rotational atherectomy extensively. Many operators still reserve rotational atherectomy for the most difficult, calcified lesions, which cannot be treated successfully by any other method. This extreme selection bias may have perpetuated a high incidence of complications in these laboratories, while preventing operators from getting the experience to use the device effectively. Cost, the paucity of data from randomised trials, and concerns regarding creatine kinase release have also slowed acceptance of rotational atherectomy.

Evolution of Rotablator technique to limit complications

Several modifications appear to have improved the reliability of rotational atherectomy. Haudenschild confirmed that plaque may actually be heated and burned by rotational atherectomy. In an in vitro model, Reisman et al demonstrated that heat can be generated by pushing the burr to drop > 5000 rpm from baseline, and that the more sustained the rpm drop, the greater the temperature change. Likewise, the higher the platform speed of the rotating burr, the greater the heat produced per incremental drop from baseline. Arterial wall heating may provoke epicardial and/or microvascular spasm, which could contribute to slow flow occasionally seen after rotablation. Burning the arterial wall would also potentially attenuate restenosis. Because of these concerns, the baseline rpm speed in many laboratories has been reduced to 145 000–160 000 rpm, and care is taken to minimise significant rpm drops that result from forcing the burr against resistance.

Analysis of results from the Study To determine Rotablator And Transluminal Angioplasty Strategy (STRATAS) has established that technique is directly related to major complications. Strip chart recorders were used to record rmps versus time during rotational atherectomy, and analysis showed that rpm drops > 5000 for a cumulative time > 10 seconds were highly associated with major adverse events (P = 0.03) and with creatine kinase increase (P = 0.005). Therefore, operator attention to limit significant rpm drops should improve results. Even though slow flow was seen in 10% of lesions post-rotational atherectomy in early experience, Stritzel and colleagues at Stanford University have evolved their technique to eliminate completely slow flow in their laboratory. They use a stepped approach with two to three runs to minimise the amount of atherosclerotic debris per burr used, finishing the procedure with > 70% burr:artery ratio. They add vasodilators to the Rotablator flush solution to diminish epicardial and microvascular spasm. Stritzel et al also use short runs of 15 to 20 seconds, and typically wait for ST changes and chest pain to resolve completely before another Rotablator pass. Flow is monitored with frequent contrast injections, and rotational atherectomy is terminated if contrast clearance is even transiently sluggish.

Evolution of rotablator equipment

Even though rotablation tends to ablate selectively inelastic plaque, differential cutting can be overridden by pressure from the guidewire and/or drive shaft pushing (biasing) the burr into the arterial wall in significantly angulated segments. To minimise biased cutting, the
If Rotablator is useful, why don’t we use it?

David R Ramsdale, John L Morris

Percutaneous transluminal coronary rotational atherectomy with the Rotablator can improve acute success in difficult lesion subsets—bulky, balloon resistant calcified lesions, lesions on bends, ostial bifurcation and long lesions, lesions in small vessels, and diffuse disease. Debunking before stenting and within-stent restenosis may be other indications. Despite such a wide range of applications, why is it that only a few cardiologists in the UK have any experience with the device? Perhaps the first reason is a reluctance to get involved with what appears to be a complex difficult technique using unfamiliar and relatively...


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