INTERVENTIONAL CARDIOLOGY AND OUR PRESENT PRACTICE

The era of invasive and interventional cardiology began with the initial attempt of Forssman1 placing a tubular urology catheter through his left antecubital vein into his own right atrium. In the field of coronary interventions, Andreas Gruentzig2,3 started the race by performing the first coronary angioplasty. The early designs of guiding catheters, wires, and balloons have undergone fascinating improvements to enable the practicing interventional cardiologists to negotiate more complex lesions and to decrease and manage complications of the procedure.

Since the invention of coronary balloon angioplasty catheters, several devices have been developed with the claim that either they cause fewer complications or lead to lower restenosis rates. Coronary perfusion balloons were developed and used successfully to tag dissections in coronary arteries caused by angioplasty balloons allowing prolonged inflations in the coronary arteries (10 to 20 minutes) without significant ischemia. 4-10

Simpson's atherectomy catheters were designed as an alternative device for coronary recanalization with a mechanism for debulking of atheroma in addition to dottering effect related to the bulk of the device. The initial goal was to decrease the rate of restenosis post-intervention. So far, the initial success rate has been high but restenosis, at least in two major multi-center randomized trials,11-13 remains more than 45%. Subsequent analysis of some of the data available showed a lesser restenosis rate especially in large vessels when the residual stenosis postatherectomy was less than 20%. The major use remains for eccentric lesions in large vessels or to shave occluding dissection flaps complicating balloon angioplasty.

The Auth rotablator device has proved itself in the field of interventional cardiology, 14-16 the major indication for its usage being on calcified lesions which do not yield to the use of conventional balloon angioplasty or to the cutting blade of the atherectomy device. With a highspeed rotating burr, which is covered with crushed microscopic diamonds, it grinds the calcified plaque into microparticles smaller in size than the red blood cell, which are engulfed by the reticuloendothelial system after being washed into the micro-circulation.

Technically, its use is more demanding, requiring continuous flushing and use of intracoronary nitroglycerin to help decrease the (no-reflow) phenomenon which may occur with the procedure related to the volume of microparticles generated. The balloon angioplasty catheters still need to be used to get optimal results in more than 80% of cases after rotablation, and the restenosis rate remains more than 40%.17-19

The transluminal extraction atherectomy (TEm) device, which is the latest of the FDA approved recanalization devices for coronary arteries, carries a high success rate specifically in recanalization of thrombosed vein grafts or native large vessels. Associated suction mechanism at the tip of the device helps to clear the debris which is shaved by the rotating blade (at slow speed). Restenosis again remains a problem.20,21

Laser technology in coronary interventions has evolved from the use of laser-heated balloons22,23 to tag dissection flaps post-balloon angioplasty, to SMART lasers sparing normal vessel and firing on atheromatous plaque,24 and to the use of the excimer laser for recanalization of ostial and other coronary lesions. The most recent of this technology is the use of eccentric laser therapy by special catheters to recanalize eccentric tough lesions and the use of laser wires to recanalize total occlusions. The major problem with this technology is the high cost and the bulk of the equipment and the cost of the laser catheters themselves. In addition to that, the good old balloon has to be used in most of the cases either
to achieve optimal luminal diameters after laser treatment or to treat complications created by the laser catheters which are by no means ignorable, such as dissections and perforations or failures to recanalize. The restenosis rate is more than 45%26.27 which makes the advantage of laser technology over other devices questionable at this stage.

Coronary stents have been designed in different shapes and from different materials, initially to maintain patency of coronary arteries after dissections caused by balloon angioplasties or other devices to avoid emergency coronary artery bypass graft surgery in patients with compromised hemodynamic status. Then the use of different stents for primary treatment of coronary lesions was started, looking at the possibility of decreasing the rate of restenosis. These continuous efforts were somewhat successful in achieving this goal, especially with the data reported on the Palmaz-Schatz stents showing lesser restenosis rates compared to balloon angioplasty both in native vessels and in vein graft lesions. The two main problems with this device include technical difficulty and the risk of stent thrombosis despite vigorous anticoagulation. This problem is being addressed with the introduction of stents which are coated by active drugs, for example, heparin, hirudin, or genetically engineered endothelial cells, which may theoretically decrease the problem of stent thrombosis. More interesting are the data from Antonio Colombo (Italy) which show much less incidence of stent thrombosis, even when patients are not given warfarin, by simply using intravascular ultrasound and high-pressure balloon inflations to ensure optimal stent expansion during the procedure.

The increasing use of intracoronary ultrasound has given us a better understanding of what is happening inside the coronary artery in three dimensions after intervention and will help to guide the interventionist to achieve the largest luminal diameter in the recanalized vessel using different available technologies. These devices and much more in the future make the field of interventional cardiology an expanding one and require a careful assessment of the practice of interventional cardiology in any country, especially in our country.

It is natural that most cardiologists are eager to use new devices but we have to take a few steps back and remember some facts. The most important fact is that the cardiologist, as any other physician, should be safe to his patients. First of all, practicing invasive cardiologists should have finished their basic training in cardiology and invasive cardiology in an accredited program. To be able to perform simple balloon angioplasty cases (i.e., beginner’s level), the cardiologist should have performed 125 percutaneous transluminal coronary angioplasties (PTCAs) fully supervised, as recommended by the American Heart Association and the American College of Cardiology. Thereafter, to be able to practice safely, again performing simple PTCAs, a cardiologist should maintain at least 50 to 75 PTCA procedures per year on his own. 32-35

In addition to the use of new interventional devices, it is highly recommended that complex angioplasty (including complex lesions, chronic total obstructions, PTCAs in acute myocardial infarction and cardiogenic shock, multi-vessel angioplasties, and patients with impaired left ventricular function) is started only after a cardiologist has achieved competence performing simple PTCAs and after a period of training on these devices in a supervised environment in a teaching center where such procedures are performed routinely. Institutional requirement of a surgical back-up team and a total number of PTCAs of more than 200 cases per year should always be met. 35

Guidelines were set by the American College of Cardiology/American Heart Association for the practice of both diagnostic and interventional procedures and are being implemented in North America. Similar guidelines are being implemented in different European countries. Those guidelines are being made to protect the patient and to ensure the performance of interventional procedures in a safe manner. I would highly recommend that a thorough review of those recommendations be done by a team of experienced interventional cardiologists in our country and rules be implemented for the practice
of both diagnostic and interventional cardiology. This will ensure excellence in patient care especially in a rapidly expanding field of interventional cardiology.

References


