

VIEWPOINT

VOICES IN CARDIOLOGY

Requiem by a Member of the Inaugural Generation of Interventional Cardiologists



Eric R. Bates, MD

I was an internal medicine house officer when Andreas Gruentzig performed the first percutaneous transluminal coronary angioplasty on September 16, 1977. Back then, patients with intolerable angina were occasionally referred for coronary artery bypass graft surgery by reluctant clinical cardiologists, but patients with stable ischemic heart disease were not, and those with acute coronary syndromes were considered to have unacceptable surgical risk. Patients were “followed” for ischemic complications, with only nitroglycerin and propranolol available for medical therapy. Antiplatelet agents, angiotensin-converting enzyme inhibitors, statins, and almost all other medications that are now routinely used in cardiovascular medicine were not yet developed or approved. Patients with ST-segment elevation myocardial infarction were observed in the coronary care unit for 1 to 2 weeks. Morphine, heparin, lidocaine, quinidine, procainamide, furosemide, and digoxin were possible treatments, but none was subsequently shown to have therapeutic benefit. In-hospital mortality was 15%, and there was a 10% risk for sudden death in the first few weeks after hospital discharge.

During my first year of cardiology fellowship, we had the on-call responsibility of inserting pulmonary artery catheters and temporary pacemakers through antecubital cutdowns, whereas the thoracic surgery house officers inserted intra-aortic balloon pump catheters through femoral artery cutdowns. These procedures were done in the intensive care unit

without fluoroscopy, and the final position of the catheter was documented by chest radiography. Patients undergoing cardiac catheterization (usually 2 patients daily), done using the Sones technique, were admitted to the hospital the day before and discharged the day after the procedure. The Veterans Administration hospital laboratory had a fixed image intensifier with a cradle table to tip the patient into oblique views, but not cranial-caudal views. Angiograms were recorded on 35-mm cine film, developed using a Jamison processor in a darkroom, and stored in circular metal cans on racks in a file room to subsequently be played on a Vanguard double-reel projector.

Everything changed during my second year of fellowship. We started our percutaneous transluminal coronary angioplasty program, with 12 of the first 70 patients rushed to emergency coronary artery bypass graft surgery because of complications, and skeptical colleagues complaining about the recklessness of the procedure. They were partly correct, because it was a crude procedure with inadequate imaging, first-generation equipment (no movable guidewires), and no proctoring assistance from experienced colleagues. We were able to rotate through the busier private hospital and performed 6 to 8 coronary angiographic studies daily using the Judkins technique with wire exchanges, because vascular sheaths were not yet available. There was no dedicated interventional cardiology fellowship training for several years.

The rapid development of interventional cardiology and reperfusion therapy with fibrinolytic therapy and primary angioplasty in my first few years on the faculty was breathtaking. Bill O’Neill, Eric Topol, Steve Ellis, and Betsy Nabel sequentially joined our laboratory. Every day was full of discovery as we explored our new

From the Division of Cardiovascular Medicine, Department of Internal Medicine, University of Michigan, Ann Arbor, Michigan. The author has reported that he has no relationships relevant to the contents of this paper to disclose.

capabilities and learned anatomy and physiology that could not be taught to us by preclinical or clinical mentors. My colleagues made us a regional referral center, with daily transfers for reperfusion therapy, and an international clinical research center.

Advances in antithrombotic therapy and the immediate clinical success of coronary stents in my second decade in the catheterization laboratory legitimized percutaneous coronary intervention as an important treatment option for both stable ischemic heart disease and acute coronary syndromes. In my first 3 decades, hundreds of colleagues around the world developed new equipment and techniques, and performed clinical research on procedures and adjunctive pharmacotherapy. This new knowledge base was shared at national and international interventional cardiology conferences, published in new journals devoted to interventional cardiology, and tested in a new certifying examination. Dramatic advances in structural heart disease have defined the past decade of my experience.

After almost 40 years as an interventional cardiologist, I put down my lead apron for the last time in June, still filled with reverence and wonder for what we learn and achieve daily in the special place called the cardiac catheterization laboratory. There are at least 1,000 others in my cohort with similar, but different, stories who are now aging out (or dying). It is a big transition for us and for the subspecialty that we helped develop and oversaw for 4 decades. One natural emotion I am sure is shared by many of us is the concern that what we know and experienced will soon be forgotten by the new generation that is being trained in a fully developed subspecialty that is very different from where it originated. So, with apologies for my ruminations, I offer up for the last time a few of the personal lessons that I can no longer teach to cardiology fellows standing next to me at the catheterization laboratory table. Some of the more than 250 trainees who have had that experience with me may break into a smile if they read this and recall my repetitive exhortations.

- Occupational health hazards are real. Wear knee-high support stockings. Keep your spine straight. Learn all the radiation reduction strategies and use them. Exercise and stretch.
- Do a history and physical examination before the coronary angiographic study, not after. This will enable you to make ad hoc decisions. Discuss treatment options with the patient before conscious sedation and vascular access, not after the study. You are treating a patient, not running an assembly line.

- Learn how to do contrast left ventriculography well, so that it will be available when you need it. Even though the test is no longer performed by many operators, it provides unique information that informs decisions and prognosis in complicated patients and that is missed by echocardiography. That means placing the pigtail catheter, not a coronary catheter, within the proximal half of the left ventricular cavity to avoid ectopy, using a power injector, and filling the apex with contrast medium.
- Constantly pursue the perfect coronary angiogram. The decline in the quality of the coronary angiograms I review weekly is disheartening and made worse with 4-F and 5-F catheters and radial access, because of the inability to achieve a good contrast injection through a properly placed coronary catheter. Avoid arterial overlap, and try to see each lesion in at least 2 different views. Carefully evaluate the rest of the imaging field for other information that might be important. Learn how to frame the coronary angiogram and pan the table to see the terminal end of each branch. Record enough images in different projections, but don't record excessive images or repeat similar angles. Interpret the angiogram at a workstation after the procedure, not off the fluoroscopic image during the procedure. Don't be stent-centric, looking for the next intervention. The coronary angiogram is so much more.
- Don't overuse intravascular imaging and left ventricular support devices. The excellent interventional cardiologist can do most procedures without them, and overuse does not make you a superior interventional cardiologist.
- Learn to choose the optimal guide catheter so that you can more easily deliver the stent. The intracoronary guide extension catheters are helpful, but prolong the procedure, increase expenses, and can be traumatic. The correct guide catheter can decrease the need for these catheters by one-half.
- Size the initial dilating balloon to the coronary reference diameters to facilitate stent delivery and expansion. Most operators seem to be undersizing the balloon for reasons that escape me. To avoid undersizing the stent, inject intracoronary nitroglycerin to relieve vascular tone after lesion preparation but before choosing a stent diameter. Expand the stent until you see the up-down impression on the coronary angiogram at the stent edges. Then, you won't need intravascular ultrasound or optical coherence tomography to evaluate for underexpansion, a common problem

now with forgiving new-generation stents and less compulsive stent implantation technique.

- Follow best practices, as defined in appropriate use and clinical guideline documents, not money. Learn scientific skepticism. Don't believe everything you hear and see, because industry promotion in the current era has become too common and acceptable.
- Don't be a dilettante. Go all in so that you don't dishonor the subspecialty or cheat the patient of the best possible interventional cardiology treatment. Read interventional cardiology journals and attend the major meetings.

The Nobel Prize in Physiology or Medicine was awarded in 1956 to Cournand, Forssmann, and Richards for their discoveries concerning right heart catheterization and pathological changes in the circulatory system. It is an irony of history (at least to me) that Dotter, Sones, Judkins, and Gruentzig were

not similarly honored for developing coronary angiography and catheter-based vascular interventions. Our subspecialty is deserving of that worth within the clinical sciences. If, by chance, you happen upon one of the old guard, stop us to talk about our experiences and consider our advice. Historians always remind us that there is much to learn from the past, and we will enjoy staying connected and relevant. We still have much to offer. The wisdom we have gained from our experiences will make you a better interventional cardiologist.

ADDRESS FOR CORRESPONDENCE: Dr. Eric R. Bates, CVC Cardiovascular Medicine, 1500 East Medical Center Drive, Ann Arbor, Michigan 48109-5869. E-mail: ebates@umich.edu.

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