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Thirty years of coronary angioplasty

On September 15th of last year, Adolph Blackman, a 70-year-old retired insurance salesman, stood before a group of cardiologists in Zurich and introduced himself. But he needed no introduction. Thirty years before, he and many of these same cardiologists had shared a historical moment, perhaps as important in our lifetime as when, over 150 years before, Dr. John Warren applied Morton's discovery and painlessly removed a tumour from the neck of a young girl before a group of surgeons in Boston. At both procedures, the observing physicians realized they were witnessing something that would change medicine forever. Thirty years before, this healthy salesman had been disabled by angina and in front of many of these same cardiologists had undergone the first coronary angioplasty. He was now in Zurich to celebrate that event and to celebrate the visionary physician, Andreas Gruentzig, whose dream and dedication as well as technical skill had made it possible. Today, over one million percutaneous interventions are performed each year in coronary arteries and in almost every important artery in the body as a direct result of this concept.

To understand the importance of that event, one has to understand the limitations of the therapy for coronary artery disease and its consequences, angina and myocardial infarction, in the late 1970s. There were very few tools for the management of angina at that time. Although the role of lipid metabolism was appreciated, the pharmacology available to normalize the lipids was inadequate. Beta blockers and nitroglycerine, and perhaps anticoagulation, were the major weapons available. The importance of thrombosis was not appreciated and myocardial infarctions were thought to be the result of coronary spasm. The value of aspirin as an antiplatelet agent had yet to be understood. Calcium channel blockers, long-acting nitroglycerine preparations and ACE inhibitors were not available. The most effective approach was a drastic lifestyle change with a nearly fat-free diet. Bypass surgery was reserved for multivessel disease and even here it was controversial as no studies had yet been reported showing any longevity advantage for surgery over medical therapy. Surgery for lesser disease was performed only reluctantly because of the likely need for additional surgery, so patients had to live with considerable angina before this could be considered.

One year before, Gruentzig had presented a poster at the American Heart Association (AHA) meeting. As related by David Faxon in a recent interview [1] "one poster was completely crowded with people. A tall Swiss guy was presenting a crazy idea. He had ligated the LAD of a dog and put a balloon in it. That is crazy, but boy is that interesting." At that time putting anything into the coronary arteries was absolutely forbidden. The reception was quite mixed; most physicians thought he was crazy, but a few were intrigued. The next year in 1977 when the results of the procedure on Mr. Blackman were reported, also at the AHA meeting, it was standing room only and after the presentation, the audience stood and applauded, almost unheard of at scientific meetings. The procedure was named percutaneous transluminal coronary angioplasty (PTCA) modifying the terminology introduced by Dotter to describe percutaneous peripheral lesion dilation.

Andreas Guentzig was born in Dresden, Germany on June 25th 1939. His father died as a pilot in the Luftwaffe during the war. After the war the East German state planned for him to become a bricklayer, but his mother escaped with Andreas and his sister (who became a professor of ophthalmology) to West Germany. He graduated from the University of Heidelberg in 1969 and he trained as an interventional radiologist. With Eberhard Zietler he performed a large number of peripheral angioplasties using the Dotter coaxial tubular catheter mechanism. Gruentzig became interested in performing angioplasties on coronary arteries but he realized that the Dotter technique was not suited to that site. As detailed in the excellent history by Gary Roubin [2], the breakthrough occurred in 1974 when, together with Professor Hoyt — a plastics engineer from the Technical University of Zurich, he was able to develop a balloon made of PVC which could form a "sausage shape" of a predetermined diameter at a given pressure. This protected the normal areas around the lesion from damage while concentrating the energy on the lesion (the previous balloon material, latex, tended to "dogbone" and damage the "normal" artery surrounding the lesion). He created a double lumen catheter by placing one catheter inside another and then folding the outside one by meticulously running a tool down it to create a "v" so it would not collapse under suction. His workshop was the kitchen in his home [3]. The development of equipment proceeded slowly at first. A small Swiss company, Schneider, known for its needles, was chosen to manufacture it. The original catheter was manufactured in a garage with

an output of 5 balloons per week, all handmade. Guiding catheters had to be designed. Gruentzig controlled every aspect of the manufacture and quality control. As recalled by Heliane Canepa [4], who later went on to become president of Schneider Worldwide, "Gruentzig was just a winner — a winner personality. He was obsessed with his invention. He was a very serious character, very good-hearted but very demanding. He wanted the prototypes, he wanted it safe. He was a very technical person, so he could talk to the engineers on a technical basis."

He also totally controlled the use of the catheter. In the beginning, in order to get a balloon catheter, a would-be angioplastier had to attend a course and then contribute data to a registry which monitored every use — no data, no balloon. Gruentzig protected and nurtured the procedure, so the procedure began slowly but with good results.

An early challenge was training the cardiology community in the new technique. Taking a clue from the surgical demonstrations of the nineteenth century, he pioneered the live demonstration course. The patients were presented and the procedures performed live; success or failure was not known before the procedure. Spencer King likened the atmosphere to that of a stock car race, in which the spectator watched not to see the cars race around the track but for the crash [4]. The real learning occurred when Gruentzig dealt with the problem, the crash, in "real time" (and usually solved it). He was a gifted teacher and impressed all who knew him.

In 1980 Gruentzig left Zurich and moved to the Emery School of Medicine in Atlanta, Georgia, where he was appointed Professor of Medicine and was fully supported in his efforts to promote and develop the procedure. The live demonstration course was refined into the form in which it remains to this day. TV cables were drawn between the cath lab and a large auditorium. There would be a minimum of three feeds, one of the operator talking to the audience, one of his hands and one from the monitor in the room, so the audience could see what Gruentzig saw. There was a moderator in the room, always a skilled interventionalist, asking questions so all the decisions were transparent and discussed with the audience. In addition, the audience could query Andreas in real time. These courses were extremely well attended by all cardiac angiographers prior to starting their own programs and were widely copied by others in the years that followed. Even now, major meetings arrange for satellite transmission of procedures from the US and international laboratories for live transmissions.

On October 29th 1985, a year that saw the deaths of angiographic pioneers Melvin Judkins and Mason Sones, Andreas Gruentzig, as his father had done before him, died at the controls of his plane, flying from St. Simon Island to Atlanta in a rainstorm for a Monday case.

But his legacy did not end with his death, since plans were underway for an NIH grant to compare PTCA with coronary artery bypass grafting (CABG) in patients with multivessel disease. This grant was pursued after his death and the study completed by King and colleagues at Emery. It showed that the survival rate was similar in patients who were randomized to PTCA and CABG.

The present success of angioplasty owes much to the man, Andreas Gruentzig, his charisma and his careful stewardship of the development and promotion of the technique. According to Dr. King, his watchword was "don't exceed your capabilities — stay within what you can do" [5]. After conceiving the procedure and carefully developing the early tools, he courageously worked in the open to minimize scepticism, willing to discuss the cases. He emphasized scientific validation with randomized trials. He pioneered the concept of a registry of all procedures to monitor results and maintain quality. This concept was central to the organization of the Society for Cardiac Angiography [now the Society for Cardiac Angiography and Interventions (SCAI)] and most recently to the American College of Cardiology in the National Cardiovascular Data Registry (NCDR), with several million procedures recorded. He pioneered the live demonstration course, a technique which has proven its value over time and which facilitated the rapid and widespread introduction of these new techniques. And first and foremost, "he was a doctor. His first concern was: was it appropriate to do it? Most of the time (in discussion) was spent discussing the management of the patient, then the details of the procedure" [1].

So, in Zurich, while the celebration was for 30 years of a technique that revolutionised the management of coronary disease, even more, it was a celebration of the genius of one man who had a dream and pursued and nurtured it so that it could properly develop to benefit us all.

References

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