Obituary

Sven-Ivar Seldinger

O. FLODMARK, T. GREITZ

Sven-Ivar Seldinger died on February 21, 1998 at his home in Mora, Dalecarlia, Sweden. He is mourned by his wife Britt-Lis, his daughters Mari, Nina and Mona with their families and by many friends and colleagues.

It is no exaggeration to state that no single contribution to the development of angiography has meant so much to the practicability and success of interventional radiology as the Seldinger technique. It would be superfluous to describe the essentials of this technique, which is well known to all radiologists and cardiologists who are active today. They have all used the Seldinger technique throughout their professional lives.

Forty-five years ago Sven-Ivar Seldinger published his method of introducing catheters percutaneously into the vascular tree. This method gained rapid acceptance all over the world. A great number of reports on the successful use of this method were soon published and for several years Seldinger became the personal name most frequently mentioned in all categories of scientific literature.

Sven-Ivar Seldinger was born in Dalecarlia, in the small town of Mora in the northern part of Sweden on April 19, 1921. He was, and remained, deeply rooted in his parental environment. It seems worth mentioning that his ancestors had for generations owned and run the Mora Mechanical Workshop and were credited as "technical geniuses". Seldinger had all his undergraduate schooling in Dalecarlia.

In the fall of 1940, he began his medical studies at the Karolinska Institute. From the beginning

Sven-Ivar made a deep impression on his fellow students with his intelligence, independence and drastic way of expressing himself.

After having earned his M.D. degree in 1948, Seldinger took an early interest in radiology. The new department of radiology at the Karolinska Hospital became his sphere of action for almost two decades. There he showed how his method could be used to reach all major arteries of the human body from the femoral route, using the parathyroid and renal arteries as examples. He defended his thesis "Percutaneous transhepatic cholangiography" for an M.D./Ph.D. in 1966. The biliary ducts were catheterized with the Seldinger technique. The following year (1967), he returned to Mora to become radiologist-in-chief in the community hospital there.

Seldinger had already come upon the ingenious idea of his new technique in 1952 when serving as a young resident at the Karolinska Hospital. Seldinger himself tells the story of how it all happened. (The following is a quotation from Seldinger, S-I "A leaf out of the history of angiography". In "Pioneers in angiography", Elsevier Science publishers (Biomedical division), Radiology, 1987. M.E. Silvestre, F. Abecasis and J.A. Veiga-Pires eds.). Seldinger writes:

"Pierce (1951) suggested a percutaneous technique in which a catheter was inserted through a puncture instrument into the femoral artery and advanced to the aorta. The catheter had to be wide enough to permit a very rapid injection. If not, the contrast medium would be so diluted by the voluminous aortic blood flow that diagnostic angiographs would not be obtained. In turn, a very

wide bore puncture instrument, with consequent risk of trauma, was required.

Thus, there was obviously a need for an improved percutaneous method for aortography, and one of the requirements to the solution was an increased bore of the catheter. Such an increase would be substantially beneficial. According to the law of Poiseuille, the rate of flow through a long narrow tube – all other factors constant – is approximately proportional to the fourth power of the diameter. When doubled, the time of injection could be divided by 16!

There existed a puncture instrument, named after Cournand, consisting of an inner sharp needle in an outer blunt cannula, the edge exceeding the cannula by one or two mm. One alternative was to use a flexible catheter instead of the cannula, but it would certainly be tricky to handle an inner needle, half a meter long. I avoided this trouble by cutting a side hole on a polyethylene catheter at such a level that a cutting needle of convenient length, when inserted through it, exceeded the tip of the catheter by one or two mm. After some moulding of the catheter and a minute incision in the skin, this instrument could be inserted into the artery by percutaneous puncture.

Some obvious disadvantages were inherent in this technique. For instance, the thin-walled catheters were so flexible that it was sometimes impossible to advance them further into the vessel. This difficulty could be overcome: When the intravascular position was obtained, the needle could be withdrawn from the side hole and replaced by a semi-flexible metal wire which was introduced through the entire length of the catheter to support it.

Now! After an unsuccessful attempt to use this technique I found myself disappointed and sad, with three objects in my hand – a needle, a wire and a catheter – and... in a split second I realized in what sequence I should use them: **Needle in – wire in – needle off – catheter on wire – catheter in – catheter advance – wire off.**

I have been asked how this idea turned up and I quote Phokion, the Greek. "I had a severe attack of common sense".

With the "beginner's luck", the first angiography performed with this technique was successful. A subclavian arteriography, with one single exposure, the catheter introduced through the brachial artery after puncture at the cubital level revealed a mediastinal parathyroid adenoma, unsuccessfully searched for by the surgeon at a former operative exploration".

The lack of appreciation that early pioneers frequently encounter also fell upon Seldinger. His chief at the department of radiology at the Karolinska Hospital did not think that Seldinger's invention of the new technique and the obvious consequences – all the arteries in the human body could be reached by this simple procedure – was enough to form the basis for a thesis. Seldinger had to start on a second project, the development of percutaneous cholangiography.

However, today it is understood that the Seldinger technique is a prerequisite for all endovascular work in modern medicine. Interventional radiology of almost any category would not have been developed without this technique. In particular, the English-speaking part of the Radiology world make contributions to maintain the awareness of Seldinger's achievement when his name is used in their reports of invasive and interventional diagnostic and therapeutic procedures.

With time, Seldinger's contributions have been acknowledged and it would be impossible to give an account of all the awards and honours he has received. Perhaps it deserves to be mentioned in this context that he was chosen in 1992 to be the first recipient of the "Pioneer in Interventional Radiology Award" by the American Society of Cardiovascular and Interventional Radiology. He was also a honorary member of the American Society of Interventional Radiology. One token of honour that made Seldinger himself exceptionally happy was an article covering eleven pages in the January 1984 issue of AJR and entitled "A Tribute to Sven-Ivar Seldinger". In that context, Herbert Abrams gave the following acknowledgement of Seldinger's contributions:

"In the movement of angiography from the part of a bit player to that of a protagonist in the scenario of diagnostic medicine, probably no single contribution has weighed more heavily than the technique developed by Sven Seldinger. To a major degree, its elegance and its usefulness lie in its very simplicity, and although Seldinger has been modest about his contribution, it took both ingenuity and creativity to lead angiography into a new period and a new arena. All of us in radiology acknowledge our great debt to Seldinger for his vision. His contribution moved the field into a new and exciting direction and left a permanent imprint on medical imaging and diagnostic and therapeutic medicine".

OLOF FLODMARK

TORGNY GREITZ