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## Sven-Ivar Seldinger

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### Sven-Ivar Seldinger

Sven-Ivar Seldinger, the world-renowned Swedish pioneer in angiography, died in his home in Mora, Dalecarlia, Sweden on February 21, 1998. It can be said without exaggeration that no single technical contribution has impacted the development of angiography, and consequently the realisation of interventional radiology, as Seldinger's method of introducing catheters percutaneously into vascular channels. It is unnecessary to describe here the essentials of this technique, which is well known to all radiologists and cardiologists who are active today, and has been used by them during their entire professional life. Forty-five years ago, Sven-Ivar Seldinger published his method in *Acta Radiologica*. A great number of reports on the successful use of the new technique soon were published, and for several years Seldinger was the name most frequently mentioned in the scientific literature of all categories.

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. His ancestors had for generations run the Mora Mechanical Workshop, and have been credited as "technical geniuses." Seldinger received all his basic schooling in Dalecarlia. He began his medical studies at the Karolinska Institute in the fall of 1940. From the very beginning, Sven-Ivar made a deep impression on his fellow students because of his intelligence, independence, and frequently drastic way of expressing himself. One of Sven-Ivar's classmates at medical school was the author of this tribute. We soon became very close friends. Sven-Ivar started his training in radiology before I did. It was he who inspired me to follow him into this field. Consequently, he had a decisive influence on my choice of profession.

After having completed his initial medical training in 1948, Seldinger took an early interest in radiology. The new university clinic at the Karolinska Hospital became his sphere of action for almost 2 decades. There he got the idea for his method of catheter insertion and showed in phantom experiments how it could be used to reach all the arteries of the human body from the femoral route, using the parathyroid and renal arteries as examples. He defended his doctoral thesis "Percutaneous Transhepatic Cholangiography" in 1966. The biliary ducts were catheterized with the Seldinger technique. The following year (1967), he returned to Mora to become chief of the radiology department of the local hospital.

Seldinger came upon the ingenious idea of his new technique in 1952 as a young resident at the Karolinska. Seldinger has related the story about his discovery. The following is a quotation from



"A Leaf out of the History of Angiography" (In: *Pioneers in Angiography*, M.E. Silvestre, F. Abecasis, J.A. Veiga-Pires eds. Elsevier Science Publishers [Biomedical Division], 1987). Seldinger writes, after giving a brief account on the state of the art in the early 1950s: "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 Cournaud, 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 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 ‘beginners 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 are frequently met with, also fell upon Seldinger. His chief at the Department of Radiology at the Karolinska 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. So Seldinger had to start on a second project, the development of percutaneous cholangiography.

Nonetheless, his contributions have been acknowledged over time, and it would be impossible to give an account of all the awards and honors he

received. One of those that made Seldinger himself exceptionally happy was an article covering eleven pages in the 1984 January issue of the *American Journal of Roentgenology* entitled “A Tribute to Sven-Ivar Seldinger.” In that context, Herbert Abrams wrote the following about 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.”

Sven-Ivar Seldinger is survived by his wife Britt-Lis, his daughters Mari, Nina, and Mona, who also have families, and by many friends and colleagues.

Sven-Ivar had a modest and somewhat sulky appearance that did not always attract people who met him. We who came to know him learned soon to appreciate his sincerity, honesty, and solicitude for others. He was a good and reliable friend. We are many who miss him today, and will continue to miss him in the future.

TORGNY GREITZ