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**Andreas Roland Grüntzig 40th anniversary****Andreas Roland Grüntzig, the man****Recollections of those early days of discovery and invention by one that was there, Bernhard Meier MD**

Andreas Roland Grüntzig was born on 25 June 1939 in Dresden, Germany, at the onset of World War II that took the life of his father. It was a difficult task during and after the War for the mother to bring up her two sons, Andreas and Johannes. Both later became professors of medicine much to the pride of their mother (Figure 1). To make that possible she disputed and fought against the German Democratic Republic government decision that Andreas had to become a mason. Before the Wall was erected separating the one Germany into an Eastern and Western German nation, the three Grüntzigs emigrated to Argentina where they had family. Yet, that stay was short lived. They then fled to West Germany and that was permanent.

Andreas Grüntzig studied medicine from 1958 to 1964 in Heidelberg. He was a resident (1964–1969) in the subspecialties of medicine. While working with Schäfer in Heidelberg and Holland in London, United Kingdom, Grüntzig became fascinated by the epidemiologic importance of coronary artery disease and frustrated by the dearth of therapeutic options at the time.

Grüntzig was looking for a tutor. He found Hegglin in Zurich, Switzerland, an internist and author of the leading German textbook of internal medicine. The two extraordinary personalities immediately synchronized. Grüntzig started in 1969 just before the sudden demise of Hegglin. Bollinger who had just founded a division of angiology (at the time for vessels, what cardiology is for the heart today) took over as tutor. Grüntzig strived to add actual repair to diagnoses. On the way, he designed claudicometry, quantifying the Achilles tendon reflex of legs as a criterion for reduced perfusion. The reflex was slower in a

leg with significant peripheral artery disease (Figure 2). Later the availability of Doppler devices rendered claudicometry a stillbirth.

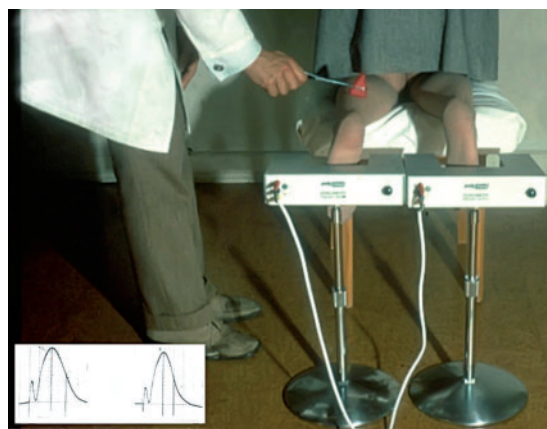
In 1971, Grüntzig watched Zeitler in Engelskirchen, Germany, performing Dotter interventions. Dotter had published in 1964 a method to dilate stenosed peripheral arteries by passing through them a thin plastic catheter over which catheters of incremental diameters were advanced. Akin to urethral dilatation of today. Grüntzig introduced that technique to Switzerland and immediately set about trying to improve it.

First, he experimented with a C-bend at the tip of a wire. It could be introduced as straight shape through a small catheter inserted in the groin and reassumed the C-bend when exiting the catheter distal to a narrowing. Spinning it with a household drill, the rotating C became a cutting olive abrading material on the pullback through the narrowing. This technique did not make it out of the dog laboratory.

Grüntzig then pursued the logical concept to introduce a deflated balloon, inflate it in the lesion, deflate it and remove it, avoiding the large puncture hole germane to the Dotter technique. Grüntzig searched and found. First, it was a book about heat treating polyvinyl chloride to turn it to form constant cylindrical balloons resisting pressures up to about 6 bar (1 bar = atmospheric pressure at sea level) with acceptably little compliance. Grüntzig had to roam Zurich to find a company providing the material and one (Schneider Medintag) to manufacture the balloons. Self-made balloons were good enough



**Figure 1** Andreas Grüntzig's mother in her 80s, proudly attending one of her son's teaching courses.



**Figure 2** Grüntzig performing claudicometry in a woman with peripheral artery disease. The insert shows that the Achilles tendon reflex curve of the diseased left leg is slowed (broader in the graphic recording on the insert).

for the initial clinical application in peripheral arteries, which Grüntzig started 1974, but not for coronary applications.

In 1973 after a training period in radiology Grüntzig was recruited by Rutishauser, chief of the cardiology division, who had a nose for a good thing. Now the coronary arteries were within reach. Unfortunately, Rutishauser left for Geneva and his successor Krayenbühl offered no support but rather shared the overly critical attitude of internists towards coronary angioplasty. Senning, the world famous chief of cardiac surgery, fancied novel technologies. His deputy Marko Turina supported Grüntzig's dog experiments for what today we call percutaneous coronary intervention (PCI). Taking a proverbial saw to the branch they were sitting on, they exposed themselves to harsh criticism from their cardiac surgeon peers and essentially the rest of the medical community. Coronary artery bypass grafting's (CABG's) history was still single digit in years.

In 1975, Grüntzig had everything ready to perform the first PCI. It was not going to be before September 1977 that he finally found a patient. Grüntzig had looked everywhere, first in Zurich and then in the rest of the world. He made several trips to the USA where he could not find a patient either, in spite of a more permissive attitude to coronary angiography there. Even in a busy centre in San Francisco where he had performed intraoperative balloon angioplasty on a few patients in May 1977, indications for coronary angiography were very restricted at that time. Angiography was undertaken late in the disease process, so that almost all patients were found to have triple vessel disease not amenable to PCI.

In September 1977, Grüntzig spent another week in San Francisco looking for a first patient and returned empty-handed to Zurich on 15 September 1977. I took him to a 38-year-old patient who had had coronary angiography the day before for unrelenting angina despite full medical therapy. The report of the radiologist who performed the coronary angiogram described several lesions. In fact, there was only one tight proximal stenosis of the left anterior descending coronary artery (LAD). The patient was scheduled for CABG and was not pleased with that perspective. He shared a room with a patient recovering from CABG, in pain from his several wounds. It took Grüntzig 10 min to explain to the patient his alternative with a good chance to obviate the need for CABG, cursorily mentioning that this had never been done before but worked well in human legs and dog hearts.

The first patient did extremely well. He celebrates these days of the 40th anniversary of this historical intervention in good health and without any surgical scars. He did need four more PCI sessions, the first one 23 years after the initial one. That is trivial.

Grüntzig took a number of shortcuts with the first procedure, intuitively knowing that he would get away with them. While he did use the air pressure driven inflation device (*Figure 3*), he did not use the roller pump which had been an integral part of the dog experiments, to provide some arterial blood distal to the inflated balloon in order to prevent ventricular fibrillation. The patient tolerated the occlusion of the LAD for about 30 seconds without even complaining of chest pain. Grüntzig, blaming it on poor fluoroscopy, also inserted the balloon catheter in the ostium of the diagonal branch just distal to the LAD lesion and inflated it there. So, the first PCI was an impromptu double vessel PCI. There was no lesion in the diagonal branch.

After this splendid inaugural success came a most difficult time for Grüntzig. He became the target of mobbing (mobbing occurred then as it does today, it was just called differently) by envious superiors



**Figure 3** Andreas Grüntzig as a budding young doctor in the late 1960s.

and peers. Grüntzig was too slick to be stopped by this. He distributed the technique in rationed doses to those openly supporting him and far enough away not to challenge him locally. They were grateful and became Grüntzig's friends for life after having introduced PCI to their cities or countries.

While Grüntzig was literally and actually kept in the basement in his working place at Zurich, he became an international star in cardiology. *Figure 4* shows what that did to his appearance. The inclination for a flashy appearance which was now affordable was in his genes *Figure 5*. Not only his attire changed but also his means of transportation from the bicycle or scooter to the Porsche or private plane. The latter got him killed on 27 October 1985.

It speaks for Grüntzig that he resisted others trying to push him to do things with his balloon that were not to the benefit of the patients or the balloon. I remember presenting him an hourglass carotid artery stenosis to make him embark upon carotid angioplasty as an addition to coronary angioplasty. He looked at the lesion and then at me and said: 'A very nice stenosis that certainly needs treatment. The lesion is less than 1cm away from the skin and the surgeon can easily take care of it without need for opening the chest or putting the patient on extracorporeal circulation. Let him do it'. I reckon he would say the same thing, today.

When Grüntzig gave lectures or live courses (another novelty he introduced to cardiology) his presentations kept the audience in awe. He topped it with his stunning appearance and another gadget he introduced into cardiology, the laser pointer (*Figure 6*).

Weary of having to fight for beds and catheterization laboratory time and to avoid the mines set for him, Grüntzig left Zurich at the end of 1980. The academic promotions that had been withheld as part of a strategy to keep him at bay were part of the offer he received from Emory in Atlanta, GA, USA. Despite even more prestige and personal salary offered by other institutions, Atlanta, having just received a grant that made it possible to create an infrastructure for PCI impossible to beat, attracted him.

PCI was not Grüntzig's only 'baby'. He had a daughter (also born in 1977) plus another daughter from a previous relationship. The daughters would be raised by their mothers, PCI was his priority. In Atlanta, everything fell into place for him professionally. People working with him may also have felt some jealousy but they knew to contain it, not to hamper Grüntzig or PCI, in contrast to their colleagues in the old world.



**Figure 4** Grüntzig presenting the original pressure inflation device for PCI featuring a pressure gauge and a glass syringe powered by compressed air.



**Figure 6** Grüntzig during a presentation using a laser pointer prototype (in his right hand) never used in cardiology conferences before. The gadget often received as much attention as the content of the presentation. Typical for Grüntzig, knowing about the hazard of the laser to human eyes, he kept his left index finger on the exit as a precaution while not pointing to slides.

Despite Grüntzig's upbringing in a society featuring the Russian language but not English, in the days of the 'Iron Curtain' (America was the arch enemy), he warmed to Americans quickly. He became proficient in their language, divorced his German wife to marry an American, and adopted many an American custom he had frowned upon hitherto. He unabatedly continued to foster PCI, warning against overestimating it, and teaching it only when teaching was on the agenda. He knew that PCI, after all, was not that difficult and throwing his wisdom and his tricks at everybody was not smart.

Even before performing his fist PCI he had arranged for a picture that, I am sure, he would use today to put things into perspective, that all of a sudden pop up as a holy grail. The currently much hailed heart team is really nothing new and has its limits (*Figure 7*).

Although Grüntzig may never have been able to accomplish his two major remaining goals (receiving the Nobel Prize and being called to the chair of cardiology at an important university in a country of his German background), he would have continued to do great



**Figure 5** Andreas Grüntzig as the world's most successful cardiologist in the early 1980s.



**Figure 7** The 'Vessel Team' of the era before interventional cardiology and its 'Heart Team'. Grüntzig (first from right) arranged his partners of the peripheral angioplasty dawn in a picture that made them happy to be part of, oblivious to the fact that they were instrumented. Bollinger, (non-invasive angiologist, second from right) corresponds to the non-invasive cardiologist in a current 'Heart Team', Leu (pathologist, first from left) to an anaesthesiologist or an intensive care physician and Brunner (vascular surgeon, second from left) to the cardiac surgeon. Brunner appeared utterly pleased, obviously ignoring that Grüntzig had placed him in the second row.

things. He would have stayed with the essentials while battling everything that complicated PCI more than helping it.



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**Conflict of interest:** none declared.