

English version of the article

Until the blood clogs

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Aneurysms are time bombs in arteries: When the small enlargement of the wall of the blood vessel ruptures, life-threatening bleeding occurs. Now physicians want to treat it without performing surgery.

By Denis Dilba

It was noon and nothing happened. The nano-particles which had been injected into a cervical vessel of a laboratory rabbit before should have caused a reaction in the meantime. None of the three men in the small operating theatre of the University Hospital in Aachen let the x-ray screen out of their eyes. The screen showing the arterial vessels of the rabbit looked exactly like before the injection. And this was awful because another experiment would not be affordable.

‘It’s gone!’ shouted Timo Krings, Neuroradiologist of the University Hospital; he was the first to notice the change. One hour before the enlargement of the arterial vessel was continuously flooded with blood and now no aneurysm was visible any longer! The microscopically small particles coated with layers of polymeric materials had caused a blood clot in the aneurysm and hence sealed it!

Andreas Spiegelberg remembers vividly every single second of this crucial experiment. ‘Our study could be the birth of a completely new era of treating aneurysms!’ exclaimed the managing director the Hamburg based Spiegelberg Company.

Aneurysms are time bombs: the arterial vessel wall is enlarged and forms a sack; the longer they are not treated the higher the risk of rupture. The consequence is a massive bleeding into the surrounding tissue. In the past aneurysms were found predominantly in the abdominal artery caused by syphilis. Nowadays the main reason for aneurysms to develop in the thoracic artery is arteriosclerosis. Especially in the brain congenital aneurysms occur; the persons affected are clueless.

Untreated bleeding aneurysms, especially when located in the brain, can cause death instantly.

‘We have focused on this criterion concerning our method’ says Peter Kirkpatrick, Neurosurgeon of Nuffield Hospital Cambridge, who co-developed the new treatment method. The self-raised financial means for the method allowed only three experiments in laboratory rabbits. Preliminary result: the method works, shows ‘extraordinary potential’ but has to be developed further before we can think of a clinical study in patients, says Spiegelberg.

The engineer made a name for himself by developing devices to measure and treat abnormal high intracerebral pressure by drainage. ‘You are an engineer’, remarked Kirkpatrick when meeting him at a conference in 2004. ‘Couldn’t we direct nanoparticles into an aneurysm by means of a magnetic field?’ The neurosurgeon thought that with a suitable coating these particles should be able to cause blood to clot. Hence the aneurysm would be obliterated. Spiegelberg found this idea very interesting. He devoured specialist literature, created an artificial aneurysm and tried to direct different powdery substances into the aneurysm by means of magnets. Only particles of the mineral magnetite showed the appreciated reaction and could be transported into the aneurysm without aggregating. The iron oxide is particularly sensitive to magnetic fields. It is also used in compasses.

Together with Kirkpatrick the search of a suitable coating causing the blood to clot on was successful. Another problem to master was lack of a suitable animal model. Spiegelberg and

Kirkpatrick found it in Timo Krings' laboratory rabbits in which he created aneurysms by means of surgical procedures which behave like 'naturally' developed ones.

With the help of a catheter located in the cervical artery the nanoparticles were directed into the aneurysm. A construction of magnets which had to be placed geometrically exactly caused the nanoparticles to stay exactly in place where it was bound to react. 'Initially we were afraid the particles would obstruct small arteries eventually or would collect in tissue of the body where they should not in spite of positive results in experiments prior to testing' says Spiegelberg. 'But fortunately these fears proved to be without foundation. The nanoparticles remained in the aneurysm under the influence of the magnetic fields and did not cause any harm anywhere in the body.'

Meanwhile the new method caused some physicians to react with restraint. 'I would perform further experiments' says Neuroradiologist Hans Henkes, expert on treatment of aneurysms at the Katharinen-Hospital Stuttgart. He considers this method to be practicable, but takes into consideration that proven treatment methods are available. With the help of a metal clip aneurysms can be clamped. Another possibility is coiling. By means of a catheter platinum wire is pushed forward into the aneurysm until it is filled up by a wire conglomerate. His colleague Jens Fiehler from the University Hospital in Hamburg considers the idea interesting, but sees no absolute need for the technology to be pushed forward.

'We anticipated statements of this kind', says Spiegelberg. The new method however does have decisive benefits: No need for risky invasive procedures carried out in the brain which are performed e.g. in clipping aneurysms. Coiling also has disadvantages: It can only be performed when the neck of the aneurysm is small enough to keep hold of the wire conglomerate. Would it be washed out of the aneurysm embolism would occur.

'Our method could principally work in all sorts of different aneurysms', says Spiegelberg. 'It might even be possible to perform this procedure completely without invasive catheters only with the help of a magnetic field.' But this is just a vision. The further development of this method will be the next step.

On Sept. 6th, 2007 this method was presented by Peter Kirkpatrick at the Conference of the 'European Association of Neurologic Surgeons' in Glasgow.

Translation: Maritta Spiegelberg