

International Day of Radiology 2014
Interview on brain imaging
Slovakia / Dr. Kamil Zeleňák



**INTERNATIONAL
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In the run-up to the International Day of Radiology, the ESR spoke with Dr. Kamil Zeleňák, deputy head of the department of radiology at the Jessenius Faculty of Medicine in Martin of Comenius University in Bratislava about how radiologists interact with patients and the importance of imaging in neurological diagnosis and treatment.

European Society of Radiology: Imaging is known for its ability to detect and diagnose diseases. What kind of brain diseases can imaging help to detect and diagnose?

Kamil Zeleňák: A wide spectrum of brain diseases can be diagnosed by imaging techniques, including stroke (both ischaemic and haemorrhagic), brain tumours and metastases, traumatic injury, vascular changes (e.g. stenosis, aneurysms, arteriovenous malformations), infectious and inflammatory diseases (and their complications like abscesses), congenital and developmental malformations, and degenerative diseases. Currently, it is possible to display not only structural, but also functional changes.

ESR: How useful is imaging in brain disease management? Does it improve the understanding of disease or improve patient prognosis?

KZ: Today it is almost impossible to treat the vast majority of brain disease without the appropriate imaging. Imaging plays a very important role in brain disease management. It can speed up the diagnosis and treatment of a disease, and also improve patient prognosis. It can detect the effects of treatment and can be used for follow-up after surgery (e.g. detecting complications or recurrence of the disease). Imaging scans can also help predict the risk of treatment procedures in some cases. It is also used in research studies to determine the effect of the treatment.

In recent years imaging techniques have had significantly positive effects on many diseases, but mainly on treatment options for stroke. Distinguishing ischaemic stroke from haemorrhagic stroke is crucial for further treatment. These techniques can also determine the size of ischaemia and a type of artery occlusion, as well as detect the source of bleeding. All this information has significant influence on further treatment decisions. Using brain imaging techniques, it is also possible to better plan a strategy of neurosurgical operations and neurointerventional endovascular procedures. For example, displaying important neural pathways and functional centres can include minimised damage and neurological deficits after removing tumours. Imaging of vascular variations and anomalies allows for planning the choice of and types of microcatheters, stents etc., which could shorten the procedure time and minimise operational risk.

ESR: What kind of technology and techniques do radiologists use to image the brain? Are there any specific techniques for particular diseases?

KZ: Computed tomography (CT), which includes non-contrast and contrast-enhanced CT scans, perfusion CT and CT angiography (CTA), is a method of choice in many cases, but magnetic resonance imaging (MRI) provides better resolution. CT and MRI, including non-contrast and contrast-enhanced MRI scans, magnetic resonance angiography (MRA), magnetic resonance spectroscopy (MRS), MRI tractography and functional MRI, have specific advantages in different conditions. In suspected diseases, e.g. multiple sclerosis, the patient is primarily examined by magnetic resonance imaging. Ultrasound is used especially in children and for brain vessel imaging. Digital subtraction angiography is essential in the imaging of certain vascular anomalies and during endovascular treatment. Some signs of brain disease can even be spotted with x-ray.

ESR: What is the difference between a radiologist and a radiographer? Who else is involved in performing brain imaging exams?

KZ: A radiologist is medical doctor who specialises in diagnosing and treating diseases and injuries using medical imaging techniques, such as x-rays, CT, MRI, ultrasound and digital subtraction angiography (DSA). A radiographer, or radiologist assistant, is a person who operates the imaging equipment. He or she works under the supervision of a radiologist to provide patient care with regard to the diagnostic imaging environment. He or she helps to improve productivity and efficiency at a time when the demand for medical imaging services is soaring. Other people who are involved in performing brain imaging are nurses, mainly for contrast administration, and sometimes anaesthesiologists.

ESR: How many patients undergo brain imaging exams in your country each year?

KZ: According to information from insurance companies, 172,671 CT and 66,534 MR brain examinations were performed in Slovakia in 2013, which has a population of 5,415,949 as of December 31, 2013.

ESR: Access to modern imaging equipment is important for brain imaging. Are hospitals in your country equipped to provide the necessary exams?

KZ: The demand for CT and MRI examinations is constantly increasing. It is possible that some requests are unnecessary. According to data from the National Health Information Centre, by the end of 2012, there were 77 CT scanners and 33 MRI scanners installed within the previous eight years, and 14 CT scanners and 10 MRI scanners older than eight years in Slovakia. Most MRI equipment is privately owned.

ESR: In many countries there are waiting lists for MRI exams. How long can patients typically expect to wait for an exam in your country?

KZ: Generally, hospitalised patients usually wait a few days for MRI exams, depending on the severity of the patient's condition. Patients with an acute condition may be examined as needed. Outpatients may wait for an MRI examination for up to two to three months.

ESR: As the global population gets older, the risk of developing neurocognitive and neurodegenerative disorders increases. How can imaging help tackle this issue?

KZ: Imaging techniques (especially MRI) may be helpful to diagnose neurodegenerative disorders, such as Alzheimer's disease, Parkinson's disease or others, by revealing typical features of these diseases. Also, new modern methods, such as MR spectroscopy, MRI tractography and functional MRI, can be useful in the early diagnosis of neurocognitive and neurodegenerative diseases. It is also very useful in differential diagnosis. Research studies help us to learn more about these disorders.

ESR: Some imaging techniques, like x-ray and CT, use ionising radiation. What risk does this radiation pose to the patient and what kind of safety measures are in place to protect the patient?

KZ: Modern imaging equipment can produce very good quality images with significantly lower doses of radiation than in the past. On the other hand, it must be emphasised that x-rays are potentially harmful. The radiation dose should be as low as possible. Attention should be paid especially to children, young people and pregnant women, for whom the risk is greater. Therefore, some rules should be observed to protect the patients: the potential benefit of the test should always outweigh the risk and unnecessary and duplicate exams should be avoided. Various forms of protective equipment for covering different parts of the body are also used.

ESR: What kind of role can imaging play in preventing and predicting brain diseases?

KZ: Imaging techniques play a very important role in preventing and predicting some brain diseases. Ultrasound is widely used in the prenatal and early postnatal period, and it can detect congenital disorders of the brain. MRI is the technique best-suited to preventing and predicting disease, because it does not use ionising radiation and can detect most of the structural changes in tissues. In

some cases, if it is indicated, preventive treatment may also be performed (e.g. coiling of brain artery aneurysm).

ESR: In general, patients do not see the radiologist. A patient will discuss the image with the neurologist, neurosurgeon or oncologist. When they ask a question, they're often told: "I'm not a radiologist". Why don't radiologists discuss the image with the patient first?

KZ: There is no simple answer to this question. Due to the development and improvement of computer technology, scanning time is constantly shortened, scans are thinner, and radiologists must evaluate more and more scans. Consequently, the radiologist may not have enough time to explain the findings to the patient. Sometimes it is necessary to wait for the results of other tests, such as laboratory tests, in order to establish a definitive diagnosis. This information may not be available to the radiologist at the time of examination. Whenever radiologists detect a malignant tumour, it is not easy to communicate to the patient they have just met. Another reason may be that some patients consider the radiologist to be more like an engineer than a doctor who has studied medicine. Finally, it must be emphasised that, at least before an interventional radiology procedure, the patient must be informed and must sign the informed consent form, so many radiologists communicate substantially with patients then.

ESR: How expensive are radiological examinations to the health service and is there a risk that some of these examinations could be blocked by health technology assessment agencies deeming them to be not cost-effective, especially in relation to screening? If so, how can patients help to ensure that these examinations are made available?

KZ: In general, these examinations are not cheap, but much more money is spent on medication. Imaging techniques help establish the correct diagnosis, and an early correct diagnosis can save money. Also, patients may request that their health insurance companies send them to a hospital where the examination can be carried out earlier.



***Kamil Zeleňák** is deputy head of the department of radiology at the Jessenius Faculty of Medicine in Martin of Comenius University in Bratislava. He specialises in interventional radiology and interventional neuroradiology. He is a pioneer interventional radiologist in his country, having been the first to perform carotid artery stenting in 2001 and endovascular treatment of an intracranial aneurysm in 2003. Dr. Zeleňák is a fellow of the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) and a member of various scientific societies, including the European Society of Radiology, the European Society of Minimally Invasive Neurological Therapy and the World Federation of Interventional and Therapeutic Neuroradiology. He received the Editor's Recognition Award for Distinction in Reviewing from CIRSE in 2011, 2012 and 2013. He has authored and co-authored over 180 publications and conference papers, and two books.*