International Day of Radiology 2015
Interview on paediatric imaging
Ireland / Prof. Stephanie Ryan

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Paediatric imaging in Ireland

An interview with Stephanie Ryan, consultant paediatric radiologist at the Temple Street Children's University Hospital and the Neonatal Department of the Rotunda Hospital in Dublin.

European Society of Radiology: What is paediatric imaging? What age are the patients, and how is it different from regular imaging?
Stephanie Ryan: Paediatric imaging is imaging of babies and children – from newborn babies to children aged 15. Many paediatric radiologists also image babies before they are born, using foetal ultrasound and foetal magnetic resonance imaging (MRI). The upper age is variable too. Some paediatric radiologists image adolescents right up to 18 years. Many image children with disabilities or chronic diseases right into adulthood.

ESR: Since when has paediatric imaging been a specialty in its own right?
SR: Many of the earliest radiographs taken after the discovery of x-rays by Roentgen in 1895 were of children, because their smaller size allowed easier penetration by the weak x-ray beams that were first produced. Many of the early scientific papers on the subject were of studies involving children. Within children's hospitals, x-ray departments were first run by paediatricians rather than radiologists. The concept of a specialist in radiology for children, whether a radiologist or a paediatrician, was established by the 1920s.

ESR: Which imaging modalities are usually used to examine paediatric patients? Does this change depending on the age of the patient?
SR: The same range of imaging modalities are used in paediatric radiology as in adults but the best choice of imaging technique in a given situation may be different for children than it is for adults, and also varies for children of different ages. Thus plain x-rays are used at all ages for evaluation of bones after an injury, to look for fractures. Evaluation of possible appendicitis is done primarily with computed tomography (CT) in adults but with ultrasound in children. Kidney stones are rare in children but intussusception is common. Kidney stones are common in adults but intussusception is rare. Both conditions are diagnosed with ultrasound in children but by CT in adults.

ESR: Some imaging techniques, like x-ray and CT, use ionising radiation. What risk does this radiation pose to paediatric patients? What kind of safety measures are in place to protect children?
SR: Radiation carries some risk in all age groups but this risk is greater in children for a variety of reasons. One reason is that children have a longer remaining life expectancy and since many adverse effects of radiation take years to occur, children have a longer opportunity for these to become manifest. Children are more sensitive to radiation for the development of certain tumours and leukaemia, but actually have less sensitivity to develop other cancers such as lung cancer. Paediatric radiologists and radiographers always strive to use the lowest radiation dose possible while maximising the diagnostic value of the imaging. The first step in minimising radiation dose is only to do necessary studies. Sometimes choosing a different type of scan reduces or eliminates radiation risk. Because of the risks of radiation, CT is used much less in children than in adults and ultrasound is used more. Sometimes MRI is used rather than CT or x-rays. Paediatric radiologists have been to the forefront with manufacturers in developing technology to reduce CT radiation doses and to develop low dose fluoroscopy equipment.

ESR: Do general radiologists always use lower radiation doses when imaging children; are there any guidelines to follow?
SR: It is very important that all radiologists and radiographers who image children know how to reduce the radiation dose for children while achieving the best possible diagnostic study. Only necessary studies are done. Options such as MR or ultrasound, which do not use ionising radiation, are used where possible. Radiation doses for x-ray and CT examinations need to be adjusted for individual children's size and weight.

ESR: How aware are parents and relatives about the risks of radiation exposure? How do you address the issue with them?
SR: Parents and carers are not always aware of the risks of radiation exposure and it is our role as specialists in paediatric imaging to sensitively explain the benefits and the risks of any alternatives to the diagnostic studies we are proposing to do.

ESR: Undergoing an imaging examination, especially a long procedure like MRI, can be an uncomfortable and sometimes frightening experience for some children. How can it be made more bearable?
SR: Some age groups and some children with disabilities simply cannot cooperate for a long study and may need sedation or general anaesthetic to safely achieve a high quality scan. Preparing a child with simple explanations, the use of distraction such as music or movies, and encouragement during and after the scan, can make even a long scan possible for young children. We compare the scan to a trip in a space ship or other fun concepts. Some departments have an MR simulator to introduce the child to the MR scanner before the scan itself. A bright, child-friendly environment and a positive attitude among skilled staff can help a great deal.

ESR: How many imaging exams are performed on paediatric patients in Ireland each year?
SR: Around 150,000 imaging exams a year are performed in dedicated children's hospitals and neonatal units. Very many more are also performed in general hospitals around the country.

ESR: Access to modern imaging equipment is important for paediatric imaging. Are hospitals in Ireland equipped to provide the necessary exams?
SR: Paediatric and other hospitals in Ireland are well equipped with modern imaging equipment for the most part. We are promoting the use of technical advances that reduce CT dose for all patients but especially children. But the greatest resource for the best paediatric imaging is skilled specialised staff.

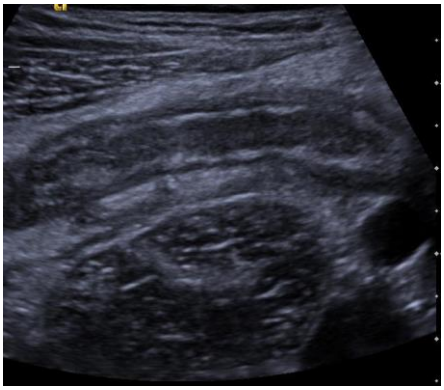
ESR: What has changed in paediatric radiology during your lifetime?
SR: The power of CT as a resource for ultrafast multi-planar imaging has changed almost beyond recognition compared to the CT that was available at the beginning of my career. But the greatest advance has been the development and improvement in MR imaging. MR is particularly suitable for children because it does not use radiation. It allows very detailed imaging of the brain and spinal cord. It has taken over from angiography and venography for imaging vessels and vascular malformations.

ESR: Where do you see the next developments in your field?
SR: Many new developments in paediatric radiology are likely to be in the imaging of function as well as structure. We are likely to see more imaging of renal function by MR, to see study of biochemical processes by MR spectroscopy and to see greater development of functional imaging of tumours in nuclear imaging. I hope we will see faster and higher resolution scans so that, like CT, fewer children will need anaesthesia for MR scanning.
Paediatric interventional radiology is a subspecialty that uses imaging to do procedures that would have required surgery in the past. I think that its development will allow a non-invasive alternative

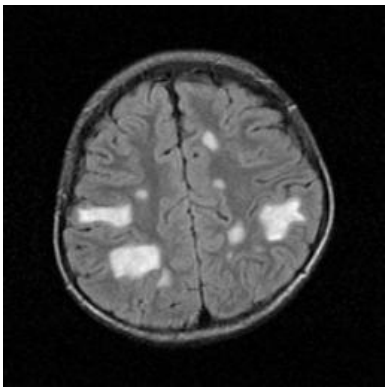
for a variety of procedures including the management of vascular, intestinal or renal tract obstructions, the removal of renal stones, the ablation of tumours and even foetal procedures to encourage lung development or treat placental conditions.

Stephanie Ryan *is a consultant paediatric radiologist at the Temple Street Children's University Hospital and the Neonatal Department of the Rotunda Hospital in Dublin.*
Her main interests are neonatal radiology and paediatric neuroimaging. She also has a special interest in teaching aspiring radiologists, paediatric radiologists, paediatricians and a variety of other specialists. She trained in general surgery and radiology in Ireland, specialised in paediatric radiology in Seattle, Washington, and did further training in angiography and interventional radiology at the Mayo Clinic, USA.
She has written several papers on paediatric imaging, chapters in imaging text books and a textbook on imaging anatomy, the third edition of which was published recently. She has presented papers and been an invited speaker at several international meetings on paediatric radiology.

Condition not found in adults – 13 month old with painless, swollen wrists. Radiograph of wrists shows widening of the growth plates and irregularity of the margins of the growth plates. These are findings of rickets – the result of vitamin D deficiency in a child.



Choice of imaging modality. Ultrasound of right lower quadrant in a seven-year-old with 12-hour history of abdominal pain. Shows an enlarged tubular structure consistent with acute appendicitis. This condition is usually evaluated with CT in adults but ultrasound in children to avoid the risks associated with radiation.



Similar findings give different diagnoses in children than in adults. A seven-year-old girl with onset of drowsiness and irritability over two days. Now has weakness of left arm and leg. MRI scan of the brain showing multiple bright areas of abnormality in the brain might suggest multiple sclerosis in an adult, but in this setting in a child, the findings are typical of acute disseminated encephalomyelitis (ADEM), a condition with a much better chance of complete recovery.

Another condition not found in adults. A four-week-old baby boy has projectile vomiting for four days and is losing weight. This ultrasound shows thickening of the pyloric muscle (note cursors) at the outlet of the stomach, consistent with hypertrophic pyloric stenosis.