International Day of Radiology 2015
Interview on paediatric imaging
Spain / Prof. Carmina Durán Feliubadaló

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Paediatric imaging in Spain

An interview with Carmina Durán Feliubadaló, Chief of the Paediatric Imaging Unit at the UDIAT Diagnostic Centre, Parc Taulí Hospital in Sabadell.

European Society of Radiology: What is paediatric imaging? What age are the patients, and how is it different from regular imaging?
Carmina Durán: Paediatric radiology is an area of radiology. Like other areas of radiology, paediatric radiology uses the different imaging techniques – x-rays, ultrasound (US), computed tomography (CT) and magnetic resonance imaging (MRI) among others – to diagnose diseases. However, the indications and applications of these imaging techniques in paediatric patients differ from those in adults.
The age of the patients varies between countries and medical centres, but it is generally from 0 to 16 or 18 years old.
Three factors clearly differentiate paediatric radiology from general radiology. In paediatrics, the size of the patients varies widely, so we have to constantly adapt the technical characteristics of the US waves and photons (as in CT) we use.
Then, it is important to emphasise that paediatric patients are more sensitive to radiation than older patients, because children have more cells actively undergoing replication and longer remaining life expectancies than adult patients. This means that genetic mutations induced by radiation are more likely to be expressed in the form of neoplasms.
Finally, the lack of cooperation from paediatric patients in many circumstances forces us to resort to sedation or anaesthesia as a last resort.

ESR: Since when has paediatric imaging been a specialty in its own right?
CD: In most European countries, paediatric radiology is not a medical specialty, but there are scientific societies dedicated to paediatric radiology. In Europe, it was Professor Jacques Lefèbvre who really helped to establish paediatric radiology. He initiated the first meeting of European paediatric radiologists in 1963. It was at this meeting that he created the European Society of Paediatric Radiology (ESPR). By contrast, the Spanish Society of Paediatric Radiology was not founded until 1983. Radiologists with a special dedication to paediatrics are recognised as paediatric radiologists; however, a project is underway to make it possible to obtain certification in paediatric radiology through the Spanish Society of Radiology and to obtain approval for the specialty from the Spanish Ministry of Health.

ESR: Which imaging modalities are usually used to examine paediatric patients? Does this change depending on the age of the patient?
CD: Currently, thanks to technological advances, US is the imaging technique of choice in paediatric patients because it avoids irradiating the patient, can be carried out easily, and can be repeated as many times as necessary. It does not require patients to be transported to the radiology department. Moreover, current US enables not only morphological evaluation of the organs but also functional evaluation (e.g. contrast-enhanced ultrasound of the urethra).
The technique used changes according to the patient's age. An example of this is how US enables evaluation of the brain through the fontanel in premature and full-term new-borns, whereas later, after the fontanel closes, MRI is necessary to evaluate the brain.

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?

CD: Every radiologist who deals with paediatric patients is very aware of their patients' greater susceptibility to ionising radiation. It is important for radiologists to determine whether the requested study is really indicated; this is especially important for CT studies because, as I said, they can cause stochastic damage (genetic mutation) that could lead to carcinogenesis. Nevertheless, it is important to inform the general public that there are diverse safety measures that enable these studies to benefit patients while minimising risks. There are child-tailored CT studies known as 'low dose' (using a minimum of radiation). On the other hand, it is usual and should be obligatory for the different CT scanners to be calibrated or adjusted by radiophysicists and paediatric radiologists to reduce the radiation that paediatric patients receive to an absolute minimum. It is also important to measure the use of protective shields for the eyes, thyroid, gonads, etc.

ESR: Do general radiologists always use lower radiation doses when imaging children; are there any guidelines to follow?

CD: I guess not always. There are many general radiologists aware of the need to adapt the protocols but it is not always possible because they lack the necessary information to carry it out.

Despite the existence of guidelines to help general radiologists to know what doses to use in paediatric patients, it is generally not enough because it is a really complex issue. They can, for example, consult the ESPR guidelines to know both the general dosage and the indications for different studies. They can also consult different international web pages, publications, and books about topics such as chest CTs in children. Nevertheless, the ideal situation would be for these studies to be done by paediatric radiologists.

ESR: How aware are parents and relatives about the risks of radiation exposure? How do you address the issue with them?

CD: Parents are increasingly aware of the risks of exposure to ionising radiation. We always discuss this matter by referring to the risks and benefits of the study, so it is of the utmost importance that the indication is correct. We also use the recommendations of the International Atomic Energy Agency for the optimisation of radiological protection in paediatric patients.

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?

CD: First of all, it is essential for the care of paediatric patients that these examinations are carried out by professionals who have an affinity and sensitivity for dealing with children. Sometimes decorating the facilities for children can help make studies more bearable or even fun. We also normally use toys, music or videos to help children relax, no matter what kind of study we are doing.

ESR: How many imaging exams are performed on paediatric patients in Spain each year?

CD: It's really difficult to give the actual number of radiological studies that have been performed in paediatric patients in our country. There is no comprehensive national registry. Our hospital covers 430,719 patients, 73,080 of whom are under 15. In 2014, we performed 20,003 examinations in conventional radiology, 595 CT scans, 779 MRI scans, 4,794 US examinations and 81 vascular and interventional radiology studies in paediatric patients.

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

CD: The equipment available varies widely from hospital to hospital. It is often difficult to have all the equipment dedicated exclusively to paediatric imaging, in part because not all studies are done by paediatric radiologists. Also, in general, the equipment is not updated often enough.

ESR: What has changed in paediatric radiology during your lifetime?

CD: The biggest change has been the technological advances that have been achieved in recent years. The image quality in US has improved (using harmonics and contrast agents), so that it is now possible to avoid more complex techniques that are more invasive in that they require patients to be sedated or irradiated.

All of the developments that have enabled the dose of radiation to be reduced have also been very important: pulsed fluoroscopy (highly indicated in paediatrics), which makes it possible to reduce dose in fluoroscopic techniques by up to 90%. In CT, the introduction of dose modulation techniques, which allow the dose to be adapted to the size of the patient, has been very important. Nowadays, iterative reconstruction allows us to reduce the dose considerably and still achieve adequate image quality. In MRI, faster sequences have enabled us to reach the diagnosis without having to use sedation or anaesthesia as often in uncooperative patients. Finally, PET/CT studies are useful in detecting disease and determining its extension in oncology.

ESR: Where do you see the next developments in your field?

CD: As far as technological advances are concerned, the future of US depends on the availability of indications for the use of contrast-enhanced US in paediatric patients, which would enable us to replace imaging tests that require fluoroscopy or CT with ultrasound examinations that avoid irradiation.

Combined positron emission tomography (PET)/MRI scanners will be a new revolution in nuclear imaging, and this will be very useful for certain diseases. This way, all the oncological applications of PET/CT in young children or pregnant women will be replaced by PET/MRI, drastically reducing the amount of radiation delivered.

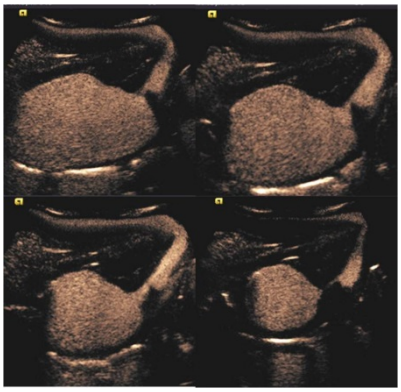
In addition, another important development would be the progressive installation of dose surveillance systems in many hospitals, which can detect and monitor the radiation dose administered to patients and thus enable us to optimise protocols.

Another important advance is the use of teleradiology for paediatric cases in places where access to a specialist in paediatric radiology is limited.

Finally, it is important to emphasise that the future of paediatric radiology and improvement in the field depend on its being established as a subspecialty. In countries where paediatric radiology is considered a subspecialty of radiology, there are enough specialised radiologists to attend to the paediatric population; however, in countries where this subspecialty does not exist, there are not enough. Paediatric radiology was the first subspecialty to emerge from radiology, in Boston, USA in 1958. Nowadays, paediatric radiology continues to be considered a subspecialty in the USA, in Ireland, and more recently it has been recognised as a subspecialty in Argentina. One of the reasons why paediatric radiology should be recognised as a subspecialty of radiology with a specific training programme is that the diseases that affect the paediatric population are completely different from those that affect adults, and it is essential to know them to be able to interpret the radiological images correctly.

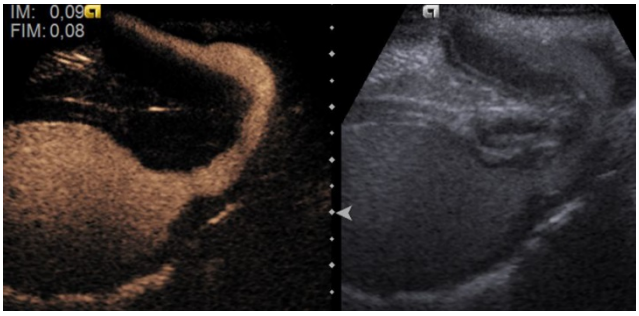
Carmina Durán Feliubadaló *is chief of the paediatric imaging unit at UDIAT Diagnostic Centre, Parc Taulí Hospital in Sabadell near Barcelona. She is a specialist in paediatrics and child care. She was also an associate physician at the Children's Hospital Center in Boston and at the Vall d'Hebron Hospital in Barcelona. She is the current President of the Spanish Society of Paediatric Radiology (SERPE), a subsidiary of the Spanish Society of Radiology (SERAM).*

Dr. Durán has authored various recent articles about paediatric uroradiology, especially on the development of voiding urethrosonography (contrast-enhanced sonography of the urinary tract). Her work has received many awards from the European Society of Paediatric Radiology (Presidential Award in 2007 and the Jacques Lefèbvre Award in 2011) for the studies which included the images shown below.



Voiding uretrosonography (VUS) sequential images of a normal micturition cycle where the progressive emptying of the bladder and proper progression of contrast through the urethra is observed.

VUS composite image of the entire urinary tract, showing vesicoureteral reflux during urination.



Dual VUS image shows abrupt change in the calibre of the urethra at bulbar level, with proximal urethral dilatation and narrowing distal to it, corresponding to a case of anterior urethral valves.