AI could help to manage, predict and even reduce patient exposure to ionising radiation

Every field of imaging is looking at the opportunities offered by artificial intelligence to advance imaging’s contribution to healthcare.

So what is it that AI can do to improve radiation protection and safety? From dose reduction to managing and adjusting dose to individual patients. The idea is to use AI methodologies to quantify image acquisition parameters and optimise procedures before or during each examination. “We are just at the beginning of something there. We are starting to build systems, based on computer systems, to determine image quality directly from existing patient images. This would be a prerequisite for the learning process of an AI tool,” said Hoeschen. “For example, for a dedicated task in a CT or SPECT application, you start acquiring images and during the generation of those images, you find out what is your already achieved image quality acquisition and just stop the examination altogether. During an interventional procedure, one could also give an indication of how to perform irradiation, in which direction or from which angle,” he said.

AI could also be used to predict rather than measure dose during an intervention, which would improve the safety of said intervention. This might be applicable to any interventional diagnostic procedure or angiographic CT.

There is a third path to enable radiation protection by means of AI, using radiogenomics to derive aspects of susceptibility of patients to ionising radiation and modulate dose accordingly. This development might influence diagnostic and treatment planning decisions.

This session is part of the EuroSafe Imaging campaign.

EuroSafe Imaging Session

Sunday, March 3, 08:30–10:00, Room N EU 7 Artificial intelligence and radiation protection

Chairpersons’ introduction
G. Frija, Paris/FR
C. Hoeschen, Magdeburg/DE

Artificial intelligence: a tool for quality and safety improvement in radiation protection
C. Frija, Paris/FR

Artificial intelligence for scatter reduction and optimising imaging procedures
C. Hoeschen, Magdeburg/DE

Artificial intelligence for intelligent reconstruction methods for radiation protection measures
C.T. Whitlow, Winston-Salem, NC/US

Using artificial intelligence for optimising procedures reflecting radiosusceptibility of patients
C. Hoeschen, Magdeburg/DE

Discussion

This session is part of the EuroSafe Imaging campaign.
Optimising the Management of the Diabetic Foot

A session presented by a panel of experts from the General University Hospital on the management of diabetic foot ulcers, the session aims to provide a practical, comprehensive, and timely update about how to manage diabetic foot complications, a significant cause of mortality and morbidity in diabetic patients.

Diabetes mellitus (DM) is a chronic metabolic disorder and a growing health problem worldwide. At present, the world is facing an epidemic of both type 1 and type 2 DM, according to the World Health Organisation (WHO), with DM currently affecting more than 422 million people worldwide, a number that is rising. As a multi-systemic disease, DM affects the body in a comprehensive way resulting in a variety of complications involving multiple end-organ systems. Complications are common among both patients with type 1 and type 2 diabetes and are responsible for significant morbidity and mortality.

Chronic DM complications can be broadly divided into microvascular and macrovascular complications. Chronic complications include neuropathy, nephropathy, and retinopathy while macrovascular complications consist of cardiocerebrovascular disease, stroke, and peripheral arterial disease (PAD). In this session, a panel of experts will take a multidisciplinary look at the diabetic foot, defined as the presence of foot ulcers associated with neuropathy, PAD, and infection, which particularly affects the soft tissue and bone, and its complications.

The diabetic foot is a significant cause of mortality and morbidity in patients with DM. Early diagnosis is of crucial importance, as it allows early treatment. With delayed treatment, progression toward a not only limb-threatening, but also life-threatening stage is often simply inevitable.

“Approximately ten percent of people with diabetes have a foot ulcer, meaning that more than one million people are suffering from diabetic foot disease. It has been observed that in 50–500 seconds one leg is amputated due to diabetes. Medical professionals, diabetologists, podiatrists, and interventional radiologists, who will chair today’s session, feel that foot ulcers and infections are among the most frequently occurring complications in the diabetic foot. Sensory neuropathy in the diabetic foot promotes many patients to traumatic injuries, which in further consequence may lead to skin breakdown, ulceration, and infections. Impaired perfusion as a result of PAD and macrovascular abnormalities reduces wound healing capacity and the ability to recover from infection. A vicious circle that must be broken in the early stage possible, according to Brountzos.”

“Prompt diagnosis and revascularisation should be offered in subjects with diabetes and PAD, in order to prevent wound healing and avoid infections. PAD and neuropathy are responsible for approximately 40% of diabetic amputations and these are at high risk of infection. Patients with PAD and a foot infection are at very high risk for major amputation, for which emergency treatment is required. These patients should be assessed by a multidisciplinary team including vascular surgeons, diabetologists, podiatrists, and interventional radiologists.”

Brountzos also plans to specifically focus on endovascular techniques used to promote wound healing and avoid infections. PAD and macrovascular abnormalities reduce wound healing capacity and the ability to recover from infection. A vicious circle that must be broken in the early stage possible, according to Brountzos.

“Today, endovascular revascularisation might be the only treatment option in cases of acute ischaemia, while for diabetic patients and PAD, while for a substantial proportion of patients with non-healing wounds, endovascular revascularisation might be the only treatment option in order to enable wound healing and avoid major amputation. Endovascular techniques have been used for more than 30 years to achieve first-line treatment options in everyday clinical practice. Moreover, technically, interventional vascular procedures performed over recent years has greatly increased to even outpatient open surgical procedures for PAD, both in the US and in Europe, while in experienced centres the endovascular-first approach has already been adopted in more than 50% of cases.”

After familiarising ECR delegates with the basics of endovascular treatment, Spiliopoulos plans to thoroughly discuss endovascular devices, methods, and techniques used to promote wound healing and avoid limb amputation, including angioplasty, stenting and novel drug-elution technologies such as drug-eluting stents (DES) and drug-coated balloons (DCBs), among others.

“Today, various endovascular methods and techniques are performed in experienced vascular centres, including infrainguinal angioplasty and DES, pedal arch reconstruction, revascularisation of long iliac and femoropopliteal chronic total occlusions, and ulcer-guided revascularisation,” noted Spiliopoulos. “Moreover, tissue perfusion methodologies can be used in order to accurately quantify tissue perfusion following endovascular procedures such as intraoperative 2D perfusion angiography, microwave radiotherapy and near-infrared spectroscopy (NIRS).” Spiliopoulos also plans to specifically address the results of IR treatment strategies in diabetic foot, the strengths and weaknesses of endovascular treatment, technical and limb salvage rates, and data demonstrating improved parity rates following endovascular revascularisation.

“A technical successful intervention should achieve a direct flow to at least one of the foot arteries. Very satisfactory long-term limb salvage rates have been reported for subjects with diabetes and critical limb ischaemia. The Achilles heel of endovascular treatment is not reaching the capability of conserving the leg and improving the quality of life.”

“Today, AI applications for revascularisation might be deterministic in principle. We have to be careful to avoid funding and testing, Hoeschen warned: “In the end, AI applications for revascularisation must be deterministic in principle. We have to be careful to avoid funding and testing, Hoeschen warned.”

“One needs to be careful at the time of using data in clinical trials, especially when it comes to AI in the title. We have to do one thing at a time, not all at once, otherwise we could have a problem,” Hoehsen remarked.

Fries pointed out that AI may help to significantly reduce the contrast agent dose in MRI examinations, theses being key in terms of patient safety in radiological procedures. "Another central topic of this session will be the magnitude of the diabetic foot as a societal problem. "The societal and economic impact of diabetic foot ulceration or major amputation is remarkable. People with diabetic foot ulcers experience a significant reduction in their quality of life, are unable to work, receive chronic treatment and require frequent medical visits and hospitalisations, while patients who suffer a major limb amputation often face problems in physical activity and social isolation, and psychological support,” said Brountzos. "In the end, AI should not be treated by a multidisciplinary team including vascular surgeons, diabetologists, podiatrists, and interventional radiologists. Furthermore, close monitoring and strict follow up schemes are crucial keys to clinical success,” he concluded. Another central topic of this session will be the magnitude of the diabetic foot as a societal problem. "The societal and economic impact of diabetic foot ulceration or major amputation is remarkable. People with diabetic foot ulcers experience a significant reduction in their quality of life, are unable to work, receive chronic treatment and require frequent medical visits and hospitalisations, while patients who suffer a major limb amputation often face problems in physical activity and social isolation, and psychological support,” said Brountzos. "In the end, AI should not be treated by a multidisciplinary team including vascular surgeons, diabetologists, podiatrists, and interventional radiologists. Furthermore, close monitoring and strict follow up schemes are crucial keys to clinical success,” he concluded.

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