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Editorial

Hybrid Images and the Orthopedic Practice: Beyond the XRays Era

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Despite a detailed history and the radiological tools available today in many circumstances the diagnostic approach in the clinical practice for the orthopedicians continue being hard, because: it is difficult to precisely locate the origin of the pain, the available information through the ancillary tools is limited, and even more when the patient has been previously operated and the anatomical repairs change, the clinical practice becomes more complex.

Conventional radiological imaging such as XRays, computerised tomography (CT), magnetic resonance imaging (MRI) and nuclear medicine techniques such as bone scan and single photon emission tomography (SPECT) are common tools available today in most countries, being part of the standard diagnostic imaging devices; nevertheless, there are disadvantages which deserve to be known by the clinicians, in order to use them in the most reasonable possible context. Although conventional radiographies (XRays) are the cornerstone of the orthopedic practice it is well known its most important weakness such is the lack of information about anatomical details, making it a test with a very low sensitivity and specificity, for example, in case of detect chondral abnormalities. CT provides a more precise and comprehensive anatomical detail, with limited information about the bone marrow structure. MRI has good anatomical approach particularly when there is bone marrow compromise, in case of osteochondral disorders, nevertheless the information about the cortical bone is poor. Nuclear medicine techniques reflect bone metabolism regarding the osteoblastic activity; they can detect subchondral bone changes as a premier of the osteochondral degenerative diseases, preceding the joint space narrowing visible in other conventional images.

As a result of the new technological advances in radiology and nuclear medicine, some limitations of these imaging tools have been improved with the advent of hybrid SPECT/CT systems which can offer in the same study a clear anatomical detail through high resolution CT device and the bone physiological activity detected by the SPECT system.

Since the integration of this two devices (SPECT+CT) which was introduced over two decades before, there have been produced important advances, leading to this technique to have a relevant place in the decision flow charts of the clinicians.

In general terms with this hybrid images it is possible to quantify the bone tracer uptake within the lesion and to define clearly if it is normal or not in case of anatomical variants; in case of identification of bone metastasis it is possible to distinguish from degenerative bone disease versus malignant compromise; in non-malignant disease such as in temporomandibular disorders it is possible to define clearly the localization of the condylar hyperplasia becoming an important tool for the surgeon at the moment of the surgical planning; it is also under investigation if it could exist a link between the quantity of the bone tracer uptake in the accessory navicular bone and the clinical outcome after treatment, serving as an objective criteria for surgical treatment decision.

Other scenarios where it is observed the great diagnostic support of hybrid images is in case of unhappy patients after hip or knee arthroplasty and in certain cases of back pathologies, like in facet joint syndromes, back pain in the athlete and back pain after surgery. The written evidence is not negligible and today we can say that SPECT/CT is mandatory in such circumstances. In unhappy patients after knee arthroplasty the evidence recommend this tool to identify the origin of the pain, because it is possible to discriminate different

sources of pain: patellofemoral origin, mal-alignment of the components, loosening of the components, fractures of the periprosthetic cortex, infection, amongst others. Likewise in facet joint syndromes, the SPECT/CT identifies the guilty facet of the pain, allowing to the interventionist to choose perfectly the facet to be treated with lidocaine infiltration thus assuring improvement of the pain; in back pain of the adolescents and or the athletes in case of spondylolysis it is important to characterize the metabolic status of the pars, in order to guide the treatment, such is to continue the sport practice with modification of the biomechanical gesture and /or stop the practice to prevent a real fracture; in back pain after surgery, hybrid images are very important because of the presence of metallic devices which impede to use the conventional imaging tools; SPECT/CT elicit the source of pain after instrumentation in the spine, allowing to discriminate the guilty structure, such as loosening of screws, pseudoartrosis of the grafts, degenerative facet joints, fractures, adjacent segment syndrome, sacroiliitis.

Hybrid images hold promise in a variety of clinical scenarios of the orthopedic practice. I would dare to think that SPECT/CT is the image tool of the new century, which requires of harmonized work under a multicenter studies model, to look for the validity of the technique in different scenarios in order to be introduced into the practice guidelines and into the daily practice of the orthopedicians.

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