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Using 3DMRI/CT fusion image to reveal the pathway and pathology of the spinal nerve root in patients with irritable radicular pain

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Background: There have been several imaging studies of cervical/lumbar radiculopathy but no three-dimensional (3D) images have shown the position, its running pathway and pathological changes of the nerve roots and spinal root ganglion relative to the bony structure. Moreover, the spinal roots are small and soft and can change shape during motion. Characteristic anatomical features of the nerve roots include curved running, no merkmal and no enhancement with contrast media. The objective of this presentation is to introduce a technique that enables the virtual pathology of the nerve root to be assessed using 3D magnetic resonance (MR)/computed tomography (CT) fusion images that show the compression of the nerve root by the herniated disc, yellow ligament and the bony spur in patients with degenerative cervical/lumbar radiculopathy.

Methods: 3D MR images were placed onto 3D CT images using a computer workstation.

Results: The entire nerve root could be visualized in 3D with or without the vertebrae. The most important characteristic evident on the images was flattening of the nerve root by a bony spur or hard disc. The affected root was constricted at a pre-ganglion site. In cases of severe deformity, the flattened portion of the root seemed to change the angle of its path resulting in tortuosity.

Conclusions: The 3D MR/CT fusion imaging technique enhances visualization of pathoanatomy in lateral spinal hidden area that is composed of the root and inter-vertebral foramen. This technique provides two distinct advantages for diagnosis of radiculopathy. First, the isolation of individual vertebra clarifies the deformities of the whole shape for root groove. Second, the tortuous or twisted condition of a compressed root can be visualized. 3D-MRI/CT fusion imaging is very useful for all clinicians treating irritable radicular pain. In addition, this technique can also be used as educational material for all hospital staff (new doctors, nurses, radiological technicians, therapists, medical students) and for patients and patients' families who provide informed consent for treatments. Virtual images have thus enabled the visualization of previously inaccessible anatomical locations and depicting conditions clearly at a glance without the need for hard-to-understand medical terminology.

Biography

Junji Kamogawa (Birth: 1969, PhD; Pathology of autoimmune arthritis: 2000, University of Ehime) is a chief Director of Spine & Sport Center in Shiraishi Hospital, a spinal surgeon, an expert for radiculopathy treatment. His clinical and research interests include spinal pain, microscopic-spinal surgery, spinal imaging, pathology, sport medicine and therapeutic stretching (Awards: Ehime medical 2002, Spine radiology 2013). For future task, he is researching for new image of both sympathetic nerve and epi-dural circulatory dynamics. He wants to get new ideas from experts in other fields such as angiography, MRI physics, and anatomy.

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