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Commentary

Commentary on "Radiological and Clinical Significance of Cervical Dynamic Magnetic Resonance Imaging for Cervical Spondylotic Myelopathy"

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Cervical spondylotic myelopathy (CSM) is a progressive, degenerative disease of the cervical spinal column that causes a great reduction in quality of life and increased morbidity in patients. A multitude of degenerative changes occur in CSM that result in spinal cord compression and neurologic deficits, and accurate diagnosis and prompt surgical treatment are essential for favorable patient outcomes. All neurosurgeons and spine surgeons need to have up-to-date information on this complex pathology and current diagnostic and treatment strategies.

We have read with great interest the prospective work of Shin et al.[1] on the clinical and radiological significance of cervical dynamic magnetic resonance imaging (MRI) for CSM. MRI is the gold standard imaging modality to diagnose CSM; in particular, T2-weighted MRI very clearly delineates the relationship between the spinal cord and surrounding structures. This prospective study provides readers with invaluable data regarding the efficacy of dynamic cervical MRI in showing the signal intensity changes at different neck positions. The authors found that neck extension significantly reduces the spinal cord diameter in the sagittal plane at compressed levels. Also, the smallest diameter of the spinal cord on an axial plane is seen in an extension posture. Furthermore, the authors demonstrated that the number of compressed levels increased in a majority of patients (63.87%) in extension posture, and Muhle classification grade cervical stenosis also increased in extension posture compared with neutral and flexion postures.

In addition, the authors associated the signal intensity on preoperative imaging with lower recovery ratios. In their study, a higher range of motion was found in patients with higher signal intensity change in the extended posture, which had unfavorable outcomes postoperatively; in other words, cervical spine stenosis worsens in an extended posture. The authors have postulated that segmental instability of the cervical spine can increase the shear and tear forces on the spinal cord and can contribute to myelopathy.[1]

Plain radiographs and computed tomography (CT) scans still have important roles in the radiological work-up of patients with CSM. The anterior-posterior and lateral radiographs can provide fast and reliable results on patients' spinal alignment, but they cannot create a

3-dimensional (3D) visualization and assessment of the paraspinal muscles, ligaments, and nerve roots of the cervical spine.[2] The CT scan can provide a 3D visualization of the cervical spinal column and is the gold standard for diagnosing ossification of the posterior longitudinal ligament, which can cause similar presenting symptoms as CSM.[2] CT can also provide the preoperative assessment of the transverse foramen and intervertebral foramen for surgical planning.[2] Also, CT myelography can be used to evaluate the spinal cord when an MRI scan is not applicable.[2]

We agree that dynamic MRI can be a valuable tool in a surgeon's arsenal for evaluating CSM, and it can provide valuable insight into patients' conditions where static MRI cannot.[3] Tykocki et al.[4] demonstrated the dynamic stretch-associated injury through dynamic MRI and found narrowing in the spinal canal on extension with reduced cerebrospinal fluid ratio compared to flexion. They also found that the spinal cord area was smaller in the flexion position due to compression by anterior osteophytes and discs. This is also backed by several studies showing the efficacy of dynamic MRI.[4-6] Makhchoune et al.[5] also concluded that the spinal canal narrowed in the extension posture more than in the flexion posture. They also compared CT and MRI scans which showed statistical significance in extension and flexion postures signifying the diagnostic value of dynamic MRI. Kolcun et al.[6] concluded that dynamic MRI showed cord compression by soft tissues, bony spurs of spondylosis, and mild segmental listhesis that may be overlooked by dynamic x-ray films.

Recently, it has been hypothesized that static MRI scans are not the most diagnostically sensitive MRI modality available. Shin et al.,[1] in their present study, demonstrated that dynamic MRI was able to demonstrate the degree of stenosis quantitatively where static MRI scans fall short, prompting its usefulness in CSM for diagnosis and presurgical planning. Although promising, there is still the need for multicenter randomized controlled trials directly comparing static and dynamic MRI and other imaging modalities. One way to design this study would be to include patients with clinical and plain radiographic findings suggestive of CSM, including patients aged between 18–80, and excluding those with previous cervical spinal surgeries. All patients would undergo plain radiographs on anteroposterior and lateral views and static MRIs would also be taken. Subsequently, patients will be randomly assigned into 2 groups: one group will only have static MRI, while a randomly selected group will additionally undergo dynamic MRI preoperatively. Dynamic MRI will be conducted in extension, neutral, and flexion postures to measure spinal parameters such as spinal canal diameter and T2 signal intensity. Preoperative scores, including the Neck Disability Index nd Japanese Orthopaedic Association scores, will be recorded. These data, along with postoperative scores and follow-up MRI findings at 3, 6, and 12 months, will be compared between the 2 groups to evaluate the diagnostic sensitivity and clinical utility of static versus dynamic MRI in diagnosing CSM, aiding in surgical planning, and patient outcomes. The data acquisition and blinding of the clinicians and radiologists would be a crucial step to reduce biases. Also one of the limitations of this study will be the financial burden on the hospital and the length of the statistical MRI procedure. Therefore seeking funding will be necessary. Questionnaires can be distributed among physicians working on the project to measure the feasibility of dynamic MRI. Also, the training of neurosurgeons and radiologists training are important factor in while examining imaging findings.

Xu et al.[7] described a protocol for a randomized prospective trial with patients divided into 3 groups based on their baseline clinical scores and static MRI images. But their protocol differed as they planned dynamic MRIs for all patients and surgeons planned 2 different surgical plans depending either on static or dynamic MRIs. They will choose the surgical plan randomly based on a number system.

In conclusion, CSM is an important cause of neurologic deficits and morbidity, with radiographic imaging as one of the pillars of patient success in treatment. Dynamic cervical MRI gave promising results in multiple studies, waiting to be proven once again in randomized controlled trials.

• **Conflict of Interest:** The authors have nothing to disclose.

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