MR/Clinical Case Study

Lumbar Spine with Degenerative Changes: Comparison of Conventional Reconstruction and Advanced intelligent Clear-IQ Engine (AiCE) Deep Learning Reconstruction

Brian Tymkiw, BS, R.T.(R)(MR)
Manager Medical Affairs-Clinical Development, MR
Canon Medical Systems USA, Inc.

Introduction

Magnetic Resonance Imaging (MRI) is a valuable tool for evaluating lumbar spine pathologies and guiding treatment decisions. This case study presents the radiological findings of a 66-year-old female patient who underwent a lumbar spine MRI due to lumbar pain. The aim is to show the improvement in image quality with Canon's AiCE DLR technology against those reconstructed with conventional reconstruction.

Canon Medical's Advanced Intelligent Clear-IQ Engine (AiCE) Deep Learning Reconstruction (DLR) removes inherent noise which enables you to alleviate the fundamental tradeoff between signal-to-noise ratio (SNR), resolution, and scan time. Through the denoising process, SNR gain could assist in providing flexibility in scan parameters and allow you as a user to make a choice to improve resolution and/or shorten scan time by adjusting the corresponding parameters. This case study evaluates the benefit of AiCE DLR compared to the conventional reconstruction in lumbar spine imaging at GO Imaging—Humble, Texas.

History

A 66-year-old female patient presented to the imaging center with complaints of lumbar spine pain. The patient's medical history indicated chronic degenerative changes as the probable cause for her symptoms. A lumbar spine MR was conducted to investigate the underlying pathologies.

Image Findings

The lumbar spine MR revealed several significant findings. Grade 1 degenerative anterolisthesis was observed, measuring 3 mm at L4 on L5 and 5-6 mm at L5 on S1. Additionally, subtle retrolisthesis was noted, measuring approximately 2 mm at L1 on L2 and L3 on L4. The examination also revealed dextrocurvature in the lumbar region, without meeting the criteria for scoliosis. No acute fractures, compression deformities, or aggressive osseous lesions were identified. The conus medullaris appeared to end at the level of L1.

Further evaluation revealed degenerative changes throughout the lumbar spine. These included diffuse disc desiccation, moderate disc height loss, Schmorl's nodes, and Modic type 1 discogenic changes. Notably, the L1-L2 level exhibited a disc bulge encroaching on the left greater than right lateral recesses, potentially contacting the descending left L2 nerve root. The L2-L3 level showed a disc bulge slightly encroaching on the left lateral recess, resulting in thecal sac stenosis. At L3-L4, a disc bulge encroached on the left greater than right lateral recesses, with associated facet arthrosis and neural foraminal stenosis. The L4-L5 level presented with a disc pseudo bulge and true disc bulge, accompanied by facet hypertrophy, ligamentum flavum thickening, and neural foraminal stenosis. Finally, at L5-S1, a disc pseudo bulge and facet arthrosis led to neural foraminal stenosis.

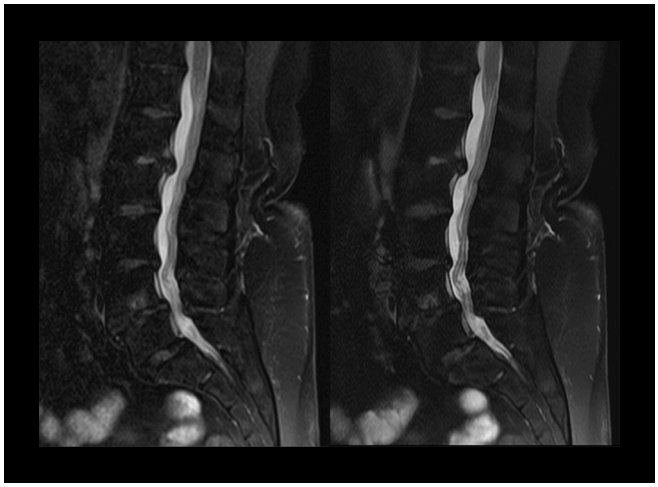

Figure 1: Sagittal T2 with Fat Saturation; The image on the left has a scan time of 2:03 minutes with a resolution of 192x224, and the image on the right is using AiCE DLR with a scan time of 1:24 minutes and a resolution of 192x304. You can see the detail of the image much clearer due to the noise being removed with AiCE DLR.

Discussion

The observed findings, in this case, are indicative of significant degenerative changes in the lumbar spine. The presence of anterolisthesis and retrolisthesis, along with disc bulges, thecal sac stenosis, and neural foraminal stenosis, highlights the impact of degenerative processes on spinal stability and nerve root impingement. These degenerative changes can contribute to the patient's symptoms and necessitate appropriate management strategies.

Conclusion

The MRI findings revealed degenerative changes, including anterolisthesis, retrolisthesis, disc bulges, thecal sac stenosis, and neural foraminal stenosis, which may collectively

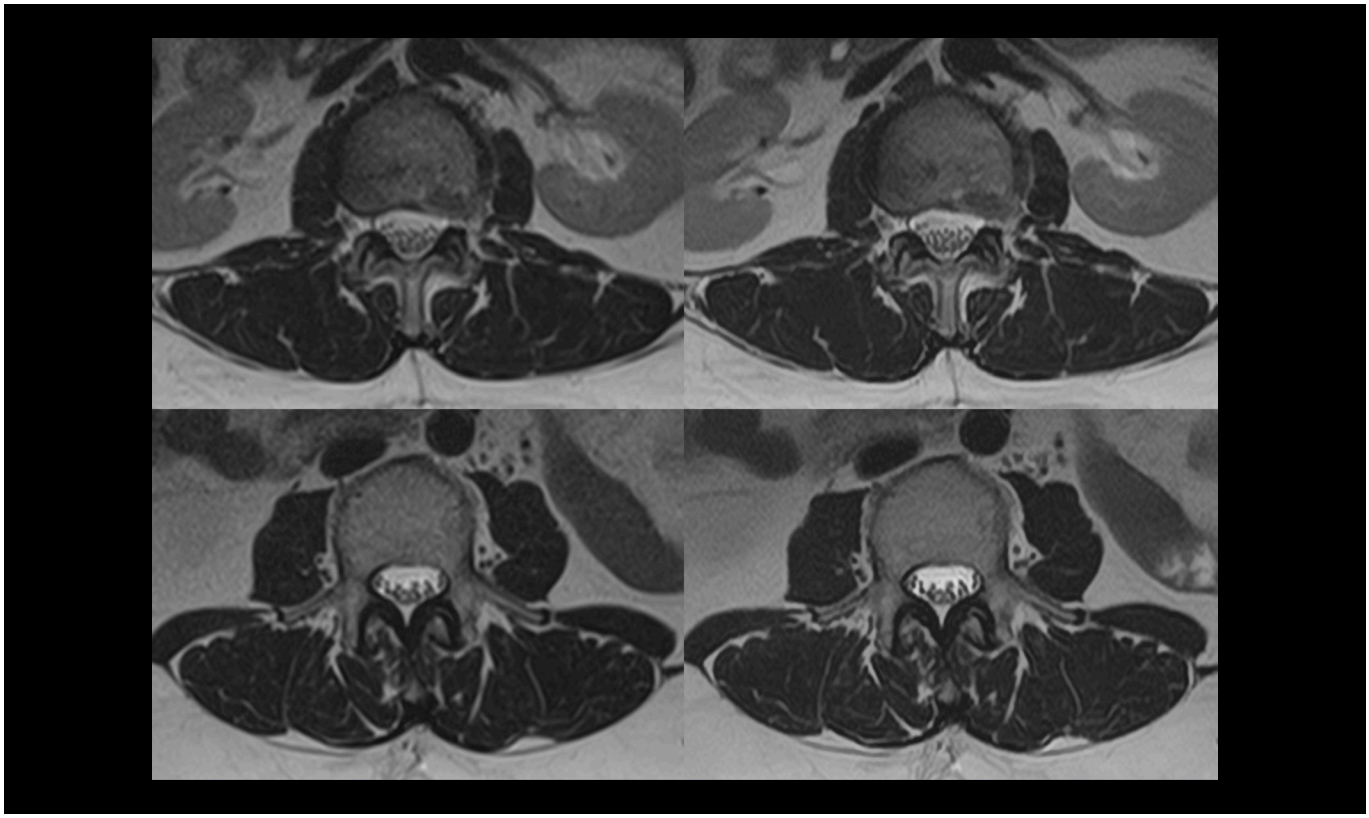

Figure 2: Two different axial T2 images the left column shows conventional images from a set of 30 images with a resolution of 480 x 480 the scan time was 3:39 minutes. The two images on the right half were scanned with AiCE the resolution was increased to 576 x 576 with a scan time of 2:41 minutes. The images on the right show better signal-to-noise because of the AiCE reconstruction and better detail due to the higher resolution.

contribute to the patient's lumbar spine pain. The comprehensive evaluation of lumbar spine MRI aids in accurate diagnosis and guides appropriate treatment strategies for patients presenting with lumbar spine pain. Imaging with AiCE increases signal-to-noise and improves image quality, enabling radiologists to acquire sharp, clear, and distinct images to depict pathologies. Additionally, the reduced scan time enabled by AiCE could help patients who are in pain to make it through the exam. This reduces the probability of motion artifacts and repeated scans.

Acknowledgements

The author would like to thank: GO Imaging, Dawn Berkeley, Hung Do Ph.D, Wissam Al Ghuraibawi Ph.D, Mo Kadbi Ph. D. and Mark Totina for their support when preparing this case study.

AiCE provides higher SNR compared to typical low-pass filters.

Canon

CANON MEDICAL SYSTEMS USA, INC

https://us.medical.canon

2441 Michelle Drive, Tustin, CA 92780 | 800.421.1968

MRCS14456US

Made For life