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Accuracy and reliability of MRI quantitative measurements to assess spinal cord compression in cervical spondylotic myelopathy: a prospective study

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ABSTRACT

Study type: Reliability study

Introduction: Cervical spondylotic myelopathy (CSM) is the most common spinal cord disorder in persons more than 55 years old. Despite multiple neuroimaging approaches proposed to quantify the spinal cord compromise in CSM patients, magnetic resonance imaging (MRI) remains the procedure of choice by providing helpful information for clinical decision making, determining optimal subpopulations for treatment, and selecting the optimal treatment strategies. However, the validity, reliability, and accuracy of the MRI quantitative measurements have not yet been addressed.

Objective: To assess the intra- and inter-observer reliability of MRI quantitative measurements of the spinal cord compromise in CSM patients.

Methods: Seventeen CSM patients (13 male) of mean age 54.5 years old were selected from the AOSpine North America database. The patients had different combinations of stenotic levels (1–4 levels) and the clinical severity (range mJOA baseline: 8–18). Asymptomatic or previous surgically treated CSM, active infection, neoplastic disease, rheumatoid arthritis, ankylosing spondylitis, trauma, or concomitant lumbar stenosis were excluded. The patients underwent preoperative MRI using 1.5T (15 patients) and 3T (two patients) scanner, including mid-sagittal T1-weighted, axial and mid-sagittal T2-weighted series. MRI data were analyzed (Mango 2.0 software; Multi-Image Analysis GUI) by four blind raters in three different sessions. Four measurements were analysed: transverse area (TA)

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(Figure 1), compression ratio (CR) **(Figure 2)**, maximal canal compromise (MCC), and maximal spinal cord compression (MSCC) **(Figure 3)**. The differences for each measurement were evaluated using mixed-effect ANOVA models (ratter, session, ratter x session). The intra- and inter-rater reliability was evaluated with intraclass correlation coefficients (ICC) **(Figure 4)**.

Results: The principal findings were: (i) for TA ($71.48 \pm 12.99 mm^2$), the intra-rater agreement was 0.97 (95% CI, range 0.94–0.99) and the inter-rater agreement was 0.76 (95% CI, range 0.49–0.90); (ii) for CR (0.35 ± 0.04%), 0.94 (95% CI, range 0.88–0.98), and 0.79 (95% CI, range 0.57–0.91) respectively; (iii) for MCC (83.21 ± 2.08%), 0.95 (95% CI, range 0.89–0.98), and 0.64 (95% CI, range 0.28–0.85) respectively; and (iv) for MSCC (82.87 ± 1.52%), 0.93 (95% CI, range 0.86–0.97), and 0.84 (95% CI, range 0.65–0.93) respectively.

Conclusions: Our data suggest that three out of four measurements (TA, CR and MSCC) have acceptable intra- and interreliability coefficients (ICC > 0.75). However, for the maximal canal compromise measure, although the intrareliability was acceptable, the inter-rater reliability was not acceptable (0.64). Based on this study, we recommend that three MRI measures: transverse area, compression ratio and maximal spinal cord compression should be used in the imaging assessment of the spinal cord in CSM patients.

Figure 1 **Transverse area (TA)**

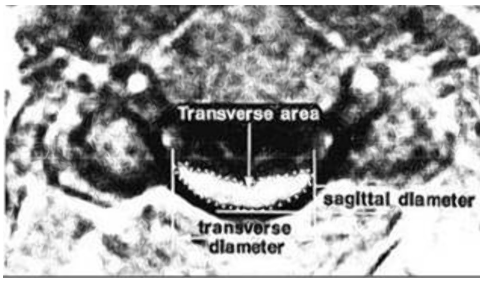


Figure 2 **Compression ratio (CR = AP/W)**

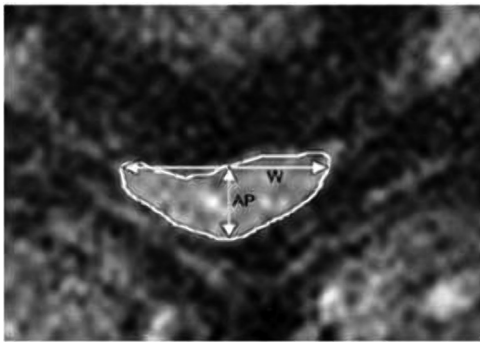


Figure 3 **Maximal canal compromise (MCC), and maximal spinal cord compression (MSCC). MCC(%) = 1-[Dx/(Da+Db)/2] × 100%; MSCC(%) = 1-[dx/(da+db)/2] × 100%**

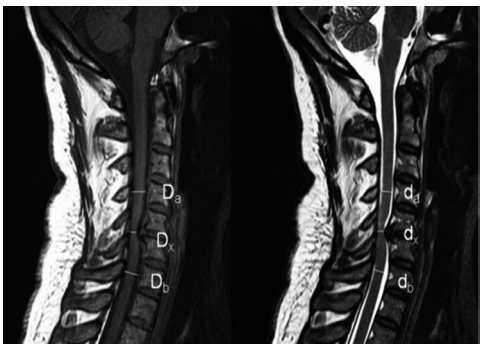
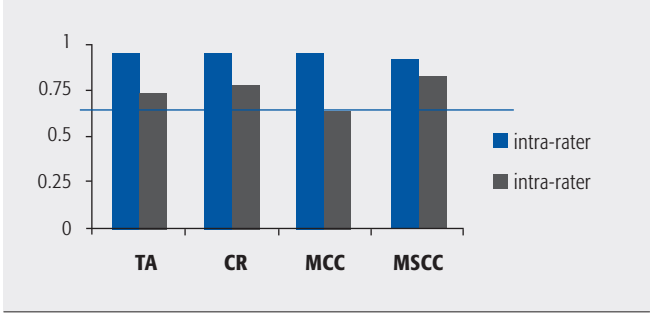


Figure 4 **Intraclass correlation coefficients (ICC)**



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