

Dynamic Magnetic Resonance Imaging Parameters For Objective Assessment of the Magnitude of Tethered Cord Syndrome in Patients with Spinal Dysraphism

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Introduction

Dynamic magnetic resonance imaging(MRI)-based criteria for diagnosing magnitude of tethered cord syndrome(TCS) in occult spinal dysraphism are proposed.

Methods

In this prospective, case-control design study, MRI lumbosacral spine was performed in 51 subjects [pilot group(n=10) without TCS ; control group(n=10) without TCS; and, study group (n= 31) with spinal dysraphism (thick filum terminale[n=12]; lumbar/lumbosacral meningomyelocele[n=6]; and, lipomyelomeningocele[n=13]). The parameters compared in control and study groups included: Oscillatory frequency(OF), difference in ratio, in supine/prone position, of distance between posterior margin of vertebral body and anterior margin of spinal cord (oscillatory distance, OD), with canal diameter, at the level of conus as well as superior border of contiguous two vertebrae above that level; delta bending angle(?BA), difference, in supine/prone position, of angle between longitudinal axis of conus and that of lower spinal cord; and, sagittal and axial root angles, subtended between exiting ventral nerve roots and longitudinal axis of cord were assessed. An outcome assessment

Results

In the study group (cord tethered), significantly less movement at the level of conus (OF0, p=0.013) and one level above (OF1, p=0.03); and, significant difference in ?BA(p=0.0), were observed in supine and prone positions, compared to controls. Ventral nerve root stretching resulted in sagittal/axial root angle changes. Median OF (0.04) in the lipomyelomeningocele group and group with thick filum terminale or meningomyelocele was significantly less than that in control group (0.23). Difference in median sagittal and axial root angles among study and control groups was statistically significant(p=0.00).

Conclusions

New dynamic MRI-based parameters to establish the presence and magnitude of TCS have been defined. OF measured extent of loss of translational cord displacement in supine and prone positions; ?BA defined the relative angulation of conus with lower spinal cord; and, sagittal and axial root angles represented ventral nerve root stretching

Learning Objectives

- 1.The objective definitions provide for an easy measurability of the parameters on routine MRI sequences and their easy reproducibility and comparison by different radiologists.
- 2.The emphasis on ratios and differences between the measured findings, rather than on absolute values, overcomes the disadvantages of variability in the measured diameters in the adults and children and between different ethnic groups.
- 3.All our parameters have been taken in a dynamic setting, that is, in supine and prone positions of the patient, exploiting the characteristic features of a tethered cord, namely, the posterior displacement and adherence of the cord and the diminution in its natural translational displacement in the supine and prone positions of the patient.

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