Should All Paediatric Patients With Scoliosis and Normal Neurological Examination Undergo MRI Screening for Neuro-axial Abnormality?

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INTRODUCTION

- Idiopathic scoliosis has an overall prevalence of 0.47-5.2% (Konieczny, 2012);
- There is evidence to suggest an association between scoliosis and neuro-axial abnormality (Koc, 2013);
- Chiari malformation +/- syringomyelia is the most common neuro-axial abnormality associated with scoliosis (Strahle, 2015; Kelly, 2015; Eule, 2002);
- Foramen Magnum Decompression (FMD) in the context of Chiari malformation and syringomyelia has been shown to improve scoliosis curve and reduce progression, some suggesting ages less than 8-10 benefit the most (Brockmeyer, 2003; Brockmeyer, 2011; Kelly, 2015);
- It is hypothesised that neuro-axial abnormalities compresses the neural tissue resulting in denervation/irregular contraction of the deep back muscles, therefore removing such a neurologic driver aids reduction in progression in scoliosis curve;
- There is a spectrum of patients with idiopathic scoliosis who are found to have a neurological cause following imaging but not all surgeons request a brain and spine MRI for congenital scoliosis if patient have no neurologic symptoms
- This poses a potential problem, if identifying such disease may improve long term quality of life and scoliosis curve (Eule, 2002; Tubbs, 2006; Zhu, 2013);
- We therefore sought to review the literature to determine what proportion of children with normal neurology + scoliosis are found to have neuro-axial abnormality on full MRI imaging of the spine.
METHODS

- Search of PubMed, EMBASE, MEDLINE were combined on NICE HDAS (Healthcare databases advanced search, https://hdas.nice.org.uk) using PRISMA search strategy;
- Search Terms: Chiari malformation AND scoliosis;
- Inclusion criteria: Patients with documented idiopathic scoliosis with a Cobb angle >20 or greater, normal neurological examination and a full spine MRI;
- Exclusion criteria: patients >18 years, scoliosis diagnosed with Cobb Angle <20, primary condition not idiopathic scoliosis, abnormal neurological examination, studies that retrospectively reviewed patients with diagnosed NAA to determine the association with scoliosis, case reports, letters, comments, reviews and non-English studies.
3,372 patients met the inclusion criteria in 11 studies;
Mean patient age at scoliosis diagnosis 9.9 years;
Out of 5 studies reporting curve direction, 58.3% were right curves;
Out of 10 studies reporting Mean Cobb Angle - 38.9 degrees;
Neuro-axial abnormality was detected in 14.7% of patients;
Chiari Malformation was detected in 8.3% of patients;
Syrinx was detected in 8.4% of patients;
Spectrum of reported neuro-axial anomalies detected: Chiari malformation, syringomyelia, diastematomyelia, para-spinal/inter-spinal mass, tethered cord, brainstem tumour, diffuse dural ectasia, low lying conus, fatty filum.
14.7% of patients with presumed idiopathic scoliosis and normal neurological examination will demonstrate a neuro-axial abnormality on full spine MRI;

This is despite a US report stating that traditional non-radiological testing is sufficient to diagnose adolescent idiopathic scoliosis (US Preventative Services Task Force, 2018);

There has been shown to be benefit to performing foramen magnum decompression (FMD) on patients with Chiari malformation +/- syringomyelia but it is difficult to correlate the intervention with the result given it is unclear whether there would be a progression without FMD (Brockmeyer, 2003; Brockmeyer, 2011; Kelly, 2015; Eule, 2002; Tubbs, 2006; Zhu, 2013);

There is a paucity of literature investigating outcomes in scoliosis curve treated for neuro-axial abnormality;

Benefit of screening must outweigh the risk of sedation for MRI in younger patients;

It is still unclear whether treatment for neuro-axial abnormality is beneficial above or only in conjunction with traditional back bracing and fusion procedures, but it is logical that removing a neurological driver may provide benefit.
There remains an association between idiopathic scoliosis and neuro-axial abnormality;

It is important to investigate for reversible causes of scoliosis;

1 in 7 patients with presumed idiopathic scoliosis and normal neurology will be found to have a neuro-axial abnormality;

There is currently no prospective multi-institutional study looking at outcomes for treatment of neuro-axial abnormality;

There is a large potential benefit if such intervention can correct scoliosis curve, particularly with regards to quality of life;

This review provides support for further studies.
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