Prevalence of Early Onset Spinal Abnormalities in Loeys-Dietz Syndrome

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Background

- Loeys-Dietz Syndrome (LDS) is a multisystemic autosomal dominant disorder caused by mutations in the TGF-βR1 and TGF-βR2 genes.
- LDS is characterized by the following triad: vascular aneurysms and tortuosity, hypertelorism, and bifid uvula.
- Although vascular abnormalities are the primary cause of morbidity and mortality, recognition of the musculoskeletal features of LDS may facilitate earlier diagnosis and treatment.
- Spinal abnormalities have been reported in patients with LDS, however, these findings were identified among a sample of patients of all ages:
  - 19% cervical spine formation defects or instability
  - 25% scoliosis
  - 67% dural ectasia.

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Objectives

This study aims to quantify the prevalence of cervical and thoracolumbar spinal abnormalities in LDS patients ≤ 10 years old.

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Methods

- IRB approval
- Patient population
  - 36 patients diagnosed with LDS
  - 67% female, 33% male
  - Age ≤ 10 years (6.9 ± 2.9) at time of imaging
- Data collection
  - Retrospective review
  - Cervical spine neutral, flexion, and extension x-rays
  - AP and lateral thoracolumbar spine x-rays
  - Whole body computed tomography
  - Whole body magnetic resonance imaging
  - Some imaging studies were not available for all patients, so results are reported based on availability.

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Results
Cervical Spine Abnormalities

Abnormality (value for inclusion)	Number of patients with abnormality	Number of patients with images available for analysis	Percentage of patients with abnormality	Mean ± SD of patients with abnormality
Anterior arch defect at C1	9	31	29%	NA
Posterior arch defect at C1	7	31	23%	NA
Basilar impression (odontoid extends > 5 mm above McGregor's Line)	12	28	48%	9.9 ± 3.3 (mm)
Elongated odontoid (> 2.87 cm)	9	31	29%	3.1 ± 0.2 (cm)
Posteriorly-angled odontoid	5	31	16%	NA
Off-center odontoid	13	31	42%	NA
Focal kyphosis (> 10°)	10	25	40%	20.6 ± 25.4°
Anterior subluxation (> 3 mm from neutral) of C1 on flexion	4	16	25%	3.5 ± 0.4 (mm)
Anterior subluxation (> 3 mm from neutral) of C2-C7 on flexion	10	23	43%	4.1 ± 0.8 (mm) at C2 ± 0.9°
Chiari malformation (> 5 mm tonsilar herniation below foramen magnum)	4	33	12%	9.1 ± 2.4 (mm)

31 (86%) of 36 patients had at least one abnormality in the cervical spine

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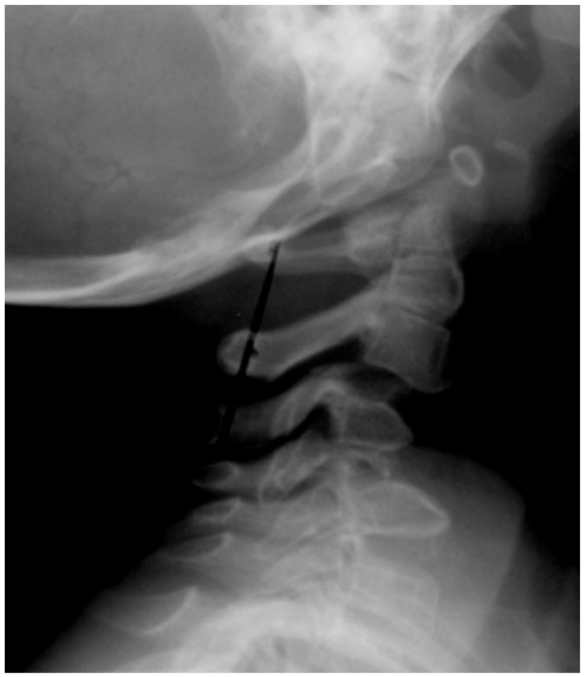
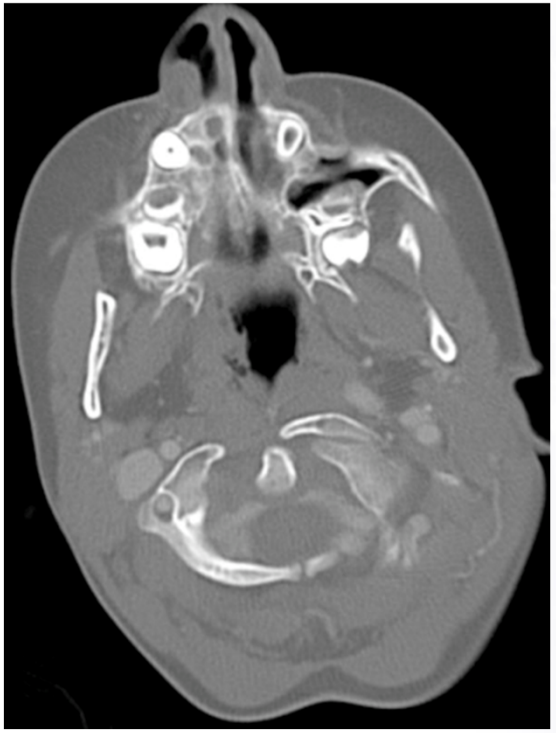
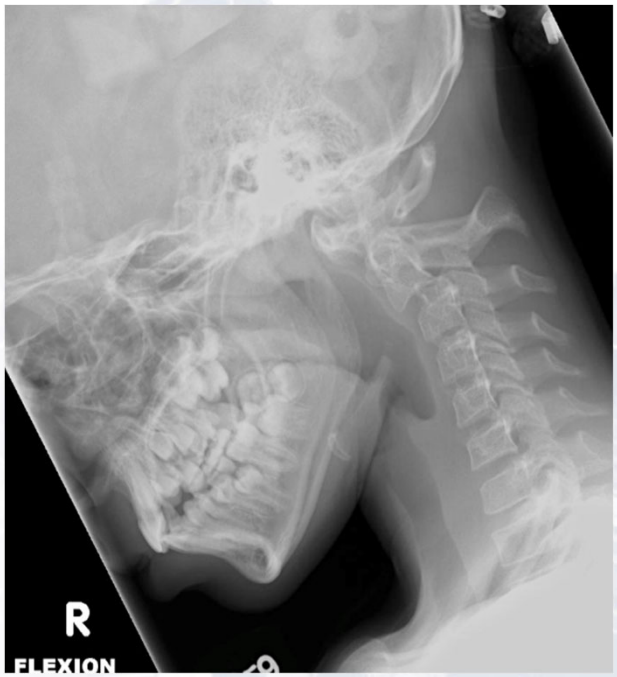
Results
Cervical Spine Abnormalities



Above: 2-year-old female with hypoplastic vertebrae and 24° C3-C5 focal kyphosis

Below: 6-year-old female with anterior and posterior arch defects at C1





Above: 9-year-old female with 4.0 mm and 4.5 mm anterior subluxation on flexion (from neutral x-ray) of C1-C2 and C2-C3, respectively

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Results
Thoracolumbar Spine Abnormalities

- Scoliosis > 25°
  - Present in 13 (45%) of 29 patients
  - Primary thoracic curve: 7 patients
    - Magnitude 51.4 ± 32.6°
    - Apex T9 ± 2.9
  - Primary thoracolumbar/lumbar curves: 6 patients
    - Magnitude 32.8 ± 12.2°
    - Apex L3 ± 1.2
- Spondylolisthesis
  - Present in 6 (25%) of 24 patients
  - Level L5 ± 0.4
  - Grade 2.3 ± 1.5
- Dural ectasia
  - Present in 15 (60%) of 25 patients

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Conclusions

Abnormalities in the cervical and thoracolumbar spine are common among patients with LDS who are ≤ 10 years old. The prevalence of abnormalities in this age group may be higher than previously reported in LDS patients of all ages.

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Limitations

1. Age: Some patients have not reached age 10.
2. Records: We do not have a complete set of radiographic data for all patients.
3. Selection bias: The more severely involved patients may have been treated at Johns Hopkins.

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References

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