P10. Outcomes of Surgical Fusion in Congenital Cervical Scoliosis by Magnitude of Correction

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Introduction

- Klippel-Feil: classic triad of low hairline, short neck and limited ROM
  - Segmentation error typically with increased load/stress at Occiput-C1-2
  - Classification from Klippel and Feil: 3 categories
  - But lots of heterogeneity
- KFS estimated incidence 1:40000 (0.000025%), but another study in NY 0.0058% (Gruber et al, Spine Deform 2018)
- Congenital scoliosis affects ~1:1000 live births
  - Categorized by McMaster et al, JBJS 1982
    - Failures of formation, segmentation, or both
    - Cause asymmetrical spinal growth
- Coincidence of Klippel-Feil and scoliosis not well reported

Aims of the Study

- For congenital scoliosis, research predominantly focuses on thoracic & thoracolumbar curves (McMaster et al, JBJS 1982)

- Papers to date include a handful of 1-2 patients and one series of 18 patients of cervicothoracic hemivertebra (Chen et al, Spine 2018)

- Paucity of literature on progression and surgical outcomes in these patients

Methods

- Retrospective chart review of 17 patients was conducted

- All patients treated surgically for congenital cervical scoliosis (CCS) with minimum 6-months follow-up

- Analysis was performed with t-tests (paired and independent samples) and binary correlation

Cohort

- 9 boys/8 girls
- The most prevalent clinical presentations were torticollis (29%) and Klippel-Feil syndrome (17.6%)
- Mean age at surgery was 7.07 ± 3.38 years
- Average follow-up was 3.06 ± 1.78 years
- 4 cognitively delayed (23.5%) and 3 non-ambulatory (17.6%)

Results

- Average total correction of 12.90 $\pm$ 27.52º in coronal Cobb angle

- Significant both at initial correction (p = 0.020) and last follow-up (p = 0.004)

- No additional radiographic metrics reached significance in these trials

- 4 complications: pressure ulcer, vertebral artery injury, pseudarthrosis and asystolic code

- Overall, properly planned surgical deformity correction for CCS is a safe and effective treatment

Comparison of Cohorts by Planar Correction			
	<50% Correction Mean ± SD	≥50% Correction Mean ± SD	p
Coronal			
Pre-op Coronal Cobb (°)	31.97 ± 21.16	32.84 ± 15.80	0.543
Post-op Coronal Cobb (°)	21.71 ± 11.83	19.66 ± 9.79	0.453
Δ Coronal Cobb	0.40 ± 17.43	-3.33 ± 21.63	0.765
Sagittal			
Δ Sagittal Profile (mm)	18.96 ± 38.73	6.70 ± 27.12	0.095
Δ C7 SVA (mm)	8.65 ± 31.68	-5.27 ± 14.03	0.025
Δ O-C2 Angle (°)	1.14 ± 7.44	-0.92 ± 5.58	0.298
Δ Cervical Lordosis (°)	8.97 ± 17.99	0.46 ± 15.56	0.594
Δ T1 Slope (°)	-0.29 ± 16.50	-0.20 ± 16.67	0.431

Comparison of Sub-Cohorts by Planar Correction						
	<50% Coronal Correction Number (%) / Mean ± SD	≥50% Coronal Correction Number (%) / Mean ± SD	p	<50% Sagittal Correction Number (%) / Mean ± SD	≥50% Sagittal Correction Number (%) / Mean ± SD	p
Age at Surgery	7.07 ± 3.38	7.40 ± 2.16	0.440	6.20 ± 3.68	6.94 ± 3.19	0.760
# Prior Surgeries	2.00 ± 2.12	2.80 ± 1.79	0.802	2.00 ± 2.12	2.80 ± 1.79	0.571
Pre-op Risser	0.29 ± 0.76	0.40 ± 0.89	0.644	0.29 ± 0.76	0.40 ± 0.89	0.762
FU Risser	1.29 ± 2.21	0.50 ± 1.41	0.093	1.29 ± 2.21	0.50 ± 1.41	0.147
# Levels	7.63 ± 6.00	3.40 ± 0.55	0.008	7.62 ± 6.00	3.40 ± 0.55	0.387
# Screws	12.2 ± 10.28	16.38 ± 10.16	0.689	12.2 ± 10.2	16.38 ± 10.16	0.921
# Osteotomies	1.00 ± 3.00	0.00 ± 0.00	0.049	1.00 ± 3.00	0.00 ± 0.00	0.034
Corpectomy	3 (33.3)	1 (12.5)	0.050	1 (11.1)	3 (37.5)	0.011
Halo	3 (33.3)	2 (25.0)	0.700	3 (33.3)	3 (37.5)	0.422
Anterior Fusion	4 (44.4)	3 (37.5)	0.841	4 (44.4)	4 (50.0)	0.681
Discectomy	2 (22.2)	3 (37.5)	<0.001	3 (33.3)	2 (25.0)	<0.001
Torticollis	1 (11.1)	3 (37.5)	0.156	3 (33.3)	2 (25.0)	0.422
Complication	1 (11.1)	3 (37.5)	<0.001	1 (11.1)	3 (37.5)	0.831
Non-ambulatory	2 (22.2)	1 (12.5)	0.802	1 (11.1)	2 (25.0)	0.011

Results: Coronal

Factors associated with ≥ 50% correction:

- # levels fused (p=0.008)
- # osteotomies performed (p=0.49)
- ACDF (p<0.001)
- Complications (p<0.001)

Results: Sagittal

Factors associated with ≥ 50% correction:

- Higher T1 slopes preoperatively (p=0.045)
- # osteotomies (p=0.034)
- ACDF (p<0.001)

Conclusions

- Anterior release procedures are higher-risk, higher-correction

- Increased use of osteotomies and fusions spanning greater numbers of vertebrae are also associated with increased correction in both planes.

- Further research is necessary to delineate balance between correction and risk and correlation with HRQoL measures.

References

- Chen et al. Posterior-only hemivertebra resection for congenital cervicothoracic scoliosis: correcting neck tilt and balancing the shoulders. Spine 43(6):394-401, 2018

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- McMaster MJ, Ohtsuka K. The natural history of congenital scoliosis. A study of two hundred and fifty-one patients. JBJS 64(8):1128-47, 1982