

Prevalence and Type of Cervical Deformity Among 470 Adults with Thoracolumbar Deformity

Justin S. Smith MD PhD; Christopher I. Shaffrey MD, FACS; Virginie Lafage PhD; Frank Schwab MD, PhD; Themistocles Protopsaltis MD; Eric Klineberg MD; Justin K. Scheer; Kai-Ming G. Fu MD PhD; Richard A. Hostin MD; Vedat Deviren MD; Robert Hart MD; Douglas C. Burton MD; Shay Bess MD; Christopher P. Ames MD; International Spine Study Group



Introduction

Deformity may present in multiple spinal regions in a single patient. Our objective was to assess the prevalence of cervical deformity among adults presenting for evaluation of TL deformity.

Methods

Multicenter, prospective, consecutive series. Inclusion criteria: adult spinal deformity (ASD) and age>18. Parameters included pelvic tilt (PT), pelvic incidence (PI), lumbar lordosis (LL), C2-C7 sagittal vertical axis (C2-C7 SVA), C7-S1 SVA and C2-C7 lordosis (CL). Cervical deformity was defined as CL>0° (cervical kyphosis [CK]) or C2-C7 SVA>4cm (cervical positive sagittal malalignment [CPSM]). Patients were stratified by SRS-Schwab ASD classification (Fig 1), including curve type (N:sagittal deformity/T:thoracic scoliosis/L:lumbar scoliosis/D:T+L

scoliosis) and modifier grades: PT (0:<20°/+:20-30°/++:>30°), C7-S1 SVA (0:<4cm/+:4-

9.5cm/++:>9.5cm), PI-LL mismatch (0:<10°/+:10-20°/++:>20°).



Results 470 patients (example shown in **Fig 2A-D**) met criteria (mean age=52yrs), with mean CL=-8° (SD=15°) and mean C2-C7 SVA=3.2cm (SD=1.7cm). Prevalence





of CK and CPSM was 31% and 29%, respectively (**Fig 3A**). Patients with CK were younger (45 vs 55, p<0.001), but age did not differ based on presence of CPSM (p=0.12). Prevalence of CK differed by curve type: N(15%), L(27%), D(37%), T(49%) (p<0.001); prevalence of CPSM did not differ by curve type (p=0.19). Higher PT grades had lower prevalence of CK (0[40%], +[27%], ++[15%]; p<0.001) but greater prevalence of CPSM (0[23%], +[28%], ++[45%], p=0.001, **Fig 3B**). Similarly, higher SVA grades had lower prevalence of CK (0[40%], +[23%], ++[11%]; p<0.001) but greater prevalence of CPSM (0[24%],





SRS-Schwab PT Modifier Grade

+[24%], ++[48%], p<0.001, **Fig 3C**). Higher PI-LL grades had lower prevalence of CK (0[35%], +[31%], ++[22%]; p=0.034) but noCPSM association (p=0.46) (**Fig 3D**).



Conclusions

Cervical deformity is highly prevalent (~30%) among adults with TL deformity. Its prevalence and type differs significantly based on SRS-Schwab curve type and sagittal spinopelvic modifier grades. Higher SVA and PT modifiers are associated with greater cervical sagittal malalignment. Evaluation of TL deformity should include assessment of cervical parameters for evidence of concurrent cervical deformity.

Learning Objectives

 (1) Appreciate high prevalence of cervical deformity in adults with TL deformity;
(2) Appreciate that prevalence of cervical deformity in patients with TL deformity differs based on SRS-Schwab curve type and sagittal spinopelvic modifier grades;
(3) Appreciate that evaluation of TL deformity should include assessment for concurrent cervical deformity.