Comparison of Outcomes Between Vertebral Body Tethering and Posterior Spinal Fusion in Pediatric Patients with Lenke 1B and 1C Adolescent Idiopathic Scoliosis

Juan Carlos Rodriguez-Olaverri, Akil Saivenkat Paturi[1], Kingsley Ogelle, Alexandra N Yiachos, Juan Rodriguez-Rivera, Constance Maglaras, Themistocles Stavros Protopsaltis
[1]Orthopedic Spine

INTRODUCTION: Lenke classification is widely used to categorize adolescent idiopathic scoliosis (AIS) to guide surgical treatment. Types 1B and 1C involve thoracic curve patterns with differing levels of flexibility and severity. This study compares the clinical and radiographic outcomes of VBT and PSF in Lenke Type 1B and 1C AIS patients.

METHODS: A retrospective review was conducted on 76 patients who underwent either double row in apex VBT (n = 43; 18 right side, 25 bilateral) or PSF (n=33). Demographic, surgical, and radiographic data were collected, including age, gender, operative time, estimated blood loss (EBL), levels fused, preoperative, postoperative, and 2-year follow-up radiographic parameters, and complications. Statistical significance was considered $p<0.05$.

RESULTS: PSF patients, the mean operative time was significantly shorter (356.09 ± 97.41 minutes) compared to VBT patients (464.44 ± 146.01 minutes, $p<0.001$). EBL was higher in PSF patients (816.03 ± 670.96 mL vs. 330.65 ± 254.46 mL, $p<0.001$), with a significant difference in blood transfusion rate (12.1% in PSF vs 0% in VBT; $p =0.019$). At 2 years, PSF showed more significant thoracic coronal Cobb correction (-34.01 ± 6.21°) (-22.06 ± 10.43°, $p<0.001$). No significant differences were found in pelvic incidence-lumbar lordosis (PI-LL) mismatch or thoracic kyphosis at 2 years. Four patients in the VBT group had complications: three with broken cords (one requiring revision to fusion) and one pleural effusion requiring outpatient drain. Revision rates at two years were low in both groups (0% in PSF and 2.3% in VBT; $p=0.664$).

DISCUSSION AND CONCLUSION: PSF demonstrated superior long-term thoracic Cobb correction compared to VBT. PSF had more significant blood loss and transfusion compared to VBT despite similar levels fused but shorter operative time. VBT had more complication than PSF at two years. We need further research should examine radiographic parameters at longer follow-up timepoints for better comparison.

Table 1: Demographics, surgical outcomes and complications between tethered and fusion patients with Lenke 1B/1C			VBT(n=43)	PSF (n=33)	p-value
Demographics	Gender(M/female)		6(86.0%)	4 (87.9%)	0.815
	Age (years)		**14.65 ± 2.516**	**15.94 ± 2.861**	**0.041**
	Height (m)		1.61 ± 0.08	1.62 ± 0.09	0.557
	Weight (kg)		53.08 ± 9.6	58.13 ± 15.05	0.079
	BMI (kg/m^2)		20.54 ± 2.83	21.92 ± 4.40	0.100
	Risser		**2.47 ± 1.63**	**3.73 ± 1.57**	**0.002**
	Sanders		5.09 ± 1.94	5.43 ± 2.15	0.681
Surgical outcomes	**Operative Time (min)**		**464.44 ± 146.01**	**356.09 ± 97.41**	**<0.001**
	Intraoperative transfusion		-	**4 (12.1%)**	**0.019**
	Intraoperative FFP		-	1 (3.0%)	0.251
	Intraoperative salvage blood		**2 (4.7%)**	**20 (60.6%)**	**<0.001**
	Postoperative transfusion		5 (11.6%)	3 (9.1%)	0.721
	EBL (mL)		**330.65 ± 254.46**	**816.03 ± 670.961**	**<0.001**
	LOS (days)		**4.84 ± 1.252**	**4.15 ± 1.004**	**0.012**
	Days in ICU		**2.65 ± 1.252**	**1.21 ± 1.386**	**<0.001**
	Levels fused/tethered		7.92 ± 2.965	8.94 ± 2.265	0.183
Complications	Post-Operative	**Pulmonary**	**5 (11.6%)**	**0 (0.0%)**	**0.0427**
		Urinary	1 (2.3%)	1 (3.0%)	0.251
		Revisions	1 (2.3%)	0 (0.0%)	0.664

BMI=Body Mass Index; LOS=Length of Stay; ICU=Intensive Care Unit; VBT=Vertebral body tether, PSF= Posterior Spinal Fusion

Table 2: Radiographic outcomes, pre, post-op and 2 years		VBT (n=43)	PSF (n=33)	p-value
Preoperative	Preop LS tilt (°)	4.33 ± 12.26	8.45 ± 7.25	0.091
	Preop Thoracic Cobb (°)	50.09 ± 7.58	53.17 ± 6.29	0.063
	Preop LL (°)	-60.02 ± 13.02	-52.47 ± 21.13	0.059
	Preop PI (°)	54.18 ± 14.52	46.51 ± 26.60	0.114
	Preop PI-LL (°)	-5.86 ± 11.35	-2.20 ± 34.29	0.515
	Preop PT (°)	9.51 ± 8.34	7.98 ± 9.26	0.458
	Preop SVA (mm)	-11.31 ± 30.71	-24.76 ± 28.05	0.053
	Preop TK (°)	25.77 ± 12.09	24.84 ± 15.92	0.773
Postoperative	**Postop LS tilt (°)**	**1.86 ± 7.60**	**7.57 ± 7.04**	**0.001**
	Postop Thoracic Cobb (°)	**40.42 ± 18.20**	**20.77 ± 6.29**	**<0.001**
	Postop LL (°)	-51.89 ± 12.44	-51.30 ± 14.64	0.851
	Postop PI (°)	51.84 ± 14.47	48.47 ± 13.03	0.306
	Postop PI-LL (°)	0.16 ± 11.03	-3.23 ± 13.83	0.245
	Postop PT (°)	11.40 ± 8.27	11.23 ± 8.97	0.933
	Postop SVA (mm)	14.62 ± 34.45	-16.97 ± 24.47	<0.001
	Postop TK (°)	26.77 ± 12.81	26.19 ± 11.43	0.840
Δ Preoperative vs. Postoperative	*Δ LS tilt (°)*	-6.18 ± 17.54	-15.79 ± 13.05	0.010
	Δ Thoracic cobb (°)	**-9.67 ± 20.88**	**-33.37 ± 7.95**	**<0.001**
	Δ LL (°)	8.14 ± 13.76	2.73 ± 20.54	0.163
	Δ PI (°)	-2.34 ± 11.05	0.42 ± 26.11	0.533
	Δ PI LL (°)	6.02 ± 11.11	-0.90 ± 30.38	0.172
	Δ PT (°)	1.90 ± 8.74	2.81 ± 8.04	0.642
	Δ SVA (mm)	25.93 ± 41.95	8.31 ± 29.12	0.043
	Δ TK (°)	1.00 ± 10.73	0.56 ± 15.04	0.881
2 years	LS tilt (°)	-4.73 ± 4.77	-5.82 ± 4.59	0.530
	Thoracic cobb (°)	**31.07 ± 7.40**	**19.42 ± 3.96**	**<0.001**
	LL (°)	-56.88 ± 8.52	-49.15 ± 38.22	0.411
	PI (°)	49.78 ± 14.01	49.94 ± 11.71	0.974
	PI LL (°)	-6.59 ± 11.67	-11.96 ± 10.26	0.195
	PT (°)	9.37 ± 7.06	7.19 ± 5.11	0.351
	SVA (mm)	**-3.71 ± 20.78**	**-34.05 ± 23.25**	**<0.001**
	TK (°)	32.73 ± 13.21	30.76 ± 12.54	0.679
Δ 2 years	*Δ LS tilt (°)*	15.98 ± 6.61	14.18 ± 9.06	0.772
	Δ Thoracic cobb (°)	**-22.06 ± 10.43**	**-34.01 ± 6.21**	**<0.001**
	Δ LL (°)	0.88 ± 9.10	6.05 ± 37.11	0.572
	Δ PI (°)	-0.25 ± 8.92	15.76 ± 35.00	0.072
	Δ PI LL (°)	-1.18 ± 11.55	-4.22 ± 9.64	0.182
	Δ PT (°)	2.30 ± 6.85	1.21 ± 5.32	0.635
	Δ SVA (mm)	6.47 ± 34.66	-4.32 ± 24.33	0.344
	Δ TK (°)	6.93 ± 17.32	7.88 ± 12.55	0.867

VBT Laterality

Unilateral	Bilateral
18 (22.8%)	25 (31.6%)