Investigating Neurologic Dysfunction in Adolescent Idiopathic Scoliosis patients treated with Thoracoabdominal Vertebral Body Tethering

Aonnicha Burapachaisri, Patrick Cronin[1], Kimberly Ashayeri, Zoe Norris, Brooke K O'Connell[2], Constance Maglaras, Samuel Zonshayn, Alex Beric, Athena Lolis, Anna Shor, Adauri Bueno De Camargo, Zoran Milan Budimija, Themistocles Stavros Protopsaltis[3], Tina Raman[4], Juan Carlos Rodriguez Olaverri[5]
[1]Atrius Health, [2]NYU Langone Health, [3]NYU Hosptial For Joint Disorders, [4]NYU Langone Orthopedic Hospital, [5]NYU LANGONE

INTRODUCTION: Vertebral body tethering (VBT) for adolescent idiopathic scoliosis (AIS) utilizes a retroperitoneal approach to achieve tether placement for thoracolumbar curves. Major neurologic complications are uncommon; however, paresthesia and/or numbness on the medial aspect of the thigh can occur due to the anatomy of the psoas muscle. To date no description of the frequency or risk factors for these sensory changes has been published. This study examined how neurologic monitoring and clinical and surgical characteristics can be used to predict transient sensory changes in the thigh following anterior-to-the-psoas approach for VBT of AIS patients.

METHODS: AIS patients who underwent anterior-to-the-psoas approach for VBT at a single academic medical center from 2020 through 2021 were retrospectively analyzed. Demographic and clinical characteristics were obtained. Neurologic monitoring and clinical variables were assessed for all patients who underwent anterior-to-the-psoas approach for VBT. Differences in variables were assessed via T-test and chi-square.

RESULTS:

30 patients were included in the case series. 15/30 (50%) experienced no postoperative paresthesias and 15/30(50%) experienced transient numbness and/or tingling in the thigh. There were no differences in demographics between groups. 3 patients (10% total cases) experienced Iliopsoas (IP) irritation. 54.5% of patients with paresthesias had a change in Quadriceps MEP (p=0.043). There were no significant differences in IP/Adductor MEPs or Saphenous SEPs between the groups. All sensory changes resolved without intervention. 57.1% resolved with ambulation, 28.6% resolved within 2 weeks, and the remaining 14.3% resolved after 2 weeks. The average time to symptom resolution was 6 days.

There were no significant differences between patients who developed paresthesias and those who did not with regard to levels corrected (8.40 vs 8.67, p=0.771), operative time (473.20 vs 493.53 min, p=0.646), estimated blood loss (303.33 vs 373.33 mL, p=0.247), preoperative lumbar cobb angle (43.76 vs 50.69˚, p=0.0980) and postoperative cobb angle (20.79 vs 24.42˚, p=0.454).

DISCUSSION AND CONCLUSION: Anterior-to-the-psoas approaches as part of VBT corrections are safe and effective. An anterior-to-the-psoas approach decreases complication risks, which is further supported by the absence of post-op motor deficits for the study cohort. Despite a significant difference in Quadricep MEP between those with and without sensory symptoms, no clinical presentation correlated to this difference. Other neuromonitoring and clinical characteristics were not predictive in this study. Sensory changes resolved without intervention within several weeks.

			No Post-op Paresthesia (n=15)	Post-op Paresthesia Present (n=15)	p value
Demographics	Age		15.13±3.87	13.53±1.81	0.158
	Gender (%F)		86.70%	86.70%	1
	BMI		20.84±2.69	21.92±2.88	0.94
	Risser		3.03±1.88	2.67±1.95	0.604
	Sanders		5.70±2.21	4.54±2.73	0.286
	Charlson Comorbidity Index		0	0	
Surgical Characteristics	Op time (min)		493.53±119.96	473.20±120.16	0.646
	EBL (mL)		373.33±211.18	303.33±89.58	0.247
	Fluro dose (mGy)		119.71±119.08	91.74±68.68	0.437
	Levels Corrected		8.67±2.53	8.40±2.44	0.771
	LIV		22.80±0.68	22.93±0.26	0.485
	Double Staple at LIV		80.00%	93.30%	0.283
	Double Curve		53.30%	46.70%	0.715
	Left Retroperitoneal Approach		69.20%	90.00%	0.231
	Retroperitoneal First Approach		60.00%	73.30%	0.439
Sensory Evoked Potentials	Change in SEP Morphology	*stable*	23.10%	40.00%	0.339
		variable	61.50%	60.00%	0.934
		absent	15.40%	0.00%	0.115
	Loss of SEP	*no loss*	66.70%	73.30%	0.706
		partial loss	25.00%	26.70%	0.922
		loss	8.30%	0.00%	0.255
Motor Evoked Potentials	Baseline Iliopsoas MEP	*present*	100.00%	91.70%	0.350
		variable	0.00%	8.30%	0.350
		absent	0.00%	0.00%	
	Change in Iliopsoas MEP	*no change*	70.00%	44.40%	0.260
		decreased	30.00%	55.60%	0.260
		absent	0.00%	0.00%	
	Baseline Adductor MEP	*present*	84.60%	85.70%	0.936
		variable	0.00%	7.10%	0.326
		absent	15.40%	7.10%	0.496
	Change in Adductor MEP	*no change*	63.60%	40.00%	0.279
		decreasd	27.30%	50.00%	0.284
		absent	9.10%	10.00%	0.943
	Baseline Quadriceps MEP	*present*	100.00%	85.70%	0.157
		variable	0.00%	0.00%	
		absent	0.00%	14.30%	0.157
	Change in Quadriceps MEP	*no change*	84.60%	45.50%	0.043
		decreased	15.40%	45.50%	0.106
		absent	0.00%	9.10%	0.267