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Meyer I[1], McArthur T[1], Tang Y[1], McKinney J[2], Morgan S[1], Richter H[1]
1. *University of Alabama at Birmingham,* ***2.*** *Marathon Physical Therapy and Sports Medicine, Norton, MA*

PELVIC FLOOR SYMPTOMS AND SPINAL CURVATURE IN WOMEN

<u>Hypothesis / aims of study</u>

Antero-posterior (AP) shifting of the spine is commonly seen a result of decreased bone mineral density or advancing age. Current data regarding the potential association of abnormal spinal curvature on pelvic floor (PF) support and function are limited and exists only for pelvic organ prolapse (POP).[1,2] Our primary aim was to characterize the association of hyper/hypo-kyphosis and/or lordosis to urinary incontinence (UI), fecal incontinence (FI) and POP in women undergoing an osteoporosis evaluation. We further examined whether changes in thoracic (T) and lumbar (L) angles are associated with having PF symptoms.

<u>Study design, materials and methods</u>

A retrospective review was conducted of women who had undergone an osteoporosis evaluation from 1/2007 to 10/2010, had completed PF symptom questionnaires, and had either a standing AP and lateral chest, standing T/L spine radiographs, or a computerized tomography of chest/abdomen/pelvis within 3 years of their questionnaire completion. A board certified musculoskeletal fellowship-trained radiologist measured the T and L spine angles using the Cobb method. The thoracic spinal curvature was categorized into hypo- (<20º), normal T (20-40º), hyper-kyphosis (>40º); the lumbar spinal curvature was categorized as hypo- (<40º), normal L (40-70º), hyper-lordosis (>70º). The presence of any, urgency or stress UI in the past 3 months were identified with the 3 Incontinence Questionnaire (3-IQ). FI in the past month was assessed with the Modified Manchester Questionnaire and POP was defined as a positive response to “Do you have a bulge or something falling out that you can see or feel in your vaginal area?” from the Pelvic Floor Distress Inventory-20. Demographic data was obtained via chart review. Outcomes were examined across the three groups using chi-square tests. Two-sample t-test was used for continuous variables, and logistic regression was used to assess the association between PF symptoms and changes in T or L angles. Statistical significance was indicated at a 0.05 level.

<u>Results</u>

Of 1665 eligible women, 824 and 302 (mean age 64.1±10.0 and 63.7±9.7) had T and L spine images, respectively. No significant differences in any of the PF symptoms were observed in the T or L spine groups categorized by the hypo-, normal, and hyper-kyphosis or lordosis ($p \geq 0.05$, see Table) except for urgency UI being more prevalent in the hypo-lordosis group ($p=0.01$, see table). However, when using logistic regression to further characterize how the changes in spinal angles affect PF symptoms, no association was observed between having PF symptoms (any symptoms, UI, FI, POP) and T or L spine angles ($p \geq 0.05$, see Table). In addition, the mean angles of T and L spines did not differ between women with vs. without PF symptoms ($p>0.05$, see Table).

<u>Interpretation of results</u>

Thoracic and lumbar spinal angles are not significantly associated with pelvic floor symptoms in women undergoing osteoporosis evaluation.

<u>Concluding message</u>

The effect of spinal curvature on the pelvic structures has been theorized using a schematic vector diagram of intra-abdominal forces exerted to the pelvis, speculating that changes in spinal angles may contribute to POP development.[3] The current study with a much larger sample size compared to existing studies shows that the changes in the T and L spine angles are not significantly associated with pelvic floor symptoms except for urgency UI.

Table: Outcomes by thoracic and lumbar curvature status, Mean Thoracic and lumbar spine angles comparing with vs. without pelvic floor symptoms

	Kyphosis (T-spine)				Lordosis (L-spine)			
	Hypo- (n=25)	Normal (n=402)	Hyper (n=397)	p	Hypo- (n=153)	Normal (n=149)	Hyper (n=0)	p
Any symptoms	20 (91%)	318 (81%)	330 (86%)	0.09	126 (88%)	128 (86%)		0.97
Any UI	18 (75%)	290 (73%)	306 (78%)	0.29	118 (77%)	115 (77%)		0.93
Stress	13 (72%)	193 (67%)	209 (68%)	0.82	82 (70%)	76 (66%)		0.58
Urge	13 (72%)	220 (76%)	237 (78%)	0.82	93 (79%)	73 (64%)		0.01
FI	3 (12%)	66 (18%)	70 (19%)	0.63	51 (37%)	48 (36%)		0.81
POP	3 (13%)	39 (10%)	40 (11%)	0.91	14 (10%)	19 (14%)		0.29

	(T-spine, n=824)			(L-spine, n=302)		
	OR	95% CI	p	OR	95% CI	p
Any symptoms	1.02	1.00-1.03	0.05	1.00	0.97-1.03	0.77
Any UI	1.01	1.00-1.02	0.09	1.00	0.98-1.02	0.78
SUI	0.99	0.98-1.00	0.30	1.00	0.98-1.03	0.71
UUI	1.00	0.99-1.02	0.79	0.99	0.97-1.01	0.44
FI	1.01	1.00-1.02	0.27	0.99	0.97-1.01	0.20
POP	1.00	0.98-1.01	0.60	1.00	0.97-1.03	0.87

		(T-spine, n=824)			(L-spine, n=302)		
		N	Angle Mean ± SD	p	N	Angle Mean ± SD	p
Any symptoms	Yes	668	40.8 ± 13.0		254	39.1 ± 12.2	
	No	128	38.4 ± 11.8	0.05	34	39.8 ± 10.1	0.77
Any UI	Yes	614	40.9 ± 13.0	0.09	233	38.9 ± 12.3	
	No	202	39.1 ± 12.4		68	39.4 ± 11.3	0.78
SUI	Yes	415	40.5 ± 12.5		158	39.1 ± 12.0	
	No	199	41.7 ± 13.9	0.30	75	38.5 ± 12.9	0.71
UUI	Yes	470	41.0 ±13.0		166	38.5 ± 12.2	
	No	144	40.6 ± 13.1	0.79	67	39.9 ±12.5	0.44
FI	Yes	278	41.0 ± 12.5		112	37.9 ± 11.9	
	No	484	39.9 ± 13.0	0.27	161	39.8 ± 11.9	0.20
POP	Yes	82	39.6 ± 13.1		33	39.4 ± 12.6	
	No	700	40.4 ± 12.9	0.60	251	39.0 ± 12.1	0.87

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