

Table S1 Mean neural foraminal dimensions

Disc level	Left NFD			Right NFD		
	Width	Height	Area	Width	Height	Area
L1–L2	9.2±2.0	17.5±2.3	130.9±33.5	9.3±5.5	17.5±2.2	131.4±32.0
L2–L3	8.9±2.0	18.7±2.3	140.5±35.4	9.0±2.0	18.8±4.6	142.5±35.6
L3–L4	8.7±2.0	18.8±2.4	141.4±35.8	8.8±2.0	18.7±3.6	140.8±36.0
L4–L5	8.2±2.1	18.1±2.6	133.7±34.8	8.1±2.0	17.8±2.4	132.4±33.4
L5–S1	8.3±2.4	15.7±4.1	119.1±34.1	8.6±4.2	15.7±3.5	119.9±32.3

Table S2 Differences in lumbar NFD measurements based on vertebral level

Level of reference	Level of comparison	Mean Difference (Reference – Comparison)											
		Left NFD width		Left NFD height		Left NFD area		Right NFD width		Right NFD height		Right NFD area	
		MD	P	MD	P	MD	P	MD	P	MD	P	MD	P
L1–L2	L2–L3	0.3	0.08	-1.1	<0.001	-9.6	<0.001	0.3	0.94	-1.3	<0.001	-11.0	<0.001
	L3–L4	0.4	<0.001	-1.2	<0.001	-10.5	<0.001	0.5	0.02	-1.1	<0.001	-9.3	<0.001
	L4–L5	1.0	<0.001	-0.6	<0.001	-2.7	>0.99	1.2	<0.001	-0.3	0.53	-0.9	>0.99
	L5–S1	0.9	<0.001	1.8	<0.001	11.8	<0.001	0.7	<0.001	1.9	<0.001	11.5	<0.001
L2–L3	L1–L2	-0.3	0.08	1.1	<0.001	9.6	<0.001	-0.3	0.940	1.3	<0.001	11.0	<0.001
	L3–L4	0.2	>0.99	-0.1	>0.99	-0.9	>0.99	0.3	>0.99	0.1	>0.99	1.7	>0.99
	L4–L5	0.7	<0.001	0.6	<0.001	6.8	<0.001	0.9	<0.001	1.0	<0.001	10.1	<0.001
	L5–S1	0.6	<0.001	2.9	<0.001	21.3	<0.001	0.4	0.107	3.1	<0.001	22.6	<0.001
L3–L4	L1–L2	-0.4	<0.001	1.2	<0.001	10.5	<0.001	-0.5	0.02	1.1	<0.001	9.3	<0.001
	L2–L3	-0.2	>0.99	0.1	>0.99	0.9	>0.99	-0.3	>0.99	-0.1	>0.99	-1.7	>0.99
	L4–L5	0.6	<0.001	0.7	<0.001	7.8	<0.001	0.6	0.002	0.8	<0.001	8.4	<0.001
	L5–S1	0.5	<0.001	3.0	<0.001	22.3	<0.001	0.2	>0.99	3.0	<0.001	20.8	<0.001
L4–L5	L1–L2	-1.0	<0.001	0.6	<0.001	2.7	>0.99	-1.2	<0.001	0.3	0.53	0.9	>0.99
	L2–L3	-0.7	<0.001	-0.6	<0.001	-6.8	<0.001	-0.9	<0.001	-1.0	<0.001	-10.1	<0.001
	L3–L4	-0.6	<0.001	-0.7	<0.001	-7.8	<0.001	-0.6	0.002	-0.8	<0.001	-8.4	<0.001
	L5–S1	-0.1	>0.99	2.3	<0.001	14.5	<0.001	-0.5	0.07	2.2	<0.001	12.5	<0.001
L5–S1	L1–L2	-0.9	<0.001	-1.8	<0.001	-11.8	<0.001	-0.7	<0.001	-1.9	<0.001	-11.5	<0.001
	L2–L3	-0.6	<0.001	-2.9	<0.001	-21.3	<0.001	-0.4	0.11	-3.1	<0.001	-22.6	<0.001
	L3–L4	-0.5	<0.001	-3.0	<0.001	-22.3	<0.001	-0.2	>0.99	-3.0	<0.001	-20.8	<0.001
	L4–L5	0.1	>0.99	-2.3	<0.001	-14.5	<0.001	0.5	0.07	-2.2	<0.001	-12.5	<0.001

Table S3 Differences in NFD measurements based on patient sex

Measurement			Male		Female		Mean Difference (Male - Female)	95% Confidence Interval		P
			Mean	SD	Mean	SD		Lower Bound	Upper Bound	
L1-L2	Left NFD	Width	9.1	2.2	9.3	1.9	-0.2	-0.5	0.1	0.15
		Height	17.9	2.3	17.2	2.4	0.7	0.4	1.0	<0.001
		Area	131.8	34.7	130.5	32.6	1.4	-3.2	5.9	0.56
	Right NFD	Width	9.0	2.2	9.6	7.3	-0.6	-1.4	0.1	0.12
		Height	17.8	2.3	17.3	2.1	0.6	0.3	0.9	<0.001
		Area	131.4	34.1	131.4	30.2	0.0	-4.3	4.4	0.98
L2-L3	Left NFD	Width	8.9	2.1	8.9	1.9	-0.1	-0.4	0.2	0.57
		Height	18.8	2.4	18.5	2.2	0.4	0.1	0.7	0.02
		Area	141.3	37.7	139.5	33.9	1.9	-3.0	6.8	0.45
	Right NFD	Width	9.0	2.0	9.1	1.9	-0.1	-0.3	0.2	0.62
		Height	18.7	2.5	18.8	6.0	-0.1	-0.7	0.6	0.77
		Area	143.2	37.7	142.0	34.2	1.2	-3.7	6.2	0.62
L3-L4	Left NFD	Width	8.7	2.0	8.8	2.0	0.0	-0.3	0.2	0.75
		Height	18.9	2.6	18.6	2.3	0.3	0.0	0.7	0.048
		Area	143.0	37.9	140.0	34.5	2.9	-2.0	7.9	0.25
	Right NFD	Width	8.6	2.0	8.9	2.0	-0.2	-0.5	0.1	0.11
		Height	18.9	4.8	18.5	2.3	0.4	-0.1	0.9	0.11
		Area	141.1	39.4	140.6	33.3	0.4	-4.6	5.5	0.86
L4-L5	Left NFD	Width	8.2	2.3	8.1	1.9	0.1	-0.2	0.4	0.57
		Height	18.2	2.8	18.0	2.5	0.2	-0.2	0.6	0.25
		Area	135.5	38.0	131.8	32.5	3.7	-1.1	8.6	0.13
	Right NFD	Width	8.2	2.1	8.1	2.0	0.0	-0.3	0.3	0.82
		Height	17.9	2.5	17.8	2.3	0.1	-0.2	0.5	0.38
		Area	134.5	35.3	131.0	32.2	3.5	-1.2	8.1	0.14
L5-S1	Left NFD	Width	8.4	2.5	8.2	2.3	0.2	-0.1	0.5	0.26
		Height	15.6	2.7	15.7	2.6	-0.1	-0.5	0.3	0.60
		Area	120.1	36.1	118.4	32.4	1.7	-3.0	6.4	0.49
	Right NFD	Width	8.9	5.8	8.3	2.4	0.6	0.0	1.2	0.06
		Height	15.6	2.7	15.7	4.2	-0.1	-0.6	0.3	0.56
		Area	121.7	32.2	118.6	32.5	3.2	-1.3	7.6	0.17

Table S4 Mean NFD measurements based on patient race and ethnicity

Measurement			African American		Caucasian		Hispanic		Asian		P
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	
L1–L2	Left NFD	Width	8.3	2.0	9.3	2.0	9.2	2.0	9.9	1.8	<0.001
		Height	17.1	2.3	17.7	2.4	17.5	2.3	17.3	2.4	0.09
		Area	121.4	30.4	135.4	36.5	129.5	31.7	138.1	31.9	<0.001
	Right NFD	Width	8.4	2.0	9.8	9.1	9.1	1.9	9.8	2.3	0.13
		Height	17.0	2.2	17.7	2.2	17.5	2.2	17.5	2.2	0.05
		Area	121.6	31.5	136.0	32.8	130.0	31.2	138.0	31.1	<0.001
L2–L3	Left NFD	Width	9.0	2.0	8.9	1.9	8.6	1.8	9.1	2.3	0.28
		Height	18.7	2.4	18.5	2.2	18.7	2.3	18.6	2.3	0.76
		Area	143.2	39.5	139.0	33.4	137.5	29.3	146.0	37.9	0.26
	Right NFD	Width	9.2	2.0	8.9	1.9	8.8	1.9	9.1	2.2	0.16
		Height	19.2	7.3	18.5	2.2	18.6	2.3	18.9	2.9	0.24
		Area	145.0	39.2	140.6	34.5	140.4	28.3	147.6	33.3	0.30
L3–L4	Left NFD	Width	8.9	2.2	8.7	1.9	8.3	1.9	8.8	2.1	0.003
		Height	18.8	2.6	18.6	2.4	19.0	2.3	18.9	2.5	0.27
		Area	144.6	39.8	139.6	34.6	140.3	29.7	142.9	31.3	0.23
	Right NFD	Width	8.9	2.2	8.7	1.9	8.6	1.8	8.9	2.0	0.12
		Height	19.0	5.3	18.4	2.3	18.8	2.5	19.3	2.2	0.004
		Area	144.7	40.5	137.9	34.4	140.6	28.7	144.2	33.1	0.03
L4–L5	Left NFD	Width	8.3	2.3	8.2	1.9	7.7	2.0	8.3	2.2	0.003
		Height	18.1	2.8	18.0	2.6	18.3	2.5	18.0	2.5	0.47
		Area	135.0	37.1	133.9	34.7	128.8	28.6	134.1	33.3	0.13
	Right NFD	Width	8.1	2.1	8.2	2.0	8.0	2.1	8.2	2.1	0.51
		Height	17.9	2.4	17.8	2.4	17.9	2.4	17.8	2.1	0.78
		Area	134.2	35.6	132.1	33.7	129.3	28.7	129.8	27.1	0.28
L5–S1	Left NFD	Width	8.3	2.5	8.3	2.4	7.8	2.1	8.4	2.5	0.003
		Height	15.8	2.6	15.6	5.2	16.0	2.6	15.7	3.2	0.46
		Area	121.5	38.6	117.8	32.3	118.4	30.2	115.7	28.7	0.30
	Right NFD	Width	8.6	2.4	8.8	5.5	8.0	2.1	7.9	2.8	0.007
		Height	15.6	2.6	15.6	4.3	16.1	2.6	15.7	3.0	0.15
		Area	123.7	34.5	118.4	31.1	118.9	30.2	113.7	34.3	0.02

Table S5 Mean differences in NFD measurements among African American, Caucasian, Hispanic, and Asian cohorts

Disc level	Reference	Comparison	Mean difference (Reference – Comparison)											
			Left NFD Width		Left NFD Height		Left NFD Area		Right NFD Width		Right NFD Height		Right NFD Area	
			MD	P	MD	P	MD	P	MD	P	MD	P	MD	P
L1 – L2	African American	Caucasian	-1.0	<0.001	-0.7	0.10	-14.0	0.002	-1.4	0.21	-0.7	0.04	-14.4	<0.001
	African American	Hispanic	-0.9	<0.001	-0.4	0.80	-8.1	0.19	-0.7	>0.99	-0.5	0.34	-8.4	0.12
	African American	Asian	-1.6	<0.001	-0.3	>0.99	-16.7	0.007	-1.4	0.63	-0.5	0.98	-16.4	0.005
	Caucasian	African American	1.0	<0.001	0.7	0.10	14.0	0.002	1.4	0.21	0.7	0.04	14.4	<0.001
	Caucasian	Hispanic	0.1	>0.99	0.3	0.82	5.9	0.12	0.7	0.71	0.2	0.91	6.0	0.08
	Caucasian	Asian	-0.6	0.11	0.4	>0.99	-2.7	>0.99	0	>0.99	0.2	>0.99	-2.0	>0.99
	Hispanic	African American	0.9	<0.001	0.4	0.80	8.1	0.19	0.7	>0.99	0.5	0.34	8.4	0.12
	Hispanic	Caucasian	-0.1	>0.99	-0.3	0.82	-5.9	0.12	-0.7	0.71	-0.2	0.91	-6.0	0.08
	Hispanic	Asian	-0.7	0.02	0.1	>0.99	-8.6	0.24	-0.7	>0.99	0	>0.99	-8.0	0.26
	Asian	African American	1.6	<0.001	0.3	>0.99	16.7	0.007	1.4	0.63	0.5	0.98	16.4	0.005
	Asian	Caucasian	0.6	0.11	-0.4	>0.99	2.7	>0.99	0	>0.99	-0.2	>0.99	2.0	>0.99
Asian	Hispanic	0.7	0.02	-0.1	>0.99	8.6	0.24	0.7	>0.99	0	>0.99	8.0	0.26	
L2 – L3	African American	Caucasian	-0.4	0.38	0	>0.99	-5.7	>0.99	-0.4	0.32	-0.6	>0.99	-4.6	>0.99
	African American	Hispanic	-0.3	0.74	0.2	>0.99	-1.5	>0.99	-0.2	>0.99	0.1	>0.99	-0.2	>0.99
	African American	Asian	-0.5	0.55	0.1	>0.99	-8.5	0.73	-0.4	>0.99	-0.2	>0.99	-7.2	>0.99
	Caucasian	African American	0.4	0.38	0	>0.99	5.7	>0.99	0.4	0.32	0.6	>0.99	4.6	>0.99
	Caucasian	Hispanic	0.1	>0.99	0.2	>0.99	4.2	0.74	0.3	0.42	0.7	0.24	4.4	0.64
	Caucasian	Asian	-0.1	>0.99	0.1	>0.99	-2.8	>0.99	0.1	>0.99	0.4	>0.99	-2.6	>0.99
	Hispanic	African American	0.3	0.74	-0.2	>0.99	1.5	>0.99	0.2	>0.99	-0.1	>0.99	0.2	>0.99
	Hispanic	Caucasian	-0.1	>0.99	-0.2	>0.99	-4.2	0.74	-0.3	0.42	-0.7	0.24	-4.4	0.64
	Hispanic	Asian	-0.2	>0.99	-0.1	>0.99	-7.0	0.74	-0.2	>0.99	-0.4	>0.99	-7.0	0.74
	Asian	African American	0.5	0.55	-0.1	>0.99	8.5	0.73	0.4	>0.99	0.2	>0.99	7.2	>0.99
	Asian	Caucasian	0.1	>0.99	-0.1	>0.99	2.8	>0.99	-0.1	>0.99	-0.4	>0.99	2.6	>0.99
Asian	Hispanic	0.2	>0.99	0.1	>0.99	7.0	0.74	0.2	>0.99	0.4	>0.99	7.0	0.74	
L3 – L4	African American	Caucasian	-0.6	0.002	0.1	>0.99	-4.3	0.76	-0.3	0.268	-0.1	>0.99	-4.1	0.89
	African American	Hispanic	-0.4	0.06	0.3	0.42	0.7	>0.99	-0.2	>0.99	0.5	0.38	2.7	>0.99
	African American	Asian	-0.4	0.06	0.1	>0.99	-2.4	>0.99	-0.4	0.21	-0.4	0.71	-3.6	>0.99
	Caucasian	African American	0.6	0.002	-0.1	>0.99	4.3	0.76	0.3	0.27	0.1	>0.99	4.1	0.89
	Caucasian	Hispanic	0.2	>0.99	0.2	>0.99	5.0	0.33	0.2	>0.99	0.6	0.12	6.8	0.06
	Caucasian	Asian	0.2	>0.99	-0.1	>0.99	1.9	>0.99	0.0	>0.99	-0.3	>0.99	0.6	>0.99
	Hispanic	African American	0.4	0.06	-0.3	0.42	-0.7	>0.99	0.2	>0.99	-0.5	0.38	-2.7	>0.99
	Hispanic	Caucasian	-0.2	>0.99	-0.2	>0.99	-5.0	0.33	-0.2	>0.99	-0.6	0.12	-6.8	0.06
	Hispanic	Asian	-0.1	>0.99	-0.3	>0.99	-3.1	>0.99	-0.2	>0.99	-0.9	0.003	-6.3	0.14
	Asian	African American	0.4	0.06	-0.1	>0.99	2.4	>0.99	0.4	0.21	0.4	0.71	3.6	>0.99
	Asian	Caucasian	-0.2	>0.99	0.1	>0.99	-1.9	>0.99	0.0	>0.99	0.3	>0.99	-0.6	>0.99
Asian	Hispanic	0.1	>0.99	0.3	>0.99	3.1	>0.99	0.2	>0.99	0.9	0.003	6.3	0.14	
L4 – L5	African American	Caucasian	-0.6	0.005	0.2	>0.99	-6.0	0.19	-0.1	>0.99	0.0	>0.99	-5.0	0.38
	African American	Hispanic	-0.4	0.03	0.3	0.83	-4.9	0.32	-0.2	>0.99	0.2	>0.99	-2.8	>0.99
	African American	Asian	-0.6	0.06	0.3	>0.99	-5.1	>0.99	-0.3	>0.99	0.1	>0.99	-0.6	>0.99
	Caucasian	African American	0.6	0.005	-0.2	>0.99	6.0	0.19	0.1	>0.99	0.0	>0.99	5.0	0.38
	Caucasian	Hispanic	0.1	>0.99	0.1	>0.99	1.1	>0.99	-0.1	>0.99	0.1	>0.99	2.1	>0.99
	Caucasian	Asian	0.0	>0.99	0.1	>0.99	0.9	>0.99	-0.1	>0.99	0.1	>0.99	4.4	>0.99
	Hispanic	African American	0.4	0.03	-0.3	0.83	4.9	0.32	0.2	>0.99	-0.2	>0.99	2.8	>0.99
	Hispanic	Caucasian	-0.1	>0.99	-0.1	>0.99	-1.1	>0.99	0.1	>0.99	-0.1	>0.99	-2.1	>0.99
	Hispanic	Asian	-0.2	>0.99	0.0	>0.99	-0.2	>0.99	-0.1	>0.99	-0.1	>0.99	2.3	>0.99
	Asian	African American	0.6	0.06	-0.3	>0.99	5.1	>0.99	0.3	>0.99	-0.1	>0.99	0.6	>0.99
	Asian	Caucasian	0.0	>0.99	-0.1	>0.99	-0.9	>0.99	0.1	>0.99	-0.1	>0.99	-4.4	>0.99
Asian	Hispanic	0.2	>0.99	0.0	>0.99	0.2	>0.99	0.1	>0.99	0.1	>0.99	-2.3	>0.99	
L5 – S1	African American	Caucasian	-0.5	0.03	0.3	>0.99	-3.2	>0.99	-0.6	0.21	0.4	0.50	-4.8	0.33
	African American	Hispanic	-0.5	0.007	0.4	0.70	0.6	>0.99	-0.8	0.02	0.5	0.19	0.5	>0.99
	African American	Asian	-0.6	0.06	0.3	>0.99	2.7	>0.99	0.1	>0.99	0.4	>0.99	5.2	0.56
	Caucasian	African American	0.5	0.03	-0.3	>0.99	3.2	>0.99	0.6	0.21	-0.4	0.50	4.8	0.33
	Caucasian	Hispanic	0.0	>0.99	0.2	>0.99	3.7	0.83	-0.2	>0.99	0.1	>0.99	5.3	0.19
	Caucasian	Asian	-0.1	>0.99	0.1	>0.99	5.8	0.50	0.7	0.37	-0.1	>0.99	10.0	0.01
	Hispanic	African American	0.5	0.007	-0.4	0.70	-0.6	>0.99	0.8	0.02	-0.5	0.19	-0.5	>0.99
	Hispanic	Caucasian	0.0	>0.99	-0.2	>0.99	-3.7	0.83	0.2	>0.99	-0.1	>0.99	-5.3	0.19
	Hispanic	Asian	-0.1	>0.99	-0.1	>0.99	2.1	>0.99	0.9	0.10	-0.1	>0.99	4.7	0.78
	Asian	African American	0.6	0.06	-0.3	>0.99	-2.7	>0.99	-0.1	>0.99	-0.4	>0.99	-5.2	0.56
	Asian	Caucasian	0.1	>0.99	-0.1	>0.99	-5.8	0.50	-0.7	0.37	0.1	>0.99	-10.0	0.01
Asian	Hispanic	0.1	>0.99	0.1	>0.99	-2.1	>0.99	-0.9	0.10	0.1	>0.99	-4.7	0.78	