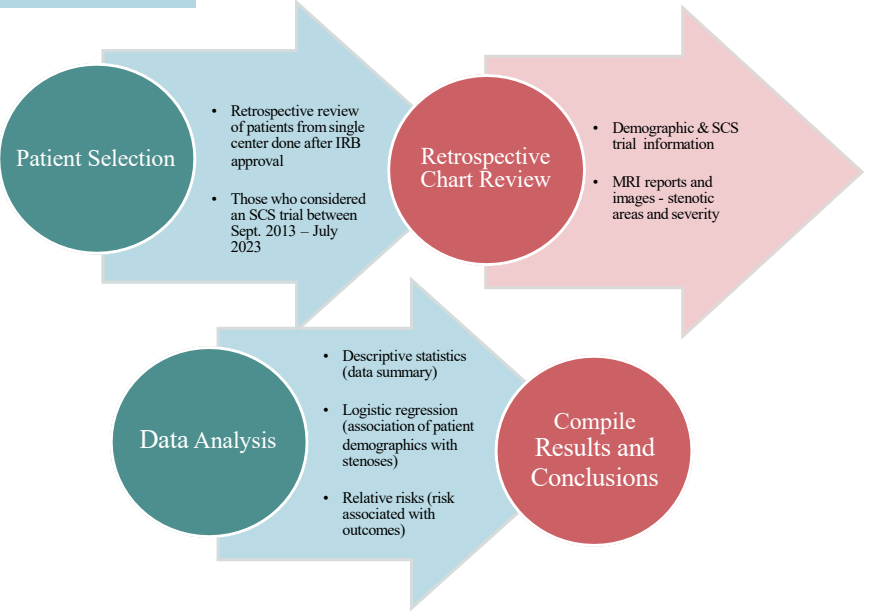


BACKGROUND:
Spinal cord stimulation (SCS), while helpful in treating chronic neck, back, and limb pain, poses a risk for neurological injury.

- Preprocedural MRIs are used to identify relevant spinal anatomical considerations that may modify SCS lead placement.
 - Location of planned lead entry
 - Location of lead placement
- However, preoperative MRIs are associated with increased cost and preauthorization burden.
- **To date, a large-scale study on preoperative MRIs for percutaneous SCS lead placement has not been performed.**

METHODS



RESULTS

- 7.3% (95% CI 4.9, 10.7) patients’ trials were influenced by MRI findings.
 - 4.4% (95% CI 2.6, 7.3) trials were altered
 - 2.9% (95% CI 1.5, 5.5) of trials were halted
- Cervical cases were 4.5 times more likely to be influenced by preprocedural MRIs than were thoracic/lumbar cases (95% CI 2.2, 9.4; p < 0.001). Out of the 12 cervical cases influenced,
 - 0% (95% CI 0.0, 30.1) had concerns for entry zone
 - 92% (95% CI 59.8, 99.6) had concerns for lead placement
 - 8% (95% CI 0.4, 40.2) had concerns outside of entry zone/lead placement.
- 27.0% (95% CI 22.0, 32.6) of patients being considered for a thoracic/lumbar trial had moderate/severe stenosis at a possible entry zone (T11-L3).
 - 91% (95 CI 81.6, 96.0) of moderate/severe entry zone stenosis occurred between L1-L3.
- 1.7% (95% CI 0.1, 10.5) of patients being considered for a cervical trial had moderate/severe stenosis at a possible entry zone (C7-T4).
 - 100% (95% CI 5.5, 100.0) of moderate/severe entry zone stenosis occurred between C7-T1.
- Older patients (≥50 years) were 10% (95% CI 6, 14; p < 0.05), 50% (95% CI 34, 67; p < 0.001), and 6% (95% CI 1, 11; p = 0.13) more likely to be associated with moderate/severe CSS, LSS, and TSS respectively, than younger patients (<50 years).

CONCLUSIONS

- Preprocedural MRIs did influence SCS trial progression (Figure 1a).
- Physicians performing cervical cases should be more concerned about moderate/severe stenosis at lead placement areas rather than entry zones.
- Physicians performing thoracic/lumbar cases and considering lead entry between L1-L3 should check preprocedural MRIs (Table 2).
- Age Group was the only risk factor associated with moderate/severe LSS and CSS (Table 3).
- Age was the only risk factor associated with moderate/severe TSS (Table 3).

- If only patients above the age of 50 received preoperative MRIs, 3.6% (95% CI 0.63, 13.6) of patients under 50 years who had altered trials due to preoperative MRIs would have been missed.
- All patient populations should be considered for preprocedural MRIs since limited selection preprocedural patient demographics were identified.

Preoperative Magnetic Resonance Imaging Does Modify Spinal Cord Stimulator Trial Progression and Planning

David A. Provenzano, Esha Vaidya, Jason S. Kilgore

- **Preoperative MRIs altered 7.3% of potential SCS percutaneous trials.**
 - 3.5% (95% CI 1.9, 6.2) of total trials influenced were cervical.
 - 20.7% (95% CI 11.6, 33.7) of cervical trials were influenced due to MRI findings.
 - 3.8% (95% CI 2.1, 6.6) of total trials influenced were thoracic/lumbar.
 - 4.6% (95% CI 2.6, 7.9) of thoracic/lumbar trials were influenced due to MRI findings.

Limited patient characteristics were identified that improved MRI-predicted capabilities. Therefore, **all** patient populations should be considered for preprocedural MRI to identify spinal pathology that may alter SCS trials.

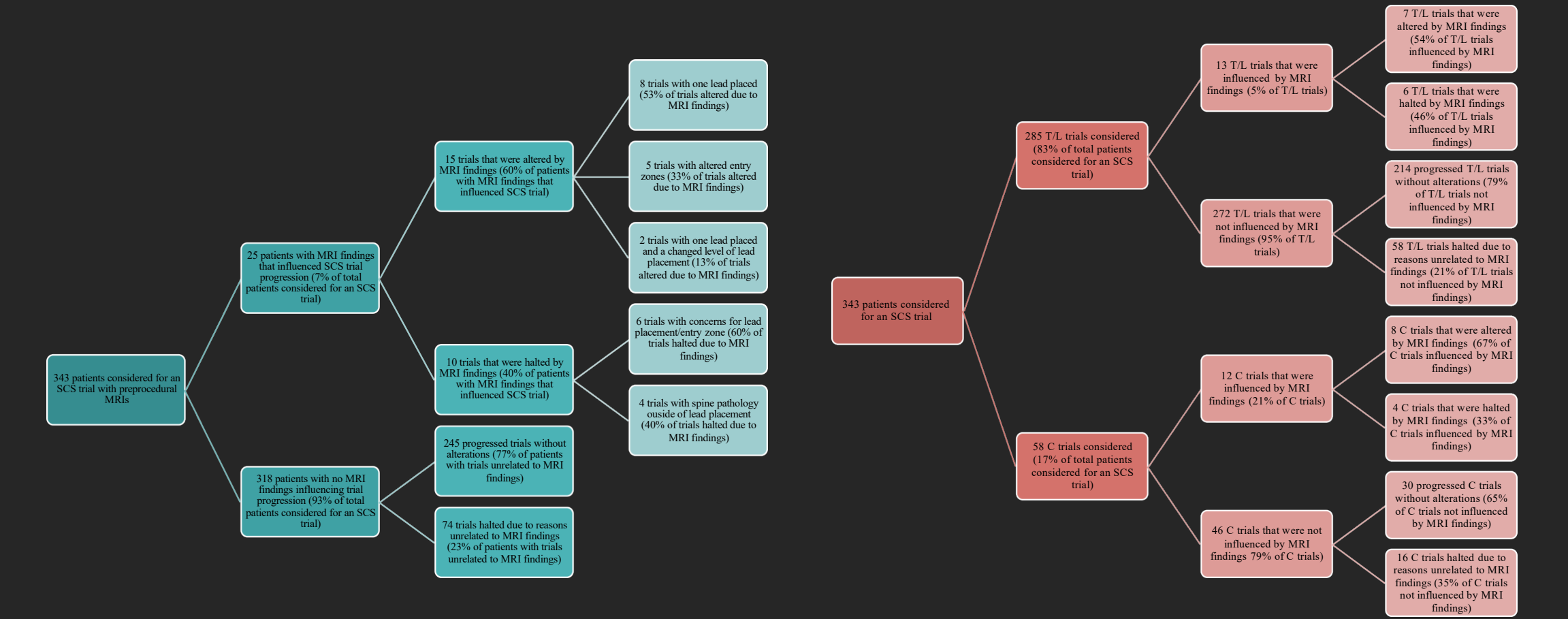


Figure 1a: Branching flow diagram of individuals considered for an SCS trial that underwent preprocedural MRIs.

Figure 1b: Branching flow diagram of individuals considered for either a thoracic/lumbar (T/L) or cervical (C) SCS trial.

TABLES

Table 1: Characteristics of patients who considered an SCS trial

Patient Characteristics		Outcomes (N = 343)
Demographics		
Age, mean ± SD (years), range	62.3 ± 13.5, 20-88	
Age Group		
1 (<40)		23 (6.7%)
2 (40-49)		32 (9.3%)
3 (50-59)		80 (23.3%)
4 (>59)		208 (60.7%)
Sex		
Female		169 (49.3%)
Male		174 (50.7%)
Body Mass Index, mean ± SD (kg/m ²)		
BMI Group ^a		
1 (<18.5)		1 (0.3%)
2 (18.5-24.9)		57 (16.6%)
3 (25.0-29.9)		118 (34.4%)
4, (≥ 30.0)		167 (48.7%)
Obesity		
Yes		167 (48.7%)
No		176 (51.3%)
Hypertension		
Yes		179 (52.2%)
No		164 (47.8%)
Diabetes		
Yes		77 (22.4%)
Diabetes Mellitus 1		5 (1.5%)
Diabetes Mellitus 2		72 (21.0%)
No		266 (77.6%)
Osteoarthritis		
Yes		110 (32.1%)
No		233 (67.9%)
Smoking		
Current		57 (16.6%)
Previous		87 (25.4%)
Never		199 (58.0%)

a: BMI Groups were designated from the Centers for Disease Control's groupings for Underweight (1), Healthy Weight (2), Overweight (3), and Obese (4).

Table 2: Stenosis characterizations and identification for areas of lead placement.

MRI-Identified Spinal Stenosis		
Stenosis-Related Characteristics by Trial Type		
Trial Type	Stenosis Type	Outcomes (N = 58)
Cervical	CSS, n (%)	26 (44.8)
	Yes	15 (25.9)
	Mild	6 (10.3)
	Moderate	5 (8.6)
	Severe	3 (5.2)
	No	30 (51.7)
Cervical and Thoracic/Lumbar	TSS, n (%)	2 (3.4)
	Yes	85 (24.8)
	Mild	63 (18.4)
	Moderate	20 (5.8)
	Severe	2 (0.6)
	No	258 (75.2)
Stenosis-Related Characteristics at Entry Zones by Trial Type		
Thoracic/Lumbar	T11-T12, n (%)	Outcomes (N = 285)
Thoracic/Lumbar	Yes	18 (6.3)
	Mild	15 (5.3)
	Moderate	3 (1.1)
	Severe	0 (0.0)
	No	267 (93.7)
	N/A ^a	0 (0.0)
Thoracic/Lumbar	L1-L2, n (%)	Outcomes (N = 285)
	Yes	67 (23.5)
	Mild	41 (14.4)
	Moderate	18 (6.3)
	Severe	9 (2.8)
	No	213 (74.7)
Thoracic/Lumbar	L2-L3, n (%)	Outcomes (N = 285)
	Yes	95 (33.3)
	Mild	51 (17.9)
	Moderate	31 (10.9)
	Severe	13 (4.6)
	No	185 (64.9)
N/A ^a		5 (1.8)

a: N/A refers to the number of patients considered for a cervical trial who did not have a preoperative cervical MRI.

b: N/A refers to the number of patients considered for either a cervical or thoracic/lumbar trial who did not have a preoperative thoracic MRI.

c: N/A refers to the patients considered for a thoracic/lumbar trial who did not have a preoperative thoracic MRI.

d: N/A refers to the number of patients considered for a thoracic/lumbar trial who did not have a preoperative lumbar MRI.

Table 3: Logistic Regression Analyses

Logistic Regression for Significant Demographic Variables			
Response	Demographic ^a	Coefficient ^b (95% CI)	p-value ^c
Moderate/Severe CSS	Age Group	0.96 (0.27, 1.94)	0.02
	DM2	-0.76 (-2.22, 0.34)	0.23
	Osteoarthritis	0.65 (-0.17, 1.46)	0.11
	Age	0.04 (0.003, 0.08)	0.04
Moderate/Severe TSS	Age Group	1.15 (0.75, 1.61)	<0.001
	BMI Group	0.24 (-0.07, 0.55)	0.14
	DM2	0.78 (0.24, 1.31)	<0.01
	Hypertension	0.55 (0.09, 1.02)	0.02
Moderate/Severe LSS	Age Group	1.15 (0.75, 1.61)	<0.001
	BMI Group	0.24 (-0.07, 0.55)	0.14
	DM2	0.78 (0.24, 1.31)	<0.01
	Hypertension	0.55 (0.09, 1.02)	0.02
Logistic Regression Analyses for Significant Age Groups			
Response	Demographic	Coefficient (95% CI)	p-value ^d
Moderate/Severe CSS	Age Group 4	1.07 (0.14, 2.19)	0.04
	Moderate/Severe LSS	-1.61 (-3.05, -0.17)	<0.01
Moderate/Severe LSS	Age Group 3	-0.78 (-1.41, -0.15)	0.01
	Moderate/Severe LSS	1.54 (1.00, 2.12)	<0.001

a: Simple logistic regressions for each demographic; only demographics found to be significant (a = 0.25) are listed. Bolded demographics were the only significant (a = 0.05) variables in multiple logistic regression models.

c: Multiple logistic regressions for demographics found to be significant (a = 0.25) in the simple logistic regression for each type of stenosis; only demographics found to be significant (a = 0.05) in the final multiple regression models are shown

d: Simple logistic regressions for each Age Group; only Age Groups found to be significant (a = 0.05) are shown