Validation of Spinal Instability Neoplastic Score (SINS) Components Through Patient-Reported Outcomes (PRO)

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Introduction

The Spinal Instability Neoplastic Score (SINS) was designed to facilitate the diagnosis of spinal instability in cancer patients and consists of six components. The purpose of this study was to determine whether individual SINS components correlate with preoperative symptoms and response to stabilization surgery. We also evaluated the heterogeneity of the "indeterminate" group (SINS 7-12) in order to delineate instability.

Methods

SINS and PRO (Brief Pain Inventory (BPI) and MD Anderson Symptom Inventory–Spine Tumor (MDASI-SP)) from 131 patients who underwent instrumented stabilization for tumor treatment were prospectively collected. SINS was analyzed as a continuous and categorical variable. Association between radiographic SINS and symptoms was analyzed using Spearman Rank Coefficient (s) and an extension of the Cochran-Armitage trend test. The association between total SINS and SINS component scores with change in postoperative PRO was analyzed using the Wilcoxon signed rank test and Kruskal Wallis test, respectively. P-values =0.05 were considered significant.

Results

The composite of radiographic SINS correlated with BPI average pain (s=0.18;P=0.049) and MDASI activity impairment (s=0.21;P=0.02). The severity of nearly all preoperative pain and functional disability symptoms differed significantly among the patients in different pain quality groups. Fracture location, lesion quality, alignment, and extent of vertebral body collapse demonstrated varying statistically significant correlations with magnitude of symptom improvement following stabilization (Table 1). Patients with SINS 10-12 demonstrated significant reductions in symptom burden following stabilization in nearly all PRO, whereas those with SINS 7-9 demonstrated fewer significant reductions in various pain items (Table 2).

Table 1

Table 1. Correlation Between SINS Components and Difference in Perioperative PRO Scores

PRO Item	σ Location	P	σ Pain	P	σ Bone Lesion	P	σ Align-ment	P	σ VB collapse	P	σ PE Involve-ment	P
BPI: Worst Pain	-0.16	0.13	-0.26	0.01	0.25	0.02	-0.06	0.60	-0.15	0.15	-0.14	0.18
BPI: Least Pain	-0.12	0.26	0.02	0.84	0.11	0.30	-0.05	0.63	-0.15	0.16	-0.03	0.75
BPI: Average Pain	-0.09	0.40	-0.20	0.06	0.12	0.26	-0.07	0.52	-0.28	0.008	-0.12	0.24
BPI: Pain Now	-0.05	0.62	-0.04	0.71	-0.002	0.98	-0.09	0.39	-0.19	0.08	0.14	0.21
BPI: Activity	-0.17	0.12	-0.17	0.11	0.16	0.15	0.01	0.96	-0.19	0.07	-0.17	0.12
BPI: Walking	-0.22	0.04	-0.12	0.25	0.08	0.47	0.05	0.67	-0.03	0.76	-0.06	0.61
MDASI: Pain	-0.16	0.13	-0.28	0.007	0.22	0.04	-0.04	0.70	-0.11	0.31	-0.11	0.30
MDASI: Spine Pain	-0.16	0.14	-0.18	0.09	0.08	0.49	-0.21	0.049	-0.03	0.79	-0.19	0.08
MDASI: Activity	-0.13	0.24	-0.15	0.15	0.05	0.63	-0.04	0.72	-0.26	0.01	-0.10	0.37
MDASI: Walking	-0.25	0.02	-0.13	0.24	0.16	0.14	-0.01	0.93	-0.07	0.51	-0.08	0.47

Abbreviations: ASIA, American Spinal Injury Association impairment score; BPI, Brief Pain Inventory; MDASI, MD Anderson Symptom Inventory; PRO, patient reported outcomes; SINS, Spinal Instability Neoplastic Score.

Table 2

Table 2. Mean Difference in Preoperative and Postoperative PRO Scores For Indeterminate SINS

PRO Item	Delta (postop-preop): SINS 7-9	P*	Delta (postop-preop): SINS 10-12	P*	P** (association)
BPI: Worst Pain	-2.4	0.007	-2.3	<0.0001	0.91
BPI: Least Pain	-0.6	0.3	-1.1	0.049	0.70
BPI: Average Pain	-0.95	0.18	-2.2	<0.0001	0.13
BPI: Pain Now	-1.7	0.01	-1.2	0.05	0.56
BPI: Activity	-1.1	0.34	-2.4	<0.0001	0.10
BPI: Walking	-1.1	0.29	-1.2	0.08	0.64
MDASI: Pain	-2.3	0.01	-2.0	0.0001	0.69
MDASI: Spine Pain	-1.3	0.19	-2.4	0.001	0.31
MDASI: Activity	0.24	0.89	-2.0	0.0006	0.0495
MDASI: Walking	-0.75	0.38	-0.59	0.40	0.91

*Wilcoxon Signed Rank Test
**Wilcoxon Two-sample Test
Abbreviations: ASIA, American Spinal Injury Association impairment score; BPI, Brief Pain Inventory; MDASI, MD Anderson Symptom Inventory; PRO, patient reported outcomes; SINS, Spinal Instability Neoplastic Score.

Conclusions

While the presence of mechanical pain has the strongest correlation with preoperative disability and response to surgery, radiographic components of SINS also correlates with these parameters, supporting their utilization in assessing spinal instability. Patients with higher scores in the indeterminate group experience improvement in a larger number of symptoms, suggesting this group includes distinct patient populations.

Learning Objectives

1. To understand the individual components and significance of the Spinal Instability Neoplastic Score (SINS) in clinical practice.
2. To evaluated how cumulative and radiographic-based scores correlate with patient reported outcomes pre- and post-operatively.
3. To assess instability specifically within the SINS group designated as "indeterminate" (7-12).