

Contents

CONTRIBUTORS	xv
INTRODUCTION	xxi

Section One Tumors

- 1 DIRECT DECOMPRESSIVE SURGICAL RESECTION IN THE TREATMENT OF SPINAL CORD COMPRESSION CAUSED BY METASTATIC CANCER: A RANDOMIZED TRIAL 1
Patchell RA, Tibbs PA, Regine WF, Payne R, Saris S, Kryscio RJ, Mohiuddin M, Young B. Lancet 366(9486):643–648, 2005
Reviewed by Christopher Kepler and Daniel Cataldo
- 2 A NOVEL CLASSIFICATION SYSTEM FOR SPINAL INSTABILITY IN NEOPLASTIC DISEASE: AN EVIDENCE-BASED APPROACH AND EXPERT CONSENSUS FROM THE SPINE ONCOLOGY STUDY GROUP 5
Fisher CG, DiPaola CP, Ryken TC, Bilsky MH, Kuklo TR, Harrop JS, Fehlings MG, Boriani S, Chou D, Schmidt MH, Polly W, Berven SH, Biagini R, Burch S, Dekutoski MB, Ganju A, Okuno SH, Patel SR, Rhines LD, Sciubba D, Shaffrey CI, Sunderesan N, Tomita K, Varga PP, Vialle LR, Vrionis FD, Yamada Y, Fourney DR. Spine 15(35):E1221–E1229, 2010
Reviewed by C. Rory Goodwin, A. Karim Ahmed, and Daniel M. Sciubba
- 3 SPINAL METASTASES: INDICATIONS FOR AND RESULTS OF PERCUTANEOUS INJECTION OF ACRYLIC SURGICAL CEMENT 11
Weill A, et al. Radiology 199(1):241–247, 1996
Reviewed by Alexander Winkler-Schwartz and Carlo Santaguida
- 4 SPINE UPDATE. PRIMARY BONE TUMORS OF THE SPINE: TERMINOLOGY AND SURGICAL STAGING 15
Boriani S, Weinstein JN, Biagini R. Spine 22(9):1036–1044, 1997
Reviewed by James Lawrence

- 5 A REVISED SCORING SYSTEM FOR THE PREOPERATIVE EVALUATION OF METASTATIC SPINE TUMOR PROGNOSIS 21
Tokuhashi Y, Matsuzaki H, Oda H, et al. Spine 30(19):2186–2191, 2005
Reviewed by Sharon Husak and Daryl R. Fourney

- 6 SURGICAL STRATEGY FOR SPINAL METASTASES 27
Tomita K, Kawahara N, Kobayashi T, Yoshida A, Murakami H, Akamaru T. Spine 26(3):298–306, 2001
Reviewed by Bryan Ryneerson, Malcolm Dombrowski, and Joon Lee

- 7 RADIOTHERAPY AND RADIOSURGERY FOR METASTATIC SPINE DISEASE: WHAT ARE THE OPTIONS, INDICATIONS, AND OUTCOMES? 33
Gerszten PC, Mendel E, Yamada Y. Spine 34:S78–S92, 2009
Reviewed by Simon Corriveau-Durand and Raphaële Charest-Morin

- 8 FEASIBILITY AND SAFETY OF EN BLOC RESECTION FOR PRIMARY SPINE TUMORS: A SYSTEMATIC REVIEW BY THE SPINE ONCOLOGY STUDY GROUP 39
Yamazaki T, McLoughlin GS, Patel S, Rhines LD, Fourney DR. Spine 34:S31–S38, 2009
Reviewed by Richard G. Everson and Laurence D. Rhines

Section Two Trauma

- 9 THE THREE-COLUMN SPINE AND ITS SIGNIFICANCE IN THE CLASSIFICATION OF ACUTE THORACOLUMBAR SPINE INJURIES 43
Denis F. Spine 8(8):817–831, 1983
Reviewed by Daniel Mendelsohn and Marcel F. Dvorak

- 10 A RANDOMIZED, CONTROLLED TRIAL OF METHYLPREDNISOLONE OR NALOXONE IN THE TREATMENT OF ACUTE SPINAL-CORD INJURY 47
Bracken MB, et al. N Engl J Med 322(20):1405–1411, 1990
Reviewed by Christopher S. Ahuja and Michael G. Fehlings

- 11 METHYLPREDNISOLONE FOR ACUTE SPINAL CORD INJURY:
AN INAPPROPRIATE STANDARD OF CARE 53
Hurlbert R. John. J Neurosurg 93:1–7, 2000
Reviewed by Bornali Kundu and Gregory W. J. Hawryluk

- 12 FRACTURES OF THE ODONTOID PROCESS OF THE AXIS 59
Anderson LD, D'Alonzo RT. J Bone Joint Surg Am 56(8):1663–1674, 1974
Reviewed by Joseph S. Butler and Andrew P. White

- 13 FRACTURES OF THE RING OF THE AXIS: A CLASSIFICATION BASED
ON THE ANALYSIS OF 131 CASES 65
Effendi B, Roy D, Cornish B, Dussault RG, Laurin CA.
JBJS 63-B(3):319–327, 1981
Reviewed by Rowan Schouten

- 14 A NEW CLASSIFICATION OF THORACOLUMBAR INJURIES: THE
IMPORTANCE OF INJURY MORPHOLOGY, THE INTEGRITY OF THE
POSTERIOR LIGAMENOUS COMPLEX, AND NEUROLOGICAL STATUS 71
Vaccaro AR, Lehman RA, Hurlbert R. John, et al.
Spine 30:2325–2333, 2005
Reviewed by Jefferson R. Wilson and Alex Vaccaro

- 15 A COMPREHENSIVE CLASSIFICATION OF THORACIC AND
LUMBAR INJURIES 77
Magerl F, Aebi M, Gertzbein SD, et al. Eur Spine J 3:184–201, 1994
Reviewed by Elsa Arocho-Quiñones, Hesham Soliman, and Shekar Kurpad

- 16 INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF
SPINAL CORD INJURY (ISNCSCI) 83
Kirshblum SC, Burns SP, Biering-Sorensen F, Donovan W, Graves DE,
Jha A, Johansen M, Jones L, Krassioukov A, Mulcahey MJ,
Schmidt-Read M, Waring W. 34(6):535–546, 2011
Reviewed by Sukhvinder Kalsi-Ryan

- 17 NEW TECHNOLOGIES IN SPINE: KYPHOPLASTY AND VERTEBROPLASTY FOR THE TREATMENT OF PAINFUL OSTEOPOROTIC COMPRESSION FRACTURES 87
Garfin SR, Yuan HA, Reiley MA. Spine 26(14):1511–1515, 2001
Reviewed by Clifford Lin

- 18 THE SUBAXIAL CERVICAL SPINE INJURY CLASSIFICATION SYSTEM: A NOVEL APPROACH TO RECOGNIZE THE IMPORTANCE OF MORPHOLOGY, NEUROLOGY, AND INTEGRITY OF THE DISCO-LIGAMENTOUS COMPLEX 91
Vaccaro AR, Hurlbert R, John, et al. Spine 32:2365–2374, 2007
Reviewed by Jonathan W. Riffle and Christopher M. Maulucci

- 19 EARLY VERSUS DELAYED DECOMPRESSION FOR TRAUMATIC CERVICAL SPINAL CORD INJURY: RESULTS OF THE SURGICAL TIMING IN ACUTE SPINAL CORD INJURY STUDY (STASCIS) 97
Fehlings MG, Vaccaro A, Wilson JR, et al. PLoS One 7(2):e32037, 2012
Reviewed by Jeffrey A. Rihn, Joseph T. Labrum IV, and Theresa Clark Rihn

- 20 THE CANADIAN C-SPINE RULE VERSUS THE NEXUS LOW-RISK CRITERIA IN PATIENTS WITH TRAUMA 103
Stiell IG, Clement CM, McKnight RD, et al. N Engl J Med 349:2510–2518, 2003
Reviewed by Theodore J. Steelman and Melvin D. Helgeson

Section Three Degenerative

- 21 LUMBAR DISC HERNIATION: A CONTROLLED, PROSPECTIVE STUDY WITH 10 YEARS OF OBSERVATION 109
Weber H, et al. Spine 1983
Reviewed by Raj Gala and Peter G. Whang

- 22 RADICULOPATHY AND MYELOPATHY AT SEGMENTS ADJACENT TO THE SITE OF A PREVIOUS ANTERIOR CERVICAL ARTHRODESIS 113
Hilibrand AS, Carlson GD, Palumbo MA, et al. J Bone Joint Surg Am 81:519–528, 1999
Reviewed by Godefroy Hardy St-Pierre and Ken Thomas

- 23 SURGICAL VERSUS NONSURGICAL TREATMENT FOR LUMBAR
DEGENERATIVE SPONDYLOLISTHESIS 117
Weinstein JN, Lurie JD, Tosteson TD, et al. N Engl J Med
356:2257–2270, 2007
Reviewed by Akshay A. Gupta and Ann M. Parr

- 24 SURGICAL VERSUS NONSURGICAL THERAPY FOR LUMBAR SPINAL
STENOSIS 123
Weinstein JN, Lurie JD, Tosteson TD, et al. N Engl J Med
358:794–810, 2008
Reviewed by Chris Daly and Tony Goldschlager

- 25 SURGICAL VERSUS NONOPERATIVE TREATMENT FOR LUMBAR DISC
HERNIATION: THE SPINE PATIENT OUTCOMES RESEARCH TRIAL
(SPORT): A RANDOMIZED TRIAL 127
Weinstein JN, Tosteson TD, Lurie JD, et al. JAMA
296(20):2441–2450, 2006
Reviewed by Christian Iorio-Morin and Nicolas Dea

- 26 2001 VOLVO AWARD WINNER IN CLINICAL STUDIES: LUMBAR FUSION
VERSUS NONSURGICAL TREATMENT FOR CHRONIC LOW BACK PAIN:
A MULTICENTER RANDOMIZED CONTROLLED TRIAL FROM THE
SWEDISH LUMBAR SPINE STUDY GROUP 133
Fritzell P, Hagg O, Wessberg P, et al. Spine 26(23):2521–2532, 2001
Reviewed by Andrew B. Shaw, Daniel S. Ikeda, and H. Francis Farhadi

- 27 CERVICAL SPINE FUSION IN RHEUMATOID ARTHRITIS 139
Ranawat CS, O’Leary P, Pellicci P. J Bone Joint Surg Am
61(7):1003–1010, 1979
Reviewed by Andrew H. Milby and Harvey E. Smith

- 28 EFFICACY AND SAFETY OF SURGICAL DECOMPRESSION IN PATIENTS
WITH CERVICAL SPONDYLOTIC MYELOPATHY: RESULTS OF THE
ARBEITSGEMEINSCHAFT FÜR OSTEOSYNTHESEFRAGEN SPINE NORTH
AMERICA PROSPECTIVE MULTICENTER STUDY 145
Fehlings MG, Wilson JR, Kopjar B. J Bone Joint Surg Am
95-A(18):1651–1658, 2013
Reviewed by Ajit Jada, Roger Härtl, and Ali Baaj

- 29 RADIOGRAPHIC AND PATHOLOGIC FEATURES OF SPINAL INVOLVEMENT
IN DIFFUSE IDIOPATHIC SKELETAL HYPEROSTOSIS 149
Resnick D, Niwayama G. Radiology 119(3):559–568, 1976
Reviewed by Tyler Kreitz and Mark Kurd

- 30 DEGENERATIVE LUMBAR SPONDYLOLISTHESIS WITH SPINAL STENOSIS:
A PROSPECTIVE, RANDOMIZED STUDY COMPARING DECOMPRESSIVE
LAMINECTOMY AND ARTHRODESIS WITH AND WITHOUT SPINAL
INSTRUMENTATION 155
*Fischgrund JS, MacKay M, Herkowitz HN, et al. Spine
22(24):2807–2812, 1997*
Reviewed by Philip K. Louie and Howard S. An

- 31 LAMINECTOMY PLUS FUSION VERSUS LAMINECTOMY ALONE FOR
LUMBAR SPONDYLOLISTHESIS 161
*Ghogawala Z, Dziura J, Butler WE, et al. N Engl J Med
374(15):1424–1434, 2016*
Reviewed by Jerry C. Ku and Jefferson R. Wilson

- 32 A RANDOMIZED, CONTROLLED TRIAL OF FUSION SURGERY FOR
LUMBAR SPINAL STENOSIS 165
Försth F, Ólafsson G, Carlsson T, et al. N Engl J Med 374(15):1413–1423, 2016
Reviewed by Jerry C. Ku and Jefferson R. Wilson

Section Four Deformity

- 33 ADOLESCENT IDIOPATHIC SCOLIOSIS: A NEW CLASSIFICATION TO
DETERMINE EXTENT OF SPINAL ARTHRODESIS 173
*Lenke LG, Betz RR, Harms J, et al. J Bone Joint Surg
Am 83-A(8):1169–1181, 2001*
Reviewed by Travis E. Marion and John T. Street

- 34 RADIOGRAPHIC ANALYSIS OF SAGITTAL PLANE ALIGNMENT AND
BALANCE IN STANDING VOLUNTEERS AND PATIENTS WITH LOW
BACK PAIN MATCHED FOR AGE, SEX, AND SIZE: A PROSPECTIVE
CONTROLLED CLINICAL STUDY 177
Jackson RP, McManus AC. Spine 19(14):1611–1618, 1994
Reviewed by Geoffrey Stricsek and James Harrop

- 35 CLASSIFICATION OF SPONDYLOLYSIS AND SPONDYLOLISTHESIS 181
Wiltse LL, Newman PH, Macnab I. Clin Orthop Relat Res 117:23–29, 1976
Reviewed by Jean-Marc Mac-Thiong

- 36 SCOLIOSIS RESEARCH SOCIETY–SCHWAB ADULT SPINAL DEFORMITY
 CLASSIFICATION: A VALIDATION STUDY 185
Schwab F, Ungar B, Blondel B, et al. Spine 37(12):1077–1082, 2012
Reviewed by Michael R. Bond and Tamir Ailon

- 37 THE IMPACT OF POSITIVE SAGITTAL BALANCE IN ADULT SPINAL
 DEFORMITY 191
Glassman SD, Bridwell K, Dimar JR, et al. Spine 30:2024–2029, 2005
Reviewed by Michael M. H. Yang and W. Bradley Jacobs

- 38 THE COMPREHENSIVE ANATOMICAL SPINAL OSTEOTOMY
 CLASSIFICATION 197
Schwab F. Neurosurgery 74(1):112–120, 2014
Reviewed by Ahmed Saleh and Addisu Mesfin

- 39 THE NATURAL HISTORY OF CONGENITAL SCOLIOSIS 201
McMaster MJ, Ohtsuka K. J Bone Joint Surg Am 64(8):1128–1147, 1982
Reviewed by Daniel J. Sucato

- 40 EFFECTS OF BRACING IN ADOLESCENTS WITH IDIOPATHIC
 SCOLIOSIS 205
Weinstein SL, Dolan LA, Wright JB, et al. N Engl J Med 369(16):1512–1521, 2013
Reviewed by Robert J. Ames and Amer F. Samdani

- 41 OUTCOMES OF OPERATIVE AND NONOPERATIVE TREATMENT FOR
 ADULT SPINAL DEFORMITY: A PROSPECTIVE MULTICENTER,
 PROPENSITY-MATCHED COHORT ASSESSMENT WITH MINIMUM
 2-YEAR FOLLOW-UP 211
Smith JS, Lafage V, Shaffrey CI. Neurosurgery 78(6):851–861, 2016
Reviewed by Ryan P. McLynn and Jonathan N. Grauer

42 SPINO-PELVIC SAGITTAL BALANCE OF SPONDYLOLISTHESIS: A REVIEW
AND CLASSIFICATION 217

Labelle H, Mac-Thiong Jean-Marc, Roussouly P. Eur Spine J
20:S641–S646, 2011

Reviewed by Joseph A. Osorio and Christopher P. Ames

Section Five Surgical Technique/Approach

43 THE PARASPINAL SACROSPINALIS-SPLITTING APPROACH TO THE
LUMBAR SPINE 221

Wiltse LL, Bateman JG, Hutchison RF, Nelson WE. J Bone Joint Surg Am
50(5):919–926, 1968

Reviewed by Sina Pourtaheri, Vinko Zlomislic, and Steven Garfin

44 THE TREATMENT OF CERTAIN CERVICAL-SPINE DISORDERS
BY ANTERIOR REMOVAL OF THE INTERVERTEBRAL DISC AND
INTERBODY FUSION 225

Smith GW, Robinson RA. J Bone Joint Surg Am 40-A(3):607–624, 1958

Reviewed by Alexander Satin and Jeff Silber

45 POSTERIOR C1-C2 FUSION WITH POLYAXIAL SCREW AND ROD
FIXATION 229

Harms J, Melcher RP. Spine 26(22):2467–2471, 2001

Reviewed by David M. Brandman and Sean Barry

46 PEDICLE SUBTRACTION OSTEOTOMY FOR THE TREATMENT OF FIXED
SAGITTAL IMBALANCE 233

Bridwell BH, Lewis SJ, Lenke LG, Baldus C, Blanke K. J Bone Joint Surg
Am 85-A:454–463, 2003

Reviewed by Markian A. Pahuta and Stephen J. Lewis

47 TRANSFORAMINAL LUMBAR INTERBODY FUSION: TECHNIQUE,
COMPLICATIONS, AND EARLY RESULTS 237

Rosenberg WS, Mummaneni PV. Neurosurgery 48(3):569–574, 2001

Reviewed by James Stenson and Kris Radcliff

Section Six Pediatrics

- 48 SPINAL CORD INJURY WITHOUT RADIOGRAPHIC ABNORMALITY IN CHILDREN—THE SCIWORA SYNDROME 241
Pang D, Pollack IF. J Trauma 29(5):654–664, 1989
Reviewed by Daniel R. Kramer and Erin N. Kiehna
- 49 PEDIATRIC SPINAL TRAUMA: REVIEW OF 122 CASES OF SPINAL CORD AND VERTEBRAL COLUMN INJURIES 245
Hadley MN, Zabramski JM, Browner CM, et al. J Neurosurgery 68(1):18–24, 1988
Reviewed by Jetan H. Badhiwala and Peter B. Dirks
- 50 THE TETHERED SPINAL CORD: ITS PROTEAN MANIFESTATIONS, DIAGNOSIS, AND SURGICAL CORRECTION 249
Hoffman HJ, Hendrick EB, Humphreys RP. Child's Brain 2(3):145–155, 1976
Reviewed by Arjun V. Pendharkar, Raphael Guzman, and Samuel H. Cheshier
- INDEX 253

CHAPTER 2

*A Novel Classification System for Spinal Instability in Neoplastic Disease: An Evidence-Based Approach and Expert Consensus from the Spine Oncology Study Group**

Fisher CG, DiPaola CP, Ryken TC, Bilsky MH, Kuklo TR, Harrop JS, Fehlings MG, Boriani S, Chou D, Schmidt MH, Polly W, Berven SH, Biagini R, Burch S, Dekutoski MB, Ganju A, Okuno SH, Patel SR, Rhines LD, Sciubba D, Shaffrey CI, Sunderesan N, Tomita K, Varga PP, Vialle LR, Vrionis FD, Yamada Y, Fourney DR. *Spine* 15(35):E1221–E1229, 2010

Reviewed by C. Rory Goodwin, A. Karim Ahmed, and Daniel M. Sciubba

Research Question/Objective Although the indications for surgical management of metastatic spinal disease are well understood (metastatic spinal cord compression [SCC], progressive neurological decline), the concept of tumor-related spinal instability was previously difficult to reliably evaluate among surgeons and nonsurgeons alike given the complexity of spinal column biomechanics.^{1,2} Given the lack of established guidelines prior to 2010, spinal instability in the setting of neoplastic disease was limited to the individual patient's subjective clinical experience combined with the associated physician's interpretation. Such subjective evaluation may result in inconsistencies in recognizing instability and may prevent clear and consistent communication among the members of the multidisciplinary treatment team, leading possibly to inappropriate or missed referrals for surgical management.³

As a result, the Spine Oncology Study Group (SOSG), an internationally recognized group of experts in spinal oncology, developed a classification system based

* Fisher CG, DiPaola CP, Ryken TC, Bilsky MH, Kuklo TR, Harrop JS, Fehlings MG, Boriani S, Chou D, Schmidt MH, Polly W, Berven SH, Biagini R, Burch S, Dekutoski MB, Ganju A, Okuno SH, Patel SR, Rhines LD, Sciubba D, Shaffrey CI, Sunderesan N, Tomita K, Varga PP, Vialle LR, Vrionis FD, Yamada Y, Fourney DR. A novel classification system for spinal instability in neoplastic disease: An evidence-based approach and expert consensus from the Spine Oncology Study Group. *Spine*. 2010; 15(35): E1221–E1229.

on review of available literature and expert consensus opinion to evaluate spine instability in patients diagnosed with neoplastic disease in 2010.⁴

Study Design The SOSG first conducted two preliminary systematic reviews to identify clinical and radiographic factors associated with overt or impending instability involving tumors of the cervical and thoracolumbar spine. A modified Delphi technique was used to integrate the available evidence with expert opinion to develop the classification system. A questionnaire was then administered to the members of the SOSG that collected factors, based on individual clinical experience and review of evidence from the literature that contributed to spinal instability. A preliminary Spine Instability Neoplastic Score (SINS) was created based on the relative ranking of a particular factor's contribution to spinal instability. A second round of questionnaires involved more critical evaluation of instability factors, in an effort to improve reliability among evaluators and to improve validity of the score to predict instability in case examples. The SOSG ultimately defined tumor-related spinal instability as "loss of spinal integrity as a result of a neoplastic process that is associated with movement-related pain, symptomatic or progressive deformity, and/or neural compromise under physical loads."⁴ Factors mentioned in the SINS included regional location of tumor, presence of mechanical/postural pain, bone lesion quality, spinal alignment, extent of vertebral body involvement/collapse, and posterolateral involvement of the spinal elements.^{4,5}

Sample Size Not applicable. Three representative cases are presented in the text. However, the total series of clinical cases reviewed by the SOSG is not reported.

Follow-Up Not applicable.

Inclusion/Exclusion Criteria Not applicable.

Intervention or Treatment Received Not applicable.

Results The final SINS classification system includes six components, with a weighted value for each component. As such, the clinical presentation and imaging findings can be combined to determine an objective status of instability for a given patient with a neoplastic lesion of the spine. The score for each component is additive to achieve a final SINS. In terms of *location-specific factors*, junctional areas (occiput-C2, C7-T2, T11-L1, and L5-S1) are at the most risk for developing tumor-related spinal instability, with an assigned score of 3; the mobile spine (C3-C6, and L2-L4) is assigned a score of 2; the semirigid spine (T3-T10) is assigned a score of 1, and the rigid sacrum (S2-S5) is assigned a score of 0. With regard to *clinical pain presentation*, mechanical or postural pain is scored based on pain that may be relieved with recumbency (score of 3), while occasional, nonmechanical pain is assigned a score of 1, and a pain-free lesions score of 0. The *quality of the bone lesion* is scored

based on whether the lesion is lytic (score of 2), mixed blastic and lytic (score of 1), or blastic (score of 0). *Deformity* is a major contributing factor and has the highest potential score, with subluxation/translation assigned a score of 4; *de novo* deformity, including kyphosis or scoliosis, assigned a score of 2; and normal spinal alignment assigned a score of 0. *Vertebral body collapse* is a score of 3 if it is greater than 50%, a score of 2 if it is less than 50%, a score of 1 if the lesion includes greater than 50% of the vertebral body but there is no collapse, and a score of 0 if none of the vertebral body criteria are met. *Posterolateral involvement of the spinal elements*, including facet, pedicle, and costovertebral involvement, may exacerbate spinal instability. If posterolateral involvement is present bilaterally in the neoplastic lesion, a score of 3 is assigned, unilateral involvement is given a score of 1, and involvement of the vertebral body without any posterolateral involvement is given a score of 0.

The maximum amount of points that can be earned is 18; a score of 0–6 denotes stability, a score of 7–12 is “indeterminate” and possible impending instability, and a score of 13–18 indicates instability. Surgical consultation is recommended for any patient with a score greater than, or equal to, 7.

Study Limitations Although the study is currently the most comprehensive classification system for spinal instability in the setting of neoplastic disease, several limitations have been highlighted by the authors. Disease that is contiguous or multi-level, previous spine surgery, and previous radiation are relevant factors that can contribute to instability. However, these are not included in this classification system. Although the classification system is relatively straightforward, the study did not grade the representative clinical cases with spine surgeons outside the SOSG for reliability.⁴ Although several additional studies have attempted to address these factors, most are retrospective in nature.^{6–11} Prospective validation of this study will determine the SINS prognostic value in determining neoplastic spinal instability.¹¹

Relevant Studies Previous studies have attempted to quantify instability but have neglected to include key contributing factors or have only focused on instability using the framework created for spine trauma.^{11–15} The Neurologic, Oncologic, Mechanical instability, Systemic disease (NOMS) and the Location of disease, Mechanical instability, Neurologic status, Oncological history, and Physical status (LMNOP) have incorporated the SINS criteria into the management paradigms of patients for patients with neoplastic spine lesions.^{8,16} The interobserver and intraobserver reliability of the SINS classification system has also been widely demonstrated.^{5,6,17,18} Furthermore, it has been determined to be more relevant for very radiosensitive tumors (i.e., multiple myeloma), where instability may be the primary indication for surgical intervention.¹⁹ Additionally, a higher instability score has been demonstrated to increase the risk of radiotherapy