

Development of the AO Spinal Metastasis Staging (SMS) Referral Tool: An International Multidisciplinary Expert Panel and Survey Study

Harmen Kuijten (Utrecht, Pays-Bas), Gal Roxanne (Utrecht, Pays-Bas), Olivier Groot (Utrecht, Pays-Bas), Marie-Laure Vial (Davos, Suisse), Ori Barzilai (New York, États-Unis), Cordula Netzer (Basel, Suisse), C. Rory Goodwin (Durham, États-Unis), Alessandro Gasbarrini (Bologna, Italie), Nicolas Dea (Vancouver, Canada), Jeremy Reynolds (Oxford, Royaume Uni), Ilya Laufer (New York, États-Unis), Nicolien Kasperts (Utrecht, Pays-Bas), Jorrit-Jan Verlaan (Utrecht, Pays-Bas), Joanne Van Der Velden (Utrecht, Pays-Bas)

Introduction

Spinal metastases may progress to advanced stages with debilitating pain, spinal instability, and neurological deficits. Timely recognition and referral are essential, yet delays are common because patients often first present to non-spine clinicians where red flags rarely expedite referral and existing guidelines primarily target spine specialists. We aimed to develop and evaluate a staging-based referral tool to support non-spine clinicians in recognizing progression and guiding referral urgency.

Materials and Methods

We defined the Spinal Metastases Staging (SMS) system as four stages reflecting typical progression: SMS I, asymptomatic; SMS II, inflammatory pain; SMS III, mechanical pain and/or spinal instability; and SMS IV, neurological deficits and/or high-grade spinal cord compression. These stages were translated into a referral algorithm organized by urgency and presented in the form of a pocket map. The tool was iteratively refined through regional and international multidisciplinary expert panels including spine and non-spine clinicians. Subsequently, usability and perceived clinical utility were evaluated in an international survey.

Results

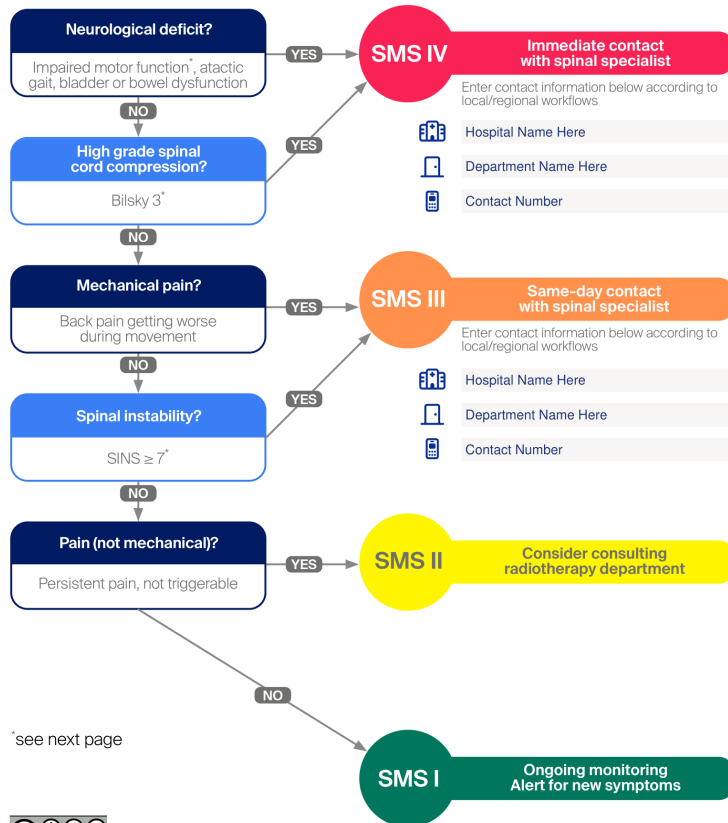
Panels endorsed the four-stage SMS system and referral algorithm. Among all survey respondents (n=120), high acceptability of the tool was reported. Among non-spine clinicians (n=32), 94% reported the tool easy to understand, 91% considered the format suitable for clinical use, and 91% anticipated improved referrals. Overall, 88% indicated they would use the tool at least occasionally, including 61% who would use the pocket map frequently or always.

Conclusion

Through an international, multidisciplinary development and evaluation process, the SMS staging system and referral tool ([link](#)) demonstrated high acceptability and perceived clinical utility among both spine specialists and non-spine clinicians. These findings support feasibility of implementation in non-spine care settings. Prospective studies are ongoing to assess effects on referral delays and patients outcomes.

AO Spinal Metastasis Staging (SMS) Pocket Map

For patients pursuing active treatment



*see next page



© 2025 AO Foundation. This work is openly licensed via CC BY-NC-ND 4.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc-nd/4.0/>

SAVE

PRINT

EMAIL

American Spinal Injury Association (ASIA) Impairment Scale ¹

A	The impairment is complete. There is no motor or sensory function left below the level of injury.
B	The impairment is incomplete. Sensory function, but not motor function, is preserved below the neurologic level (the first normal level above the level of injury) and some sensation is preserved in the sacral segments S4 and S5.
C	The impairment is incomplete. Motor function is preserved below the neurologic level, but more than half of the key muscles below the neurologic level have a muscle grade less than 3 (i.e., they are not strong enough to move against gravity).
D	The impairment is incomplete. Motor function is preserved below the neurologic level, and at least half of the key muscles below the neurologic level have a muscle grade of 3 or more (i.e., the joints can be moved against gravity).
E	The patient's functions are normal. All motor and sensory functions are unhindered.

Bilsky grading Best assessed with an MRI ²



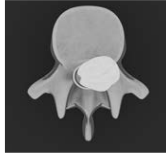
Grade 0: bone-only disease



Grade 1: epidural extension without cord compression (1b shown)



Grade 2: spinal cord compression, with cerebrospinal fluid (CSF) visible around the cord



Grade 3: spinal cord compression no CSF visible around the cord

Spinal neoplastic instability score (SINS) ³

Element of SINS	SCORE	Element of SINS	SCORE
Location		Radiographic spinal alignment	
Junctional (occiput-C2, C7-T2, T11-L1, L5-S1)	3	Subluxation/translation present	4
Mobile spine (C3-C6, L2-L4)	2	De novo deformity (kyphosis/scoliosis)	2
Semi-rigid (T3-T10)	1	Normal alignment	0
Rigid (S2-S5)	0	Vertebral collapse	
Pain relief with recumbency and/or pain with movement/loading of the spine		> 50% collapse	3
Yes	3	< 50% collapse	2
No (occasional pain but not mechanical)	1	No collapse with > 50% body involved	1
Pain free lesion	0	None of the above	0
Bone lesion		Posterolateral involvement of the spinal elements (facet, pedicle of CV joint fracture or replacement with tumor)	
Lytic	2	Bilateral	3
Mixed (lytic/blastic)	1	Unilateral	1
Blastic	0	None of the above	0

NOTE: the total SINS score is the sum of all SINS elements



References and remarks

- Hematological tumors/metastases are different, discuss with center/specialist who has experience in this field
- If unsure about SINS or Bilsky, please consult your local radiologist
- See QR code for minimum referral information, examples, and support with pain types, ASIA, SINS, and Bilsky

¹doi:10.46292/sci2702-1 ² doi:10.3171/2010.3.SPINE09459 ³ doi:10.1097/BRS.0b013e3181e16ae2

Visit: www.aofoundation.org/spine/clinical-library-and-tools/ao-spine-staging-systems-referral-tool