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Spinal Instability Associated with Metastatic Lesions

Current Management Approaches

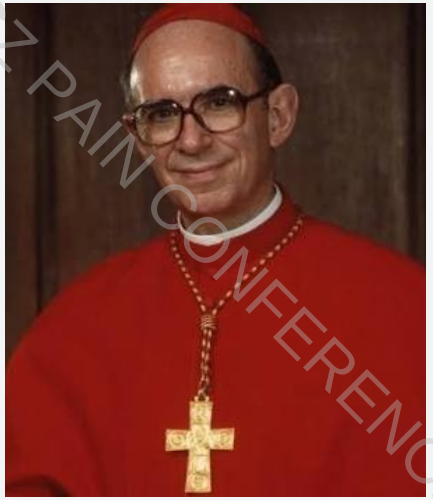
Vikram B. Patel

MD, DABA, FIPP, DABIPP

Conflict of Interest

No conflict of interest to be declared

Cardinal Bernardin cancer center 2000-2007



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My approach to spine pain in a cancer patient

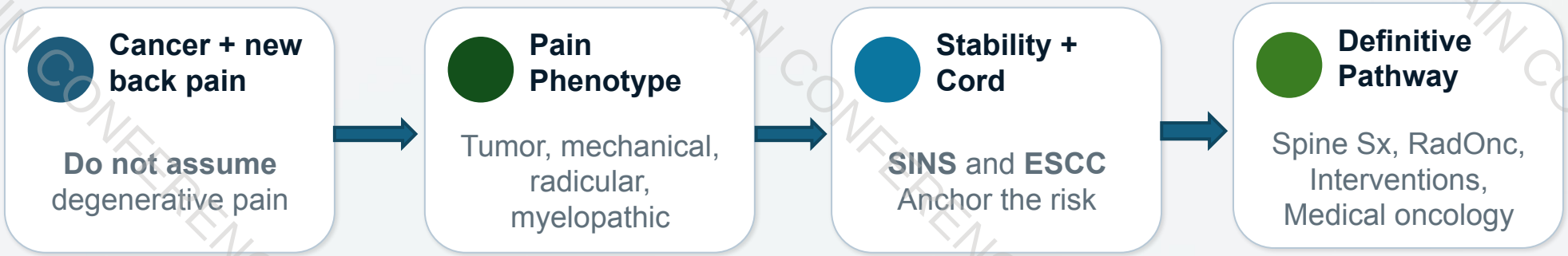
- **S**uspect
- **E**valuate
- **A**ddress

Some relevant terms/abbreviations

- **ESCC** (Bilsky) scale
  - **E**pidural **S**pinal **C**ord **C**ompression Scale
- **MSCC**
  - **M**yelopathic **S**pinal **C**ord **C**ompression
- **NOMS** decision framework
  - **N**eurological
  - **O**ncologic
  - **M**echanical instability
  - **S**ystemic disease
- **SINS** Screening
  - **S**pinal **I**nstability **N**eoplastic **S**core
- **SBRT**
  - **S**tereotactic **B**ody **R**adiation **T**herapy
- **EBRT**
  - **E**xternal **B**eam **R**adiation **T**herapy

Why should we care?

- Spinal pain in a cancer patient is **more of a diagnostic problem than a procedural problem** – any spine pain in a cancer patient is metastatic **UNLESS PROVEN OTHERWISE**



Pain physician's responsibility

* **Recognize mechanical** pain and **neurologic** change early.
* Provide **safe analgesia without delaying MRI**, steroids, or referral when indicated.
* **Avoid** injections that pass **through tumor, epidural disease, or an unstable segment**.
* Translate pain phenotype into the **spine oncology decision framework**.

Framework concepts: NICE NG234, 2023; Laufer et al., Oncologist 2013; Fisher et al., Spine 2010. (National Inst for Health and Care Excellence)

From metastasis to mechanical failure

The key **clinical distinction** is whether pain is generated by **tumor biology**, **neural** compromise, or loss of **load-bearing** integrity.

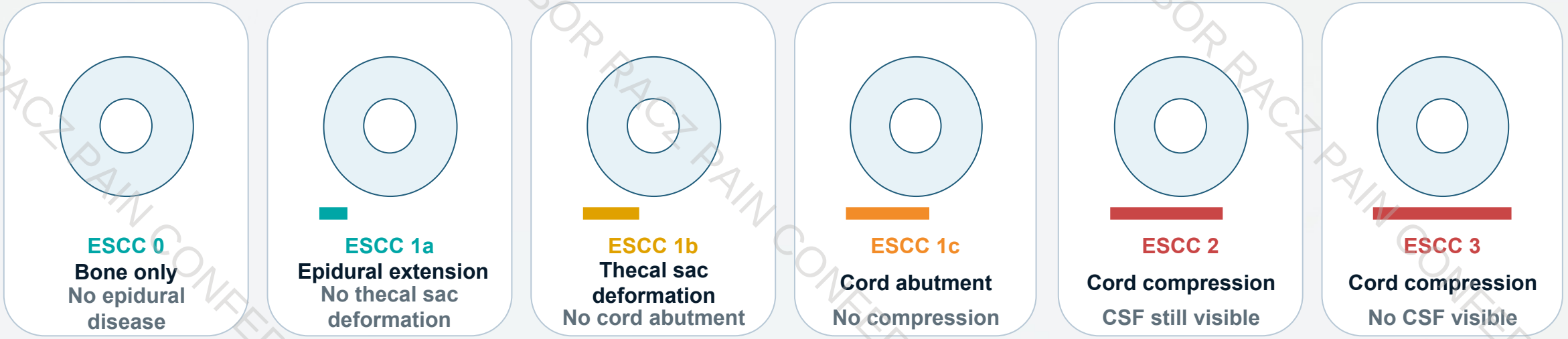
1. **Tumor infiltration**
   Marrow replacement
   lytic/mixed/blastic
2. **Cortical breach**
   Vertebral body or pedicle erosion
3. **Collapse/ deformity**
   Wedge collapse, translation, kyphosis
4. **Motion under load**
   Pain with transfers, standing, axial loading
5. **Neural risk**
   Root, cord, cauda equina compromise

- **Biologic tumor pain**
  Constant, nocturnal, inflammatory; often RT/systemic responsive.
- **Mechanical pain**
  Movement/loading pain, relieved by recumbency; instability signal.
- **Radicular pain**
  Dermatomal, foraminal/root involvement; image the level.
- **Myelopathic/MSCC**
  Gait, weakness, sensory level, bowel/bladder; emergency.

SINS definition of neoplastic instability: Fisher et al., Spine 2010; Conti et al., Front Oncol 2019.

Neurologic axis: ESCC / Bilsky scale

Use axial T2 MRI at the worst level to grade epidural disease and cord/cauda equina compromise.



ESCC 0
Bone only
No epidural disease

ESCC 1a
Epidural extension
No thecal sac deformation

ESCC 1b
Thecal sac deformation
No cord abutment

ESCC 1c
Cord abutment
No compression

ESCC 2
Cord compression
CSF still visible

ESCC 3
Cord compression
No CSF visible

Lower grade disease

Often amenable to RT/SBRT if mechanically stable and neurologically intact.

High grade or symptomatic compression

Urgent surgical/RadOnc discussion; radiosensitivity and systemic status determine route.

Bilsky et al., J Neurosurg Spine 2010; AO Foundation ESCC description; Laufer et al., Oncologist 2013.

Red flags: escalate before injecting !

Pain features suggesting spinal metastasis or instability

* Severe, **progressive, unremitting, or night pain**
* **Pain with movement**, standing, transfers, or straining
* Localized spinal **tenderness**
* Known or suspected cancer with **new axial pain**

Mechanical pain + cancer = assess stability.

Neurologic features suggesting MSCC or cauda equina

* **Gait** disturbance or **claudication**
* Limb **weakness**, sensory level, numbness, paresthesia
* **Radicular** band-like pain
* **Bowel or bladder** dysfunction

New neurologic deficit = MSCC pathway now.

First actions: contact MSCC/spine service, urgent MRI, immobilize if neurologic instability suspected, and give dexamethasone 16 mg when neurologic symptoms/signs of MSCC are present.

NICE NG234 recommendations on recognition, referral, immobilization, MRI and dexamethasone; ASTRO bone metastases guideline 2024.

Mechanical axis: SINS (Spinal Instability Neoplastic Scale) for screening

Score each symptomatic lesion separately. SINS >= 7 should trigger spine referral for stability assessment.

0-6 Stable	7-12 Potentially unstable	13-18 Unstable

SINS domains	Point anchors for fast screening
Location	Junctional 3 | mobile 2 | semirigid 1 | sacrum 0
Pain	Mechanical 3 | non-mechanical 1 | painless 0
Bone lesion	Lytic 2 | mixed 1 | blastic 0
Alignment	Translation/subluxation 4 | new deformity 2 | normal 0
Collapse	>50% 3 | <50% 2 | >50% body involved 1 | none 0
Posterolateral elements	Bilateral 3 | unilateral 1 | none 0

High-yield clue: mechanical pain alone contributes 3 points and often drives referral urgency.

Fisher et al., Spine 2010; Fourney et al., J Clin Oncol 2011;

Modern metastatic spine care integrates **four sentinel questions** before choosing RT, surgery, percutaneous therapy, or systemic care.

NOMS based decision framework

N — Neurologic

ESCC grade, myelopathy, radiculopathy, deficit trajectory

O — Oncologic

Radiosensitivity, systemic options, prior RT, target durability

Treatment choice

M — Mechanical

SINS, load-bearing pain, deformity/collapse: structural decision

S — Systemic

Performance status, prognosis, comorbidities, goals of care

NOMS take-home: instability is an independent indication for stabilization; radiation controls tumor, not load-bearing mechanics.

Laufer et al., Oncologist 2013; updated NOMS reviews; NICE NG234, 2023.

Initial management algorithm

Cancer + new spine pain

Screen pain phenotype and complete neuro exam

Any neurologic signs?

Weakness, gait, sensory, radicular, bowel/bladder

Urgent imaging

MRI whole spine; CT for bony stability/procedure planning

NOMS/SINS review

Route to surgery, RT, IR, systemic, supportive care

MSCC suspected

Contact MSCC/spine service now
Immobilize if unstable/neuro signs
Dexamethasone 16 mg if neuro signs of MSCC
Definitive decompression/stabilization and/or RT

Mechanical pain or SINS >= 7

Urgent spine oncology referral
CT to define cortical/posterior element failure
Brace/limit activity until stability decision
Consider surgery, cement augmentation, ablation

Stable tumor pain

Analgesia and oncology-directed care
Conventional RT or SBRT when appropriate
Systemic therapy and bone-modifying agents
Pain procedures only after safe target confirmed

NICE NG234: urgent MRI and urgent RT pathways; Fisher 2010 SINS; Laufer 2013 NOMS.

Percutaneous options: rapid palliation and focal stability

For selected patients **without high-grade MSCC or gross instability**, **minimally invasive procedures** can **reduce pain** quickly and complement RT/systemic therapy.

Biopsy
Diagnosis when primary unknown, discordant histology, or molecular testing needed.

Ablation
RFA, cryoablation, or microwave for focal painful tumor cytoreduction.

Cement augmentation
Vertebroplasty or kyphoplasty for painful VCF/body failure.

RT / systemic plan
Coordinate timing with RadOnc, medical oncology, and surgical plan.

Good candidates

Focal painful vertebral body lesion or compression fracture; stable or potentially stable segment; no high-grade cord compression; safe access route; corrected platelets/coagulation; treatment goals favor rapid palliation.

Proceed with caution / avoid

High-grade MSCC, retropulsed bone or severe posterior wall breach with canal compromise, gross translation/deformity, infection, uncorrected coagulopathy, unsafe prone/sedation tolerance, or no coordinated oncologic plan.

NICE HTG670/IPG759 2023; Tomasian, Levy and Jennings, Semin Intervent Radiol 2024; NICE NG234 invasive interventions.

Pain physician procedural boundaries

Before any deep spinal intervention, ask: could this pain be instability or cord/root compression from tumor?

GREEN

Reasonable after imaging review

* Analgesic optimization and bowel regimen
* Non-neuraxial injections for a proven benign generator away from tumor
* Intrathecal or neurolytic cancer pain approaches after structural emergency is excluded

YELLOW

Proceed only with multidisciplinary checks

* Known metastatic disease at or near procedural trajectory
* Neuraxial/transforaminal procedures in cancer patients
* Thrombocytopenia, anticoagulation, infection risk, chemotherapy timing

RED

Stop and escalate

* New weakness, gait change, sensory level, bowel/bladder symptom
* Mechanical pain in known vertebral metastasis without stability assessment
* Needle path through tumor, epidural disease, or unstable posterior elements

Document baseline gait, motor strength, sensory findings, reflexes, and bowel/bladder status before and after high-risk decisions.

Procedural safety synthesis based on NICE NG234, NOMS, SINS and interventional spine oncology literature. (National Inst of Health and Care Excellence)

Supportive management: treat pain while the spine is being stabilized

Goal: reduce suffering without masking deterioration or delaying definitive stabilization.

NICE NG234 pain, steroid, orthosis and invasive intervention guidance; oncology bone-modifying therapy principles.

Pain clinic workflow: practical routing

1. **Cancer history + new/ worsening spine pain**
2. **Screen: neuro + mechanical pain**
3. **MRI/CT when red flags or known lesion**
4. **Calculate SINS and read ESCC**

Neurologic signs

ED/MSCC service now
MRI urgently
Dexamethasone if MSCC signs
Spine/RadOnc decision

SINS >= 7 or mechanical pain

Urgent spine oncology
Activity precautions/brace
CT for stability/procedure plan
No routine injection delay

Stable tumor pain

Radiation/medical oncology
Analgesic plan
Consider SBRT/EBRT based on goals
Monitor neuro status

Alternative pain generator

Treat only after imaging confirms safe target
Review labs/anticoagulation
Coordinate oncology timing

Any deterioration while awaiting treatment should reset the pathway to emergency reassessment.

Adapted workflow from NICE NG234, SINS and NOMS principles for pain medicine triage.

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Thank You