Clinical Predictors of Dedicated MRI Ordering in Emergent Spine Evaluation: Assessing Whole-Spine Screening Practices

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INTRODUCTION: Total magnetic resonance imaging (MRI) spine screens are frequently ordered in emergency department (ED) patients presenting with spine-related complaints, serving as a rapid survey of the entire spine to determine etiology and rule out pathology across multiple spinal levels. While whole-spine imaging can expedite broad assessment, its diagnostic efficiency for focal, time-sensitive conditions such as cauda equina syndrome (CES) and spinal cord compression (CC) remains unclear. Many patients undergo both a spine screen and a subsequent dedicated regional MRI, increasing imaging time and delaying definitive diagnosis. This study evaluated clinical predictors of dedicated MRI use in patients with suspected CES or CC who initially had a spine screen ordered to identify factors associated with subsequent dedicated imaging. We hypothesized that patients with clinical findings concerning for either CC or CES would be more likely to undergo a dedicated MRI.

METHODS: We retrospectively reviewed 360 patients who presented to a level one trauma center between 2019-2024 who had an MRI spine screen study ordered. Patients aged ≥18 who had a spine screen MRI ordered for a musculoskeletal complaint were included. Exclusion criteria included pregnancy, incarceration, and imaging performed primarily for oncologic or infectious etiologies (e.g., malignancy, abscess). Demographics, MRI indication, ED physical exam findings, surgical history, and radiology reports were abstracted from the electronic medical record. Patients underwent either (1) a spine screen MRI only, (2) a spine screen followed by a dedicated cervical, thoracic, and/or lumbar MRI, or (3) cancellation of the spine screen with subsequent dedicated MRI. Patients were grouped based on the following imaging indications: CES, CC, or general musculoskeletal (MSK) symptoms. Additional subgroups were formed based on clinical presentation using a tiering system: Tier 1 (objective weakness, saddle anesthesia, peri-anal sensory loss, loss of rectal tone, urinary or bowel incontinence), Tier 2 (sensory deficit without motor loss, hyperreflexia, Hoffmann/Babinski signs, clonus, gait/coordination issues), or Tier 3 (pain or paresthesia). The primary outcome was completion of a dedicated MRI, representing cases where a spine screen did not provide sufficient diagnostic information. Multivariable logistic regression was performed in Jamovi (version 2.7.5.0) to identify predictors of dedicated MRI completion, including age, sex, symptom tier, prior spine surgery, and imaging indication. Subgroup multivariable logistic regressions were also performed for the CES and CC indication groups. Significance was set at $\alpha = 0.05$.

RESULTS: Among all patients (n = 360; 51.7% male), 44.4% underwent spine screen only, 24.4% completed both a spine screen and a dedicated MRI, and 31.1% had the spine screen canceled with direct dedicated imaging. Similar distributions were seen in the CES (n = 106; 42.5% male; 50.0%, 22.6%, and 27.3%) and CC (n = 165; 54.5% male; 44.2%, 29.7%, and 26.1%) subgroups. In the combined cohort, older age (OR 1.02, 95% CI 1.00–1.04, p = 0.016) and Tier 2 symptoms (OR 3.45, 95% CI 1.27–9.34, p = 0.015) independently predicted receiving a dedicated MRI, whereas sex, Tier 1 symptoms, prior spine surgery, indication (CES or CC vs MSK), and spine screen completion were not significant. In the CES subgroup, no covariates were significant predictors of receiving a dedicated MRI. In the CC subgroup, Tier 2 symptoms independently predicted dedicated MRI (OR 5.37, 95% CI 1.33–21.72, p = 0.018), while no other covariates were significant.

DISCUSSION: Tier 2 symptoms were strong predictors of dedicated MRI completion, both overall and within the cord compression subgroup. These moderate deficits are broad and nonspecific, and the limited detail of the spine screen likely fails to clarify or rule out potentially significant pathology. This leaves clinicians dissatisfied and prompts them to obtain a dedicated MRI for formal evaluation. Based on these findings, patients presenting with Tier 2 symptoms or suspected of CC should proceed directly to a dedicated MRI. Older patients were also more likely to get a dedicated MRI, likely reflecting greater degenerative and pathologic spinal changes that require higher imaging detail to distinguish acute processes from chronic findings. In contrast, Tier 1 red-flag findings did not independently predict dedicated MRI completion, even though CES is a localizable, clinical diagnosis best visualized with a lumbar MRI. This may reflect protocol-driven defaults to whole-spine screening in highly acute, suspected CES cases. However, because CES typically arises from large, readily visualized lesions, the spine screen may be diagnostically sufficient, reducing the need for dedicated imaging. Together, these findings suggest that comprehensive screening appropriately captures high-acuity CES, while moderate, focal deficits and older age mark a transition point where an initial dedicated MRI could accelerate diagnosis and potentially intervention in emergent cases.

SIGNIFICANCE/CLINICAL RELEVANCE: Tier 2 symptoms were the strongest predictors of dedicated MRI in both the total cohort and the cord compression subgroup, suggesting that whole-spine screening may not provide enough detail to evaluate the subtle pathology commonly found in patients with these presentations. Older age also predicted dedicated MRI, possibly reflecting greater degenerative complexity that requires more comprehensive imaging. Tier 1 red-flag findings were not independently associated with dedicated MRI, potentially because pathology causing CES is typically larger and more easily ruled out with low resolution whole-spine screening. Overall, whole-spine screening is effective when CES is suspected, while moderate deficits or older age are more likely to prompt additional dedicated imaging, increasing the risk of redundant studies and delayed diagnosis.

IMAGES AND TABLES:

Table 1. Multivariate Logistic Regression Predicting Dedicated MRI Completion

Predictor	Combined (n = 360)			Cord Compression (n = 165)			CES (n = 106)		
	OR	95% CI	*P*	OR	95% CI	*P*	OR	95% CI	*P*
Age (per year)	1.02	1.00–1.04	**0.016**	1.01	0.99–1.04	0.28	1.02	0.99–1.05	0.18
Male sex	1.35	0.78–2.33	0.28	0.92	0.43–1.97	0.83	1.82	0.64–5.18	0.26
Tier 1 symptoms	1.16	0.59–2.28	0.66	1.28	0.53–3.05	0.59	0.66	0.14–3.05	0.59
Tier 2 symptoms	3.45	1.27–9.34	**0.015**	5.37	1.33–21.72	**0.018**	1.59	0.13–19.17	0.72
Prior spine surgery	0.73	0.25–2.11	0.56	0.13	0.01–1.19	0.07	1.53	0.29–8.03	0.61
Indication: CES vs MSK	1.25	0.55–2.82	0.60	—	—	—	—	—	—
Indication: CC vs MSK	1.55	0.75–3.22	0.24	—	—	—	—	—	—