

Get Clarity On Generics

Cost-Effective CT & MRI Contrast Agents





This information is current as of August 1, 2025.

Enhancing Clarity in Dynamic Myelography Reporting: Results of a Survey of Patients and Referring Providers Evaluating a Standardized Reporting System in the Myelographic Workup of Patients with Suspected Spontaneous Intracranial Hypotension

Andrew L. Callen, Samantha L. Pisani Petrucci, Debayan Bhaumik, Peter Lennarson, Marius Birlea, Jennifer MacKenzie, Jodi Ettenberg and Lalani Carlton Jones

AJNR Am J Neuroradiol published online 26 March 2025 http://www.ajnr.org/content/early/2025/03/26/ajnr.A8751

This represents the accepted version of the manuscript and also includes the supplemental material; it differs from the final version of the article.



Enhancing Clarity in Dynamic Myelography Reporting: Results of a Survey of Patients and Referring Providers Evaluating a Standardized Reporting System in the Myelographic Workup of Patients with Suspected Spontaneous Intracranial Hypotension

Andrew L. Callen, Samantha L. Pisani Petrucci, Debayan Bhaumik, Peter Lennarson, Marius Birlea, Jennifer MacKenzie, Jodi Ettenberg, and Lalani Carlton Jones

ABSTRACT

BACKGROUND AND PURPOSE: Dynamic myelography is a critical diagnostic tool for identifying cerebrospinal fluid (CSF) leaks, yet the current lack of standardized reporting can lead to variability in both clinical decision-making and patient understanding. To address these issues, we developed the Spontaneous Intracranial Hypotension Reporting and Data System (SIH-RADS), a standardized scoring system designed to categorize findings on dynamic myelography based on the degree of diagnostic certainty. We then administered a survey to patients and referring providers in order to evaluate the perceived value, clarity, and impact of SIH-RADS on patient and provider experiences as an adjunct to traditional reporting methods for dynamic myelography.

MATERIALS AND METHODS: The SIH-RADS scoring system was developed as a collaborative effort between patients and physicians, with six categories ranging from "Definite Positive with Precise Localization" (SIH-RADS 5) to "Technical Failure" (SIH-RADS 0). Surveys were distributed to three groups: (1) patients who had undergone myelography at our institution for suspected SIH, (2) anonymous patients via private spinal CSF leak groups on social media who had previously undergone myelography, and (3) referring providers who order myelograms for SIH evaluation. Survey questions assessed understanding of traditional reports, clarity of the SIH-RADS system, its impact on decision-making, and preferences for future reporting. Statistical comparisons between local and anonymous patient responses were performed using chi-square tests for categorical variables and t-tests for continuous variables. The observational study STROBE Checklist was utilized, with the proposed methodology followed.

RESULTS: A total of 125 patients (78 local patients, 47 anonymous patients) and 13 providers participated in the survey. Among patients, 77% expressed a preference for SIH-RADS over traditional reporting methods, and 58% believed it would improve their understanding of myelography results. Among providers, 92% favored adopting SIH-RADS for future reports, with 85% rating it as very or extremely useful for guiding clinical decisions. 92% of providers reported that the standardized system would enhance communication with patients. Qualitative feedback emphasized the benefits of clearer categorization and actionable recommendations, while also highlighting opportunities to refine patient-facing language and address ambiguities in intermediate scores.

CONCLUSIONS: A structured reporting system improves the perceived clarity, utility, and communication of dynamic myelography findings among both patients and providers.

ABBREVIATIONS: CSF = cerebrospinal fluid; SIH = spontaneous intracranial hypotension; CVF = CSF venous fistula.

Received February 11, 2025; accepted after revision March 21, 2025.

From the Department of Radiology (A.L.C, S.LP, D.B.), Department of Neurosurgery (P.L), Department of Neurology (M.B.) at the University of Colorado Anschutz Medical Campus, Aurora, CO, USA and patient authors (J.M., J.E.).

The authors declare no relevant conflicts of interest.

Please address correspondence to Andrew L. Callen MD, Department of Radiology, University of Colorado Anschutz Medical Campus, 12401 E 17th Ave, Aurora CO 80045 USA; andrew.callen@cuanschutz.edu

SUMMARY SECTION

PREVIOUS LITERATURE: Prior studies in radiology have emphasized the importance of structured reporting systems (e.g., BI-RADS, LI-RADS), but no standardized approach exists for interpreting dynamic myelography in spontaneous intracranial hypotension. Unstructured reports often lack clarity, contributing to variability in treatment and patient understanding.

KEY FINDINGS: The majority of both patients and providers found SIH-RADS to be clearer and more useful than traditional reporting,

with 77% of patients and 92% of providers preferring its adoption.

KNOWLEDGE ADVANCEMENT: SIH-RADS introduces a novel, structured scoring system for dynamic myelography that improves communication, enhances diagnostic clarity, and facilitates shared decision-making between clinicians and patients.

INTRODUCTION

Dynamic myelography is an essential diagnostic modality for evaluating cerebrospinal fluid (CSF) leaks and CSF venous fistulas (CVF) in patients with spontaneous intracranial hypotension (SIH). While some CSF leaks or CVF are clearly delineated on myelography, at other times findings can be more ambiguous. For example, while some CVF are clearly delineated by a single markedly hyperdense paraspinal vein or a dural tear localized to a precise point of contrast extravasation (Figure 1), other leaks may have an indeterminate origin, with several hyperdense veins, and/or contrast emanating more diffusely from a dural defect. (Figure 2). Perhaps even more challenging, some paraspinal veins may demonstrate intermediate density, raising the question of a potential but not definite CVF. (Figures 3 and 4). Other exams may be definitively negative (Figure 5), while on occasion artifacts may render an exam nondiagnostic. (Figure 6) Due to these factors, the interpretation and reporting of dynamic myelography findings remain inconsistent across institutions, often leading to variability in patient care and understanding. Unstructured reports lack standardized terminology and may fail to communicate the degree of diagnostic certainty effectively, which may hinder clinical decision-making and patient comprehension. Prior work has suggested that ambiguous or unclear language in radiology reports can lead to poor patient care. ^{2,3} In the context of SIH, treatment options include targeted or empiric epidural patching, transvenous embolization, and/or surgical intervention. As a result, effective clinical decision-making depends on the accurate characterization of both the probability and the precise location of a spinal CSF leak to balance the risks and benefits of available treatments.

To address these challenges, we developed the Spontaneous Intracranial Hypotension Reporting and Data System (SIH-RADS). This system categorizes dynamic myelography findings into six distinct levels of certainty and provides actionable recommendations tailored to each category. We then administered a survey to patients and referring providers in order to assess the scoring system's clarity and potential clinical utility. This study evaluates the impact of the SIH-RADS system on patients and providers by assessing its perceived value, clarity, and potential to improve clinical decision-making compared to traditional reporting methods.

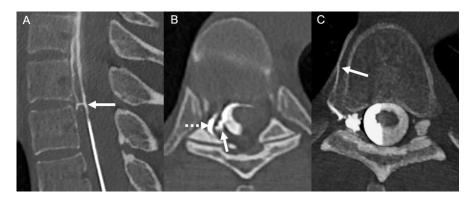


FIG 1. SIH RADS 5 - Definite Positive - Precise Localization. (A) Prone dynamic CTM showing ventral leakage of contrast at T1-T2 (arrow). (B) Right lateral decubitus dynamic CTM showing a lateral leak (arrow) with epidural accumulation of contrast (dashed arrow). (C) Right lateral decubitus CTM showing a CSF-venous fistula at right T6-T7 with opacification of the right T6 paravertebral vein (arrow).

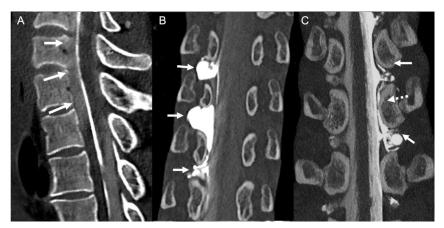


FIG 2. SIH RADS 4 - Definite Positive - Uncertain Origin. (A) Prone dynamic CTM shows ventral epidural accumulation of contrast

(arrows), confirming a leak, but the point of communication with the subarachnoid column of contrast is not shown. (B) Right lateral decubitus CTM shows irregular collections of contrast in multiple thoracic foramina but the site of the lateral leak is not demonstrated clearly. (C) Left lateral decubitus CTM shows abnormal opacification of foraminal veins at two levels (arrows) and the intervening internal vertebral venous plexus (dashed arrow), indicating a CSF-venous fistula but the level of origin of the CVF is not clear.

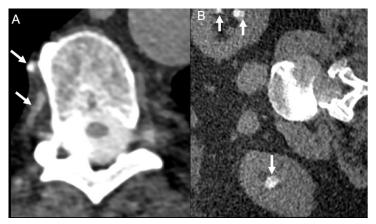


FIG 3. SIH RADS 3 - Possible Positive. (A) Right lateral decubitus CTM shows equivocal increased attenuation in a right paravertebral vein at T8 (arrows) but not substantially greater than on the left side, other than distally. Appearances were regarded as suspicious but not definitive for a CSF-venous fistula. (B) Same right lateral decubitus CTM shows early renal excretion of contrast (arrows) further supporting evidence of CSF venous fistula. The patient underwent surgical exploration which confirmed the presence of a fistula at this level which was ligated with full recovery.



FIG 4. SIH RADS 2 - Unlikely Positive, Artifact Favored. Left lateral decubitus CTM shows apparent minor increase in attenuation of the left internal vertebral venous plexus (arrow) which was attributed to a combination of beam hardening artefact and scatter caused by adjacent dense contrast medium.



FIG 5. SIH RADS 1 - Definite Negative. Left lateral decubitus CTM, performed in same session as initial right lateral decubitus CTM, did not show any abnormal venous opacification at any level on either side.



FIG 6. SIH RADS 0 - Technical Failure. (A) Prone dynamic CTM shows inadequate coating of the ventral theca by contrast, but with clear evidence of posterior displacement of the contrast column by a ventral epidural fluid collection. (B) Prone dynamic CTM shows significant motion artefact caused by patient breathing during the acquisition. (C) Left lateral decubitus CTM shows typical appearance of a subdural injection of contrast.

MATERIALS AND METHODS

Development of SIH-RADS

The SIH-RADS scoring system was developed collaboratively between neuroradiologists who routinely perform dynamic myelography (A.L.C., L.C.J, D.B, and S.P.P) and patients who had undergone workup for CSF leaks in the past (J.E. and J.M.). Specifically, the scoring system was initially drafted by neuroradiologists and was subsequently reviewed by patient authors who provided feedback on terminology and clarity, which was incorporated into the final version to enhance patient understanding. There was no direct input from neurologists during its creation.

The scoring system includes six categories, each with a corresponding definition and clinical recommendation. (**Table 1**) Each category is defined by specific imaging findings, with corresponding recommendations for clinical management. The reporting schema was introduced at our institution shortly before the survey was deployed to patients.

Table 1: SIH RADS Scoring System

Table 1. 3111 NAD3 3corning 3ystem			
Score 5: Definite Positive - Precise Localization	` '		
Definition	Clear evidence of a CSF leak or CSF venous fistula, with		
Recommendation	precise localization on imaging. Targeted treatment is indicated based on the precise location		
Recommendation	of the leak or fistula.		
Score 4: Definite Positive - Uncertain Origin (SIH-RADS 4)			
Definition	Clear evidence of a CSF leak or CSF venous fistula, but the		
	precise origin remains uncertain.		
Recommendation	Repeat myelography may be required to identify the exact		
	source. Consider repeat myelography or targeted patching as an immediate next step.		
Score 3: Possible Positive (SIH-RADS 3)	an initiadate flexe seep.		
Definition	Findings suggest the possibility of a CSF leak or venous fistula,		
	but certainty is low.		
Recommendation	Consider targeted patching for both diagnostic clarification		
	and potential therapeutic benefit. Depending on the patient's response to patching, repeat myelography may be considered		
	at a future date.		
Score 2: Unlikely Positive - Artifact Favored (SIH-RADS 2)			
Definition	Findings that are unlikely to represent a true CSF leak or CSF		
Recommendation	venous fistula, with a higher likelihood of reflecting artifact. No further definite action required. However, if high clinical		
Recommendation	or radiographic suspicion for intracranial hypotension,		
	targeted patching and/or repeat myelography may be		
	considered.		
Score 1: Definite Negative (SIH-RADS 1)			
Definition:	No evidence of a CSF leak or CSF venous fistula on dynamic myelography with high degree of certainty.		
Recommendation:	No further specific action is required based on the		
	myelography results. If MRI brain indicates high probability of		
	a CSF leak, repeat myelography should be considered. Empiric		
	non-targeted epidural patching could also be considered		
Score 0: Technical Failure (SIH-RADS 0)	depending on the degree of clinical suspicion.		
Definition:	Technical failure of the procedure due to either		
	subdural/epidural injection, inadequate contrast layering,		
	patient motion artifact, or scanner failure resulting in non-		
Recommendation:	diagnostic study.		
Recommendation.	Repeat myelography is recommended.		

Survey Design

Three tailored surveys were developed for the following groups:

- 1. **Local Patients:** Patients worked up for spontaneous CSF leaks at our institution.
- 2. Anonymous Public Patients: Individuals with prior myelography experiences who responded via social media.
- 3. **Providers:** Referring physicians who regularly order or interpret myelography studies.

The surveys incorporated multiple-choice, Likert-scale, and open-ended questions to explore patient understanding of traditional myelography reports, perceived clarity and utility of the SIH-RADS system, preferences regarding future adoption of standardized reporting, and the potential influence of SIH-RADS on clinical decision-making. Surveys were administered via the Qualtrics online platform. Survey questions administered to both patients and providers are provided in **Supplementary Tables 1 and 2.**

Data Collection and Statistical Analysis

The survey was initially deployed to local patients at the University of Colorado School of Medicine who had previously undergone myelography at our institution as a quality improvement project, and the retrospective analysis of the survey results was approved by the institutional review board at the University of Colorado School of Medicine. Surveys administered to internal patients included a detailed preamble outlining the purpose of the study, potential risks, and participant rights, with survey completion serving as implied consent. Surveys distributed anonymously via private spinal CSF leak groups on social media were designed to avoid the collection of any identifiable information, ensuring participant confidentiality and adherence to ethical guidelines. Surveys were also distributed to neurologists and nurse practitioners within and outside our institution, and neuroradiologists outside our institution via email who care for patients with known or suspected SIH. Survey responses were collected electronically via Qualtrics and anonymized for analysis. Quantitative data were summarized using descriptive statistics, while qualitative responses were evaluated using thematic analysis. Statistical comparisons between local and anonymous patients were conducted using chi-square tests for categorical variables (e.g., clarity ratings, preferences for SIH-RADS) and independent-sample t-tests for continuous variables (e.g., Likert-scale clarity ratings). Statistical significance was defined as p < 0.05.

RESULTS

Overall Patient Survey Results

A total of 125 patients participated in the survey, including 78 patients treated at our institution and 47 anonymous patients via social media. Selected patient survey responses are illustrated in **Figure 7**, and a complete list of questions and patient responses are provided in **Supplementary Table 1.** 32% of patients reported having one past myelogram, 28% reported having two past myelograms, and 39% reported having 3 or more past myelograms. 38% of patients had their most recent myelogram within the last 6 months, 28% had their most recent myelogram 6-12 months prior to taking the survey, and 33% of patients had their most recent myelogram over 12 months prior to taking the survey.

When all patients were analyzed together, 75% reported that they "mostly" or "completely" understood their original myelography reports, while 25% expressed lesser understanding, rating their comprehension as "somewhat", "slightly", or "not at all". 46% of patients felt that their original report described any uncertain or possible, but not definite findings. Among patients who had one myelogram, 37.5% reported complete understanding, compared to 34.3% of those with two myelograms and 22.0% of those with three or more myelograms. ($\chi^2 = 1.56$, p = 0.458)

Following exposure to SIH-RADS, 58% of respondents indicated that the scoring system was "somewhat clearer" or "much clearer" than their original reports. In contrast, 30% found it "about the same," while 12% felt it was less clear. Overall, 77% of patients preferred the SIH-RADS system to traditional reporting methods. 58% expressed that the system would have helped them better understand their myelography results.

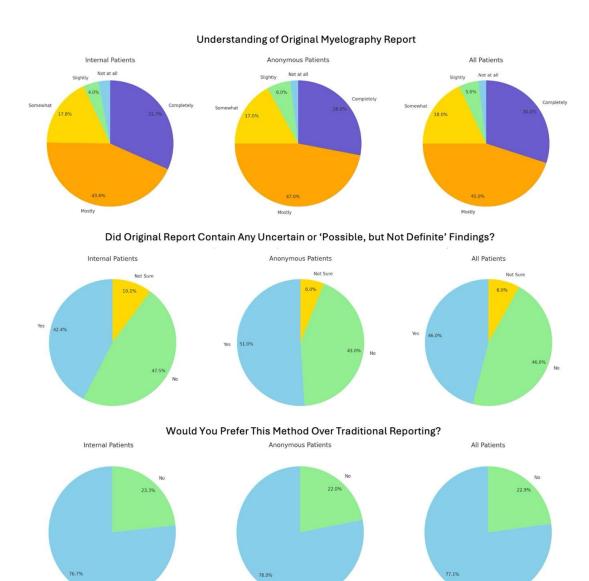


FIG 7. Pie charts illustrating selected patient survey responses.

Subanalysis: Local Patients vs. Anonymous Patients

Among local patients, 32% reported a "complete" understanding of their original myelography reports, compared to 28% of anonymous patients, a difference that was not statistically significant ($\chi^2 = 0.10$, p = 0.75). Despite this, the majority of both groups demonstrated a preference for SIH-RADS in future reporting, with 56% of local patients and 60% of anonymous patients favoring its use (p = 0.87).

When asked about clarity, 38% of local patients found SIH-RADS to be "somewhat clearer" than traditional reports, compared to 21% of anonymous patients, though this difference did not reach statistical significance ($\chi^2 = 3.23$, p = 0.072). Additionally, 22% of local patients and 34% of anonymous patients rated SIH-RADS as "much clearer" than traditional reporting methods.

More anonymous patients felt that SIH-RADS would have influenced their decisions to pursue further treatment or testing post-myelography, with 50% responding yes compared to 24% of local patients. This difference was statistically significant (p = 0.0087).

Provider Survey Results

Thirteen providers, including 8 neurologists (62%) including 5 within our institution and 3 outside our institution, 3 neuroradiologists from

outside our institution (23%), and two headache Nurse Practitioners within our institution (15%) participated in the survey, with a mean of 10.9 years in practice (SD 9.6). Selected provider survey responses are illustrated in **Figure 8**, and a complete list of questions and provider responses are provided in **Supplementary Table 2**. All (100%) providers rated SIH-RADS either "Much Clearer" or "Somewhat Clearer" than traditional reporting, with 77% rating it "Much Clearer" and 23% rating it "Somewhat Clearer". 85% of providers rated it as "very" or "extremely useful" for guiding clinical decisions. Providers emphasized the value of standardized reporting for reducing ambiguity, improving communication with patients, and clarifying next steps in management.

The majority of providers (92%) indicated that SIH-RADS would enhance their ability to communicate findings effectively to patients. Qualitative feedback highlighted the importance of transparency and consistency in reporting, which fosters trust and reduces misinterpretation by both patients and referring clinicians. Providers also suggested refining the intermediate scores (e.g., SIH-RADS 3 and 4) to address potential ambiguities.

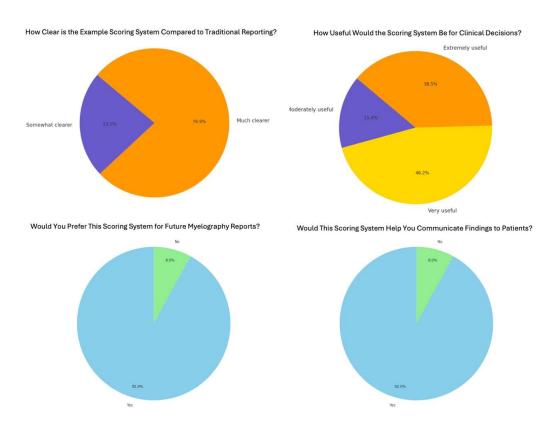


FIG 8. Pie charts illustrating selected provider survey responses

Thematic Analysis of Feedback

Key themes emerged from qualitative feedback. Respondents praised SIH-RADS for its clear categorization of findings, actionable recommendations, and potential to standardize reporting practices across institutions. Some patients recommended simplifying technical language for non-clinical audiences, while providers advocated for greater precision in scoring criteria for ambiguous cases.

DISCUSSION

The findings of this pilot study suggest that a standardized reporting lexicon for findings on dynamic myelography enhances the clarity, utility, and communication of dynamic myelography reports for both patients and providers. By introducing standardized terminology and actionable recommendations, the system addresses challenges in reporting practices in a field where diagnostic findings can be ambiguous at times while directed or empiric treatment options pose tangible risks to the patient.

Our findings are in keeping with a generalized trajectory across radiology to standardize lexica in several pathologies, including the characterization of thyroid (TI-RADS), breast (BI-RADS), and liver (LI-RADS) lesions.^{4,5} Inherent to these lexica and their followup recommendations are the necessary characterization of uncertain, or indeterminate findings, such as the management of incidental

pulmonary nodules.⁶ However, unlike these systems, SIH-RADS also addresses a broader spectrum of diagnostic uncertainty, incorporating intermediate categories that reflect the inherent complexities of dynamic myelography and diagnostics in the field of spinal CSF leaks. The communication of the degree of diagnostic certainty (or uncertainty) is a necessary part of radiology reporting. Unfortunately, the manner in which diagnostic ambiguity is communicated in traditional unstructured radiology reports varies significantly amongst radiologists and between radiologic subspecialities.^{7,8} Meanwhile, referring clinicians tend to prefer radiology reports that are less ambiguous, and the misinterpretation or misunderstanding of a radiology report's intended meaning may lead to inappropriate tests or treatment.⁹⁻¹² In this study, provider responses highlighted potential ambiguities in intermediate SIH-RADS categories, particularly between SIH-RADS 3 and 4. These categories were intentionally designed to reflect a continuum of diagnostic certainty, with SIH-RADS 4 indicating a higher level of confidence than SIH-RADS 3 while still acknowledging some uncertainty, ensuring that reports communicate the degree of confidence in imaging findings rather than forcing a binary classification.

The majority of patients in this study reported that the structured format of SIH-RADS improved their confidence in understanding diagnostic findings and facilitated informed decision-making, while providers valued the system's potential to reduce variability in interpretation, increase accuracy, foster multidisciplinary collaboration, and improve patient communication. Anonymous patients were statistically significantly more likely to report that the use of this system would have likely changed their decisions on whether or not to pursue further treatment or testing compared with local patients, likely attributable to institutional practices and patient followup/post procedure communication. However, local and anonymous patients reported similar baseline comprehension of their original myelography reports. The nuances in both report comprehension and the effect of reporting on decision making warrants further investigation.

Importantly, many of the comments provided by patients in the survey expressed concern that a "definitive negative" designation on their myelography report would preclude them from obtaining further workup or empiric treatment for suspected SIH. Further, some patients shared that their CSF leak was not detected on their first myelogram but was localized on a subsequent myelogram, and were thus concerned that this language may have created an obstacle for the repeat testing that eventually achieved leak localization and the potential for cure. These sentiments highlight important themes in the field of SIH diagnosis and treatment, which has seen rapid advances in the past several years. First, the true sensitivity of myelography is unknown, particularly as different institutions have varying procedural techniques, and several factors such as timing, contrast density, respiratory phase, and pressure augmentation have been suggested to influence CSF-venous fistula detection. The Further photon-counting CT has emerged as a potentially more sensitive tool for CSF-venous fistula localization, compared with energy integrating detector CT. Thus, the diagnostic value of a repeat myelogram utilizing a different combination of these adjunctive techniques and/or repeating a myelogram on a photon-counting CT after a "negative" examination on an integrating detector CT is unknown. Second, work by Carroll et al. has demonstrated long term clinical benefit of empiric epidural patching in a subset patients who had clinical symptoms suspicious for SIH, but with negative myelography. Thus, it is important to recognize that any negative test result, or in this context a low SIH-RADS score, should be interpreted in the context of the patient's entire clinical picture and should not independently influence limitations to repeat testing and/or empiric therapy, as clinically appropriate.

There are significant limitations to this study. A key limitation being the relatively small number of provider responses, with a majority of surveyed providers practicing at our institution. Thus this sample may not fully represent broader provider perspectives on SIH-RADS implementation across different institutions. Future studies with a larger and more diverse provider sample would help further assess the generalizability of these findings. Additionally, we could not guarantee duplication between our patients and the anonymous patients, nor was there a way to guarantee that the anonymous patients truly underwent prior myelography. Recall bias could have affected the answers as one third of the patients had their myelograms more than one year before the survey. Further, responses were based on memory rather than a direct review of their original reports, which may have influenced their perceptions, and approximately two-thirds of patients had undergone multiple myelograms, some of which may have been reported differently, making direct comparisons between the standardized and prior reports more challenging. Followup recommendations made in this survey are based on our practice patterns and may not be reflective of generalized practice patterns. Future refinements should address the need for simplified language in patient-facing reports and additional clarity in intermediate scoring categories. These improvements could further enhance the system's impact on clinical decision-making and patient outcomes.

CONCLUSIONS

The SIH-RADS system provides a structured approach to reporting dynamic myelography findings in patients evaluated for SIH. This study suggests that SIH-RADS improves clarity and communication for both patients and referring providers, addressing a key gap in traditional reporting methods. Survey results highlight the need for consistent terminology in radiology reporting, particularly in conditions where diagnostic uncertainty is common. Future research should focus on validating the system's clinical utility, assessing its impact on diagnostic accuracy and treatment outcomes, and refining its intermediate categories to ensure optimal applicability across diverse clinical settings.

ACKNOWLEDGMENTS

We thank the survey participants for their valuable insights and contributions to this study.

REFERENCES

- Callen AL, Timpone VM, Schwertner A, et al. Algorithmic Multimodality Approach to Diagnosis and Treatment of Spinal CSF Leak and Venous Fistula in Patients With Spontaneous Intracranial Hypotension. American Journal of Roentgenology https://doi.org/10.2214/AJR.22.27485.
- 2. Valls C. Pitfalls of the vague radiology report. AJR Am J Roentgenol 2001;176:253-4.
- 3. Levinson W. Physician-patient communication. A key to malpractice prevention. JAMA 1994;272:1619–20.
- Hoang JK, Middleton WD, Farjat AE, et al. Reduction in Thyroid Nodule Biopsies and Improved Accuracy with American College of Radiology Thyroid Imaging Reporting and Data System. Radiology 2018;287:185–93.
- Tang A, Bashir MR, Corwin MT, et al. Evidence Supporting LI-RADS Major Features for CT- and MR Imaging-based Diagnosis of Hepatocellular Carcinoma: A Systematic Review. Radiology 2018;286:29–48.
- MacMahon H, Naidich DP, Goo JM, et al. Guidelines for Management of Incidental Pulmonary Nodules Detected on CT Images: From the Fleischner Society 2017. Radiology 2017;284:228–43.
- 7. Rosenkrantz AB, Kiritsy M, Kim S. How "consistent" is "consistent"? A clinician-based assessment of the reliability of expressions used by radiologists to communicate diagnostic confidence. Clin Radiol 2014;69:745–9.
- 8. Callen, Dupont, Price, Laguna, McCoy, Do, Talbott, Kohli, Narvid. Between Always and Never: Quantifying Hedging in Radiology using Natural Language Processing. *J Am Coll Radiol*.
- 9. Clinger NJ, Hunter TB, Hillman BJ. Radiology reporting: attitudes of referring physicians. Radiology 1988;169:825-6.
- 10. Panicek DM, Hricak H. How Sure Are You, Doctor? A Standardized Lexicon to Describe the Radiologist's Level of Certainty. AJR Am J Roentgenol 2016;207:2–3.
- 11. Wallis A, McCoubrie P. The radiology report--are we getting the message across? Clin Radiol 2011;66:1015-22.
- 12. Sobel JL, Pearson ML, Gross K, et al. Information content and clarity of radiologists' reports for chest radiography. Acad Radiol 1996;3:709–17.
- 13. Edelmuth DGL, Amrhein TJ, Kranz PG. Density and Time Characteristics of CSF-venous fistulas on CT myelography in Patients with Spontaneous Intracranial Hypotension. *AJNR Am J Neuroradiol* 2024 Sep 30. [Epub ahead of print].
- Callen AL, Fakhri M, Timpone VM, et al. Temporal Characteristics of CSF Venous Fistulas on Dynamic Decubitus CT Myelography: A Retrospective Multi-Institution Cohort Study. AJNR Am J Neuroradiol https://doi.org/10.3174/ajnr.A8078.
- 15. Lützen N, Zander C, Dersch R, et al. Cerebrospinal fluid-venous fistula visualisation by intrathecal pressurization: A technical note and illustrative case. *Neuroradiol J* 2024 Jul 31. [Epub ahead of print].
- Kranz PG, Malinzak MD, Gray L, et al. Resisted Inspiration Improves Visualization of CSF-Venous Fistulas in Spontaneous Intracranial Hypotension. AJNR Am J Neuroradiol 2023;44:994

 –8.
- Madhavan AA, Yu L, Brinjikji W, et al. Utility of photon-counting detector CT myelography for the detection of CSF-venous fistulas. AJNR Am J Neuroradiol 2023;44:740–4.
- Madhavan AA, Cutsforth-Gregory JK, Brinjikji W, et al. Diagnostic Performance of Decubitus Photon-Counting Detector CT Myelography for the Detection of CSF-Venous Fistulas. AJNR Am J Neuroradiol https://doi.org/10.3174/ajnr.A8040.
- Carroll I, Han L, Zhang N, et al. Long-term epidural patching outcomes and predictors of benefit in patients with suspected CSF leak nonconforming to ICHD-3 criteria. Neurology 2024;102:e209449.
 - 8. Callen AL, Dupont SM, Price BD, Laguna B, McCoy MJ, Do HM, Talbott JM, Kohli MD, Narvid J. Between always and never: quantifying hedging in radiology using natural language processing. J Digit Imaging. 2020;33(5):1194-1201.

SUPPLEMENTAL FILES <u>Supplementary Table 1:</u> Survey questions and results from patients.

Question	Answer Choices	Internal Patients (n = 78)	Anonymous Patients (n = 47)	All Patients (n = 125)
How well did you understand the results	Not at all	2/78 (3%)	1/47 (2%)	3/125 (2%)
of your original myelography report?	Slightly	3/78 (4%)	3/47 (6%)	6/125 (5%)
	Somewhat	14/78 (18%)	8/47 (17%)	22/125 (18%)
	Mostly	34/78 (44%)	22/47 (47%)	56/125 (45%)
	Completely	25/78 (32%)	13/47 (28%)	38/125 (30%)
Do you feel that your original myelography report described any	Yes	33/78 (42%)	24/47 (51%)	57/125 (46%)
uncertain or "possible, but not definite" findings?	No	37/78 (47%)	20/47 (43%)	57/125 (46%)
	Not Sure	8/78 (10%)	3/47 (6%)	11/125 (8%)
After reading the example scoring	Much less clear	1/78 (1%)	5/47 (11%)	6/125 (5%)
system, how clear is the information presented compared to your original report?	Somewhat less clear	6/78 (8%)	3/78 (6%)	9/125 (7%)
your original reports	About the same	24/78 (31%)	13/78 (28%)	37/125 (30%)

	Somewhat clearer	30/78 (38%)	10/78 (21%)	40/125 (32%)
	Much clearer	17/78 (22%)	16/78 (34%)	33/125 (26%)
Do you think this standardized scoring system would have helped you better	Yes	44/78 (56%)	28/47 (60%)	72/125 (58%)
understand your myelography results?	No	34/78 (44%)	19/47 (40%)	53/125 (42%)
If this scoring system had been used in your original report, do you think it would have influenced your decision on treatment options, pursuing	Yes	19/78 (24%)	23/47 (50%)	42/125 (34%)
further treatment or testing?	No	59/78 (76%)	23/47 (50%)	82/125 (66%)
Did your original report include any	Yes	10/78 (13%)	5/47 (11%)	15/125 (12%)
standardized lexicon or scoring system?	No	32/78 (42%)	37/47 (80%)	69/125 (55%)
	Not sure	34/78 (45%)	4/47 (9%)	38/125 (30%)
After reviewing the example scoring system, would you prefer this method over traditional reporting for understanding your medical results?	Yes	56/73 (77%)* 17/73 (23%)*	36/47 (78%) 10/47 (22%)	92/120 (77%) 27/120 (23%)
*(5 nonresponses)				
How long ago was your most recent	Within the last 6 months	29/78 (38%)	18/47 (39%)	47/125 (38%)
myelogram?	6-12 months ago	22/78 (29%)	13/47 (28%)	35/125 (28%)
	More than 12 months ago	26/78 (34%)	15/47 (33%)	41/125 (33%)
How many total myelograms have you	1	29/78 (38%)	11/47 (23%)	40/125 (32%)
had?	2	26/78 (34%)	9/47 (19%)	35/125 (28%)
	3 or more	22/78 (29%)	27/47 (57%)	49/125 (39%)

Supplementary Table 2: Survey questions and results from providers.

Question	Respondents (n = 13)	
Does your current practice or the radiology reports you receive for myelography include any standardized lexicon or scoring	Yes	1/13 (8%)
system?	No	10/13 (77%)

Much less clear Somewhat less clear About the same	0/13 (0%) 0/13 (0%)
	, ,
About the same	0/13 (0%)
	0/13 (0%)
Somewhat clearer	3/13 (23%)
Much clearer	10/13 (77%)
Not at all useful	0/13 (0%)
Slightly useful	0/13 (0%)
Moderately useful	2/13 (15%)
Very useful	6/13 (46%)
Extremely useful	5/13 (38%)
Yes	12/13 (92%)
No	1/13 (8%)
Worse	0/13 (0%)
About the same	1/13 (8%)
Better	12/13 (92%)
Yes	12/13 (92%)
No	1/13 (8%)
	Much clearer Not at all useful Slightly useful Moderately useful Very useful Extremely useful Yes No Worse About the same Better Yes