Evaluating Correlation of Two Pain Scales in Spinal Procedures

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The Visual Analog Scale and Verbal Numeric Rating Scale are valuable tools to assess pain intensity in certain groups of patients. This study explores whether these scales can be used interchangeably in patients who are undergoing spinal intervention for chronic pain.

Patients undergoing interventional spinal procedures for chronic pain—such as selective nerve root blocks (SNRB), epidural steroid injections (ESI), and zygapophysial facet injections (FAC)—often are asked to rate the intensity of their pain using one of two pain scales: the Visual Analog Scale (VAS) or the Verbal Numeric Rating Scale (VNRS). Some researchers, however, have questioned whether results of the VAS and VNRS correlate in all clinical situations, and as such, practitioners cannot assume the scales are applicable with regard to interventional spinal procedures.[1,2] Therefore, we examined the use of these scales specifically in patients who underwent spinal procedures for chronic pain management. To our knowledge, our study is the first to assess the validity and interchangeability of these scales in this specific population.

BACKGROUND

From a physiologic standpoint, the sensation of pain has been well characterized: Receptors located throughout the body sense stimuli, and specialized nerve fibers relay these signals from the periphery through the spinal cord to the brain, where they are perceived as pain.[3] From a clinical standpoint, however, the difficulty encountered in characterizing pain has resulted in much research aimed at creating a quality tool for accurate, reproducible, and efficient measurement of pain. The VAS and the VNRS were utilized to address these issues.

The VAS is a vertical line anchored by words describing absence of pain at one end and intense pain at the other; a continuum on which the patient marks the level of pain he or she is experiencing. The VNRS features a numeric range from which the patient selects to indicate pain intensity. These pain scales have found favor because they are easy to administer and score, have the potential for consistent and accurate use by a variety of health care professionals, and have high levels of interrater reliability and validity.[4–9]

In addition, the VAS and VNRS have emerged as valuable tools for assessing pain because they have been studied extensively in patients with a variety of pain backgrounds. Jensen and colleagues, for example, showed the validity of the VAS and VNRS in patients undergoing first trimester abortions.[10] Other studies have demonstrated high correlation between the VAS and VNRS in patients with postoperative, cancer-related, rheumatologic, labor, and acute pain in an emergency department (ED) setting.[4,5,11–15]

Some studies have suggested that verbal and visual analog scales may not always correlate, however. Lund and colleagues concluded that the two types of scales may confer different meanings of rated pain intensity and may not be interchangeable, depending on the cause of pain.[2] Hartrick and colleagues found linear correlations between the VAS and VNRS for patients in labor and for postoperative patients with thoracic or abdominal incisions during cough, but not for the same postoperative patients with pain at rest or for postoperative orthopedic patients.[1] These results have led some researchers to conclude that the VNRS and VAS should not be used interchangeably. There is limited research on the use of these scales in the setting of interventional pain procedures, which our study aims to address.

STUDY DESIGN AND PARTICIPANTS

After receiving approval from our VA facility's Institutional Review Board, we screened 83 patients treated at the outpatient surgery center of a large VA hospital for inclusion in the study on a consecutive basis during six months in 2004. All patients had

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Table 1. Preprocedure and postprocedure pain scores using the VAS[a] and VNRS[b]

	Preprocedure		Postprocedure	
Score statistic	VAS	VNRS	VAS	VNRS
Mean	6.55	6.83	1.99	2.21
Median	6.80	7.00	1.70	2.00
Mode	6.80	5.00	1.00	1.00
SD[c]	2.19	1.79	1.72	2.07

[a]VAS = Visual Analog Scale. [b]VNRS = Verbal Numeric Rating Scale. [c]SD = standard deviation.

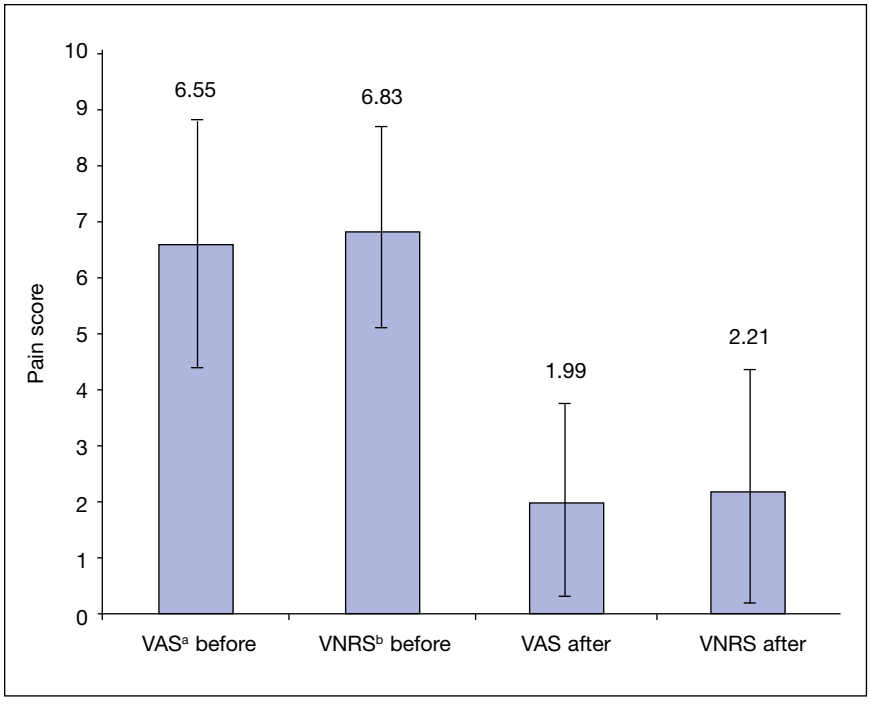

Figure. Mean pain scores reported by patients before and after undergoing interventional spinal procedures. [a]VAS = Visual Analog Scale. [b]VNRS = Verbal Numeric Rating Scale.

chronic lower back pain and were referred from the hospital's chronic pain clinic to undergo SNRB, ESI, or zygapophysial FAC in order to manage their pain. Patients who were unable to complete the VAS because of cognitive or physical impairments (such as dementia or impaired vision), patients who did not understand English, and patients who ultimately did not undergo the procedure were excluded from the study. Forty-seven of 83 patients met inclusion criteria and completed both scales with data intact. No study participants received sedation before, during, or after the procedures.

Before each interventional spinal procedure, the injecting physician administered the two pain scales to the patient within 10 minutes of each other. Patients first were given the VAS with instructions to mark their pain on a 10-cm vertical line with "no pain" noted at the bottom end and "the most excruciating pain imaginable" noted at the top end. For the VNRS, the physician asked the patient to verbally convey his or her pain level from 0 to 10, with 0 being "no pain" and 10 being "the most excruciating pain imaginable." Five minutes after the procedure, patients completed another VAS followed by a second physician-directed VNRS in the recovery area. A physician measured the VAS line to the nearest millimeter. We calculated the difference between the preprocedure and postprocedure scores and analyzed them using the paired *t* test and Pearson's correlation coefficient to assess the correlation between the pain scales.

RESULTS

We collected preprocedure and postprocedure VAS and VNRS scores for all 47 patients and determined mean, median, and mode for both sets of data (Table 1). The mean preprocedure VAS and VNRS scores were 6.55 and 6.83, respectively. After the procedures, the mean VAS and VNRS scores were 1.99 and 2.21, respectively (Figure).

The paired samples *t* test showed that differences between the VAS and the VNRS were not statistically significant for either preprocedure or postprocedure administration (Table 2). This conclusion was associated with a *P* value of .257 for comparing preprocedure VAS with preprocedure VNRS and a *P* value of .419 for comparing postprocedure VAS with postprocedure VNRS. The Pearson correlation coefficient for the samples of +0.662 preprocedure and +0.522 postprocedure indicated high correlation between VAS and VNRS scores. With 47 subjects, a power analysis revealed 80% power to detect a corre-

Table 2. Results of paired samples *t* test

Paired scores	Mean (difference)	SD[a]	Standard error mean	95% CI[b]		*t* value	Degrees of freedom	*P* value
				Lower	Upper			
VAS[c] before[e] VNRS[d] before	–0.281	1.68	0.246	–0.773	0.212	1.148	46	.257
VAS after[f] VNRS after	–0.223	1.88	0.274	–0.775	0.328	0.816	46	.419
VAS before VAS after	4.560	2.50	0.365	3.826	5.294	12.500	46	< .0001
VNRS before VNRS after	4.620	2.45	0.357	3.900	5.340	12.900	46	< .0001

[a]SD = standard deviation. [b]CI = confidence interval. [c]VAS = Visual Analog Scale. [d]VNRS = Verbal Numeric Rating Scale. [e]Before interventional spinal procedure. [f]After interventional spinal procedure.

lation between VAS and VNRS of 0.4 and 90% power to detect a correlation of at least 0.45.

DISCUSSION

The VAS and VNRS often are used interchangeably to assess pain improvement in patients undergoing interventional spinal procedures despite the lack of statistical evidence showing a correlation between the two scales. Yet studies that show correlation between pain scales are important because intrinsic properties of these tools may result in different measurements of pain with potentially the same clinical significance. The VAS tends to produce fractional numbers (because it is measured in millimeters), for example, while the VNRS has an intrinsic bias towards whole numbers. Nonetheless, our study produced positive correlation coefficients between both scales in measuring pain intensity in this patient population. We conclude that either scale may be used with a high degree of reliability for assessing pain in patients undergoing interventional spinal procedures for pain management. Our finding is consistent with previous studies that have demonstrated good correlation between these two scales in patients with other pain conditions.[12,16–23]

This is not to say that the two scales are equivalent across the board. While both the VAS and VNRS scales are simple, reliable, and valid tools for measuring pain intensity and outcome in a variety of patient populations, each has advantages and disadvantages. Some observers believe that, compared with the VNRS, the VAS is more suitable as a research tool than as a clinical tool.

Clinicians should address pain measurement in various ways to ensure consistency in evaluating the "true" pain level, given discrepancies in how individual patients react to different types of pain scales. For example, when asked about their pain level, some patients have difficulty assigning a number to it as required by the VNRS. Visualizing the severity of their pain on the VAS line may help them define that level. With its infinite number of choices, the VAS also has been shown to be more accurate than the fixed-interval VNRS.[24,25]

Scoring the VAS takes more time than the VNRS, however, as it requires measuring distance along a line.[20] Furthermore, studies have associated the VAS with high nonadherence rates, possibly because the scale requires more abstract thinking and the use of an upper limb.[12,13,16,19] Another drawback of the VAS is that photocopying it may alter the length of the line.[19]

By contrast, the VNRS has better adherence rates and is less cumbersome to use. The VNRS may be preferable to the VAS in assessing pain in the ED and in patients with cancer who are acutely ill because of its higher adherence rate and because a verbal response requires less effort than a written one.[5,13,19,22,26] It is our experience that the VNRS seems to be preferable to the VAS in patients undergoing interventional spinal procedures because it is easier to administer and score, particularly in a busy outpatient surgery center. Finally, an important drawback of both scales is that they cannot be used to assess quality of pain. A consistent, reliable, reproducible, efficient, and easy method to assess pain quality has not been fully researched and developed.

Study limitations

One limitation of this study is that we analyzed only two pain scales. Although other scales—such as the qualitative scale, McGill Pain Ques-

tionnaire, and pain faces scale—are used to assess pain in interventional spinal procedures, we were unable to draw any conclusions about the correlation between these other scales and the VAS and VNRS. Future studies should address this issue by evaluating other pain assessment scales.

Another limitation is that all our study participants were from a VA patient population, which is mostly male and includes many individuals with a history of unique physical or emotional stressors. Thus, our findings may be most useful to those practicing in VA settings but may not be as applicable to patients treated in other environments.

A related limitation is the lack of diversified demographic data, since overrepresentation of a subgroup may influence study results. Peters and colleagues showed that increasing patient age correlated with increased mistakes in all pain scales, especially the VAS.[27] And by studying pain in Dutch and Egyptian women with rheumatoid arthritis, Vlaar and colleagues found that cultural differences may influence responses to different measurement methods.[28] Conversely, a study in an ED setting found no significant differences in VAS scores between gender, age, and cause-of-pain groups.[29] Because of this conflicting data, future studies should explore the correlative properties of the VAS and VNRS among larger, non-VA patient populations and subgroups (defined by age, gender, and ethnicity, for example) undergoing interventional spinal procedures.

The order in which the pain scales were administered represents a third limitation. All patients were instructed to complete the VAS before a physician-directed VNRS was administered. This raises the possibility that the VAS response of some patients may have influenced their subsequent VNRS response. We did not have a large enough population to evaluate this possibility, however, which would require comparing results in a group of patients who completed both scales with one control group who used only the VNRS and one control group who used only the VAS. Alternatively, future studies could vary the timing and order of VAS and VNRS administration. Although this alternative strategy cannot eliminate the possibility of an order effect, it may mitigate some of its influence over the data and produce more robust results.

Lastly, while this study appears to offer some support for the efficacy of these procedures by showing significantly lower postprocedure VAS and VNRS scores, it was not designed to explore efficacy. (To determine true efficacy, each interventional procedure would need to be studied in the context of each condition for which it was being used.) In addition, the postprocedure scores were obtained relatively soon after the procedure. In this timeframe, a significant amount of pain reduction could be related to the local anesthetic component of the injected mixture—the effects of which would be expected to decrease over the course of a few hours. To measure procedural efficacy, the VNRS and VAS would have to be readministered hours, days, and weeks after the procedure to determine lasting pain relief. Proving procedural efficacy, therefore, is far beyond the scope of this study.

CONCLUSION

Having a reliable method for assessing patients' level of pain is an essential part of performing interventional procedures in patients with chronic pain. Before choosing a pain assessment scale, the clinician should be aware of the advantages and disadvantages of each scale and of their relationship to one another. This study is not the first to demonstrate the correlation between the VAS and VNRS in the assessment of pain, but its value lies in being the first to support the correlative properties of these scales specifically in patients undergoing interventional spinal procedures. Although our study does not address the efficacy of the procedures in reducing pain, our data do suggest that these pain scales may be used somewhat interchangeably in this patient population. Furthermore, clinicians can be assured that both the VAS and VNRS reliably and adequately can assess whether and how much the procedures have improved their patients' pain.

Author disclosures

The authors report no actual or potential conflicts of interest with regard to this article.

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