

# Evaluating postherniorrhaphy groin pain: Visual Analogue or Verbal Rating Scale?

M. J. A. Loos · S. Houterman · M. R. M. Scheltinga ·  
R. M. H. Roumen

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## Abstract

**Introduction** Several tools for pain measurement including a Visual Analogue Scale (VAS) and a Verbal Rating Scale (VRS) are currently used in patients with chronic pain. The aim of the present study was to determine which of these two pain tests performs optimally in patients following groin hernia repair.

**Patients and methods** A questionnaire identified pain level in a cohort of patients that had previously undergone corrective groin hernia surgery. Current pain intensity was graded on a four-point VRS scale (no pain, mild, moderate or severe pain) and on a 100-mm VAS scale (0 = no pain, 100 = unbearable). “Scale failure” (one or both tests not completed correctly) was determined, and cut-off points for the VAS test were calculated by creating the optimum kappa coefficient between both tools.

**Results** The response rate was 78.2% (706/903). Scale failure was present in VAS tests more than VRS (VAS: 12.5%, 88/706 vs. VRS: 2.8%, 20/706;  $P < 0.001$ ). Advanced age was a risk factor for scale failure ( $P < 0.001$ ). The four categories of VRS corresponded to mean VAS scores of 1, 20, 42, and 78 mm, respectively. VAS categories associated with the highest kappa coefficient ( $k = 0.78$ ) were as follows: 0–8 = no pain, 9–32 = mild, 33–71 = moderate, >71 = severe pain. VAS scores

grouped per VRS category showed considerable overlap. Age and sex did not significantly influence cut-off points.

**Conclusions** Because of lower scale failure rates and overlapping VAS scores per VRS category, the VRS should be favored over the VAS in future postherniorrhaphy pain assessment. If VAS is preferred, the presented cut-off points should be utilized.

**Keywords** Groin pain · Visual Analogue Scale · Verbal Rating Scale · Hernia repair

## Introduction

The introduction of mesh techniques in groin hernia surgery has reduced recurrence rates but has rekindled interest in postherniorrhaphy pain syndromes. Several tools for assessment of pain severity are currently utilized. The McGill Pain Questionnaire [1] and the Wisconsin Brief Pain Questionnaire [2] are multidimensional pain questionnaires assessing sensory, affective, and evaluative aspects of pain. In contrast, the Visual Analogue Scale (VAS), Verbal Rating Scale (VRS), and Numerical Rating Scale (NRS) are simple unidimensional tests that only rate sensory components of pain and omit affective and psychosocial pain aspects. Researchers often rely on unidimensional systems [3] as multidimensional questionnaires are generally considered too long and too complicated.

The widely used VAS represents a 100-mm horizontal line with “no pain” (score 0) written on one end and “unbearable pain” (score 100) on the other end. Individuals are instructed to put a mark along this line at the position that currently reflects their intensity of pain. The VAS test may allow for rapid completion and has a high sensitivity. However, its conceptual complexity may result in a high

This study was unfunded.

M. J. A. Loos (✉) · M. R. M. Scheltinga · R. M. H. Roumen  
Department of Surgery, Máxima Medical Centre, PO Box 7777,  
De Run 4600, 5500 MB Veldhoven, The Netherlands  
e-mail: M.Loos@mmc.nl

S. Houterman  
MMC Academy, Máxima Medical Centre, PO Box 7777,  
De Run 4600, 5500 MB Veldhoven, The Netherlands

noncompliance rate or scale failure, particularly in elderly patients with cognitive and psychomotor impairments [4]. In contrast, a VRS exists in several versions ranging from a simple four-point (no pain, mild, moderate or severe pain) to a more complex 15-point list. The VRS excels in simplicity but may lack sensitivity due to its ordinal character [4].

The ideal pain assessment tool should be determined by type of pain and the setting in which it is measured. Unidimensional scales have routinely been employed in the evaluation of postherniorrhaphy groin pain syndromes. Which pain rating scale serves best under these circumstances is unknown since a gold standard is lacking. A random list of groin pain studies and employed pain assessment tools is depicted in Table 1 [5–18]. Some investigators used VAS tests to investigate groin pain intensity [5, 6]. To convert VAS into VRS scores, cut-off points are mandatory. These investigators introduced VAS cut-off points on arbitrary grounds (0 mm = no pain, <10 mm = mild, 10–50 mm = moderate, and >50 mm = severe pain) [5]; other general pain researchers suggested different cut-off points [19–22].

The aim of this study was to evaluate two frequently used pain rating scales (VAS and four-point VRS) for scale failure and to determine which test performs better in patients following groin hernia repair.

## Patient and methods

The present study was based on pain data obtained from a questionnaire among postherniorrhaphy cases [7]. Patients with a groin hernia repair between January 2000 and August 2005 in the Máxima Medical Centre received a postal questionnaire in February 2006. The Máxima Medical Centre is a teaching hospital serving a total population

of approximately 175,000 inhabitants. Each individual was asked to grade their present groin pain intensity on a four-point VRS (no pain, mild, moderate or severe pain) followed by a VAS (0–100 mm). Brief written instructions regarding the VAS were provided, whereas VRS instructions were deemed unnecessary. Results were analyzed for scale failure, which was defined as a situation in which the patient did not complete the pain rating scale, or if the response could not be coded to a unique score.

Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS), Windows version 12.0.1. An “outlier” in Fig. 1 was defined as a position between 1.5 and 3 box lengths from the upper or lower interquartile range. Similarly, an “extreme case” was defined as a position more than three box lengths removed from the upper or lower interquartile range. Mean and median VAS scores per VRS category with standard deviation and range were calculated. Frequency distribution of paired VAS-VRS data using different cut-off points for VAS classification was evaluated by means of square contingency tables. Optimum VAS cut-off points were identified in such a way that the VAS classification concurred optimally with VRS answers creating the optimum kappa coefficient. Using these optimum cut-off points, a subgroup analysis for sex and age was carried out to detect any difference in kappa. Kappa coefficients were compared after application of Page’s cut-off points [5] (0 mm = no pain, <10 mm = mild, 10–50 mm = moderate, and >50 mm = severe pain) on the current data set.

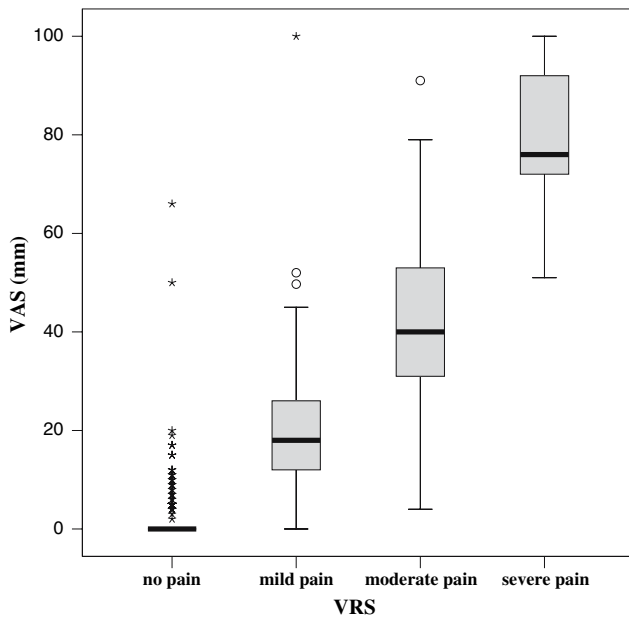
## Results

A total of 903 eligible adult patients received an elective groin hernia repair in the study period. The questionnaire was returned by 706 individuals (response rate 78.2%).

**Table 1** Pain measurement tools used in postherniorrhaphy groin pain literature

	First author	Publication date	Unidimensional	Multidimensional
	Cunningham [8]	1996	NRS/VRS (4-point)	
	Callesen [9]	1999	VRS (4-point)	
	Bay-Nielsen [10]	2001	VRS (4-point)	
	Poobalan [11]	2001		McGill
	Courtney [12]	2002		SF-36/Wisconsin
	Page [5]	2002	VAS	
	Kumar [13]	2002	Presence of pain/discomfort?	
	Lau [14]	2003	VRS (4-point)	
	Mikkelsen [18]	2004		McGill
	Grant [15]	2004	VRS (5-point)	
	Nienhuijs [6]	2005	VAS	
	O’Dwyer [16]	2005	VAS/VRS (5-point)	
	Franneby [17]	2006		DIBS
	Loos [7]	2007	VAS	

NRS Numerical Rating Scale,  
VRS Verbal Rating Scale,  
VAS Visual Analogue Scale,  
McGill McGill Pain questionnaire,  
SF-36 Short Form 36,  
Wisconsin Wisconsin Brief Pain questionnaire,  
DIBS Duration-Intensity-Behavior Scale



**Fig. 1** VAS scores ranged per VRS category in patients with groin hernia repair who completed the questionnaire ( $n = 603$ ). Outlier (*open circle*) between 1.5 and 3 box lengths from the upper or lower interquartile range. Extreme case (*asterisks*) more than 3 box lengths from the upper or lower interquartile range

Ninety-three percent of the patients were male and the mean age was  $60 \pm 14$  years. A total of 7.6% were octogenarian ( $\geq 80$  years).

Scale failure rates are listed in Table 2. Failures were present in VAS tests significantly more frequently than VRS [VAS: 12.5% (88/706) vs. VRS: 2.8% (20/706),  $P < 0.001$ ]. Five patients failed to complete both tests. Sex did not affect scale failure. In contrast, age appeared to be a significant factor for scale failure as patients who failed to complete a test ( $n = 103$ ) were on an average 7 years older than the remainder of the group (67 vs. 60 years,  $P < 0.001$ ).

Table 3 shows VRS categories plotted against corresponding VAS scores. Each VRS category displays a wide

**Table 2** Scale failures in VAS and VRS completion in patients with groin hernia repair who completed the questionnaire

Scale	$n$ (%)
VAS ( $n = 88$ )	
No result	47 (6.7) (VRS “no pain” group: $n = 43$ )
Invalid result	41 (5.8) (VRS “no pain” group: $n = 34$ )
VRS ( $n = 20$ )	
No result	10 (1.4)
Invalid result	10 (1.4)

VAS Visual Analogue Scale, VRS Verbal Rating Scale

Five patients failed to complete both scales

**Table 3** Descriptive statistics of VAS and VRS in patients with groin hernia repair who completed the questionnaire ( $n = 603$ )

	VAS (mm)	
	Mean (SD)	Median (range)
VRS		
No pain ( $n = 391$ )	1.3 (5.1)	0 (0–66)
Mild ( $n = 141$ )	20.1 (12.3)	18.0 (3–100)
Moderate ( $n = 62$ )	42.0 (18.8)	40.0 (4–91)
Severe pain ( $n = 9$ )	78.3 (16.8)	76.0 (51–100)

VAS Visual Analogue Scale (mm), VRS Verbal Rating Scale, SD standard deviation

range of VAS values. Moreover, a considerable overlap between categories was observed. The median categorized VAS scores are also depicted in Fig. 1, showing outliers (*open circles*,  $n = 3$ ) and extreme cases (*asterisks*,  $n = 18$ ). Notably, all extreme cases except for one were present in the “no pain” group.

Paired VRS and VAS data are listed in square contingency tables after application of various cut-off points. Table 4 depicts the VAS subdivision (0–8 = no pain, 9–32 = mild, 33–71 = moderate,  $>71$  = severe pain) resulting in the highest kappa coefficient (0.78). With these optimum cut-off points, there was no significant difference for the variables sex or age. In contrast, applying cut-off points as proposed by Page et al. [5] to the present data set (0 mm = no pain,  $<10$  mm = mild, 10–50 mm = moderate, and  $>50$  mm = severe pain) led to a kappa coefficient of only 0.43 (Table 5).

## Discussion

Several tools for pain measurement including a VAS and a VRS are currently used in patients with chronic pain. Ideally a pain-measurement tool is simple, sensitive, and reproducible. In the present study determining intensity of postherniorrhaphy pain, both tests were examined for simplicity by assessing their failure rate. The VAS failure rate was significantly higher compared to the VRS. This may have been affected by the order in which the scales were presented, since the highest VAS noncompliance rate was in the VRS “no pain” group. However, comparable scale failure rates ranging from 10.0 to 14.1% (VAS) and 0.0 to 0.5% (VRS) have been reported in the literature [3, 4]. Our study identified advanced age as a risk factor for VAS scale failure. In a previous pain study evaluating various pain rating scales, mental and motor impairment were also identified as relative risk factors associated with scale failure [4]. The lowest scale failure in postherniorrhaphy groin pain patients can thus be attained using a VRS.

**Table 4** Optimum VAS cut-off points in patients with groin hernia repair who completed the questionnaire ( $n = 603$ ) and kappa coefficient

	VRS category	VAS cut-off points				Kappa
		No pain = 0–8	Mild = 9–32	Moderate = 33–71	Severe = >71	
		$n = 388$	$n = 143$	$n = 61$	$n = 11$	
VAS Visual Analogue Scale (mm), VRS Verbal Rating Scale	No pain ( $n = 391$ )	372	17	2	0	0.78
	Mild ( $n = 141$ )	13	113	14	1	
	Moderate ( $n = 62$ )	3	13	43	3	
	Severe ( $n = 9$ )	0	0	2	7	

**Table 5** VAS cut-off points as used in groin pain literature [5] ( $n = 603$ ) and kappa coefficient

	VRS category	VAS cut-off points				Kappa
		No pain = 0	Mild = 1–9	Moderate = 10–50	Severe = >50	
		$n = 341$	$n = 51$	$n = 179$	$n = 32$	
VAS Visual Analogue Scale (mm), VRS Verbal Rating Scale	No pain ( $n = 391$ )	341	34	15	1	0.43
	Mild ( $n = 141$ )	0	14	125	2	
	Moderate ( $n = 62$ )	0	3	39	20	
	Severe ( $n = 9$ )	0	0	0	9	

Apart from mandatory simplicity, any pain test must also possess a high sensitivity. VAS tests are inherently associated with a higher sensitivity when compared to a VRS. However, in cross-sectional pain assessment studies this advantage also poses analytical difficulties. Application of cut-off points is mandatory in order to convert VAS into VRS scores. VAS cut-off points were introduced at an arbitrary level in one postherniorrhaphy groin pain study [5]. After application of both VAS and VRS tests on a comparable cohort of postherniorrhaphy groin pain patients, the present study revealed totally different cut-off points with higher kappa values. Moreover, our results agreed with other pain studies assessing patients with a stroke, laparotomy or knee surgery (0 mm = no pain, <30 mm = mild, 30–70 mm = moderate and >70 mm = severe pain) [19–22]. Thus, with employment of the present cut-off points, the best possible interpretation of VAS scores can be obtained.

What factors determine the level of VAS cut-off points? The present study did not reveal any age- or sex-related VAS scale variation, in keeping with other studies [20, 22]. However, cut-off points are known to be influenced by pain experience and etiology. A study among 80 patients recovering from spinal cord injury demonstrated that chronic pain of neuropathic etiology is associated with higher cut-off points compared to nociceptive pain [22]. Patients with post-herniorrhaphy pain frequently suffer from neuropathic pain concurring with the need for upgrading cut-off points [23].

There are considerable interindividual differences in how patients grade their pain intensity on a VAS. Wide ranges with outliers and extreme cases in the “no pain, mild and

moderate pain” categories resulted in a considerable overlap. For example, three cases with each of the different VRS scores (mild, moderate and severe) marked their VAS at 52 mm. For these individuals, identical VAS scores represented entirely different pain intensities. In accordance with a previous study this suggests that VAS scores are not interchangeable with VRS results [22]. To simplify the matter, Collins et al. tried to investigate what moderate pain is in millimetres on the VAS. One thousand and eighty cases (with both VAS and four-point VRS scores) were taken from 11 randomized controlled trials investigating the analgesic effects of various drugs on postoperative pain [20]. They suggested grading an estimate of >30 mm on a VAS as moderate or severe pain since 85% of all patients who reported moderate pain and 98% of those who reported severe pain on a four-point VRS would be included. However, this statement also implies acceptance of over- and under-estimation of pain intensity, which is certainly not desirable in clinical practice. Therefore, VAS data should not be labelled with VRS categories for individual pain assessment.

Reproducibility is another quality a test should exhibit. Unfortunately, the present study did not contain sequential ratings making a test-retest reliability analysis impossible. Previous studies showed that rapid repeated VAS assessments frequently result in different ratings as opposed to the more consistent VRS [21, 22]. In follow-up pain intensity measurements, the VRS is also preferable to the VAS.

In conclusion, a higher scale failure was present using the VAS compared to the VRS in a large cohort of patients following corrective groin hernia surgery. The VAS can be

categorized into VRS scores using optimized cut-off points (<10 mm = no pain, 10–30 mm = mild pain, 31–70 mm = moderate pain and >70 mm = severe pain) rather than those used in previous groin pain research. VAS scores are not interchangeable with VRS scores due to considerable overlap. The VRS should therefore be favored over the VAS in future postherniorrhaphy pain assessment.

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