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ORIGINAL ARTICLE

A prospective cohort study comparing the VAS spine score and Roland–Morris disability questionnaire in patients with a type A traumatic thoracolumbar spinal fracture

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Abstract The Roland Morris Disability Questionnaire (RMDQ-24) and the VAS spine score have been regularly used to measure functional outcome in patients with back pain. The RMDQ-24 is primarily used in degenerative disease of the spine and the VAS Spine is used in trauma patients. The aim of this study is to compare these scores and to see if there is a correlation in patients with a traumatic thoracolumbar spinal fracture. Prospective cohort study comparing the RMDQ-24 and the VAS spine score in patients with a traumatic type A fracture thoracolumbar spine fracture. Fifteen non-operatively patients (group one) completed 118 questionnaires and 17 operatively treated patients (group two) completed 140 questionnaires. Group one scored an average of 6.6 and 65.9 for the RMDQ-24 and VAS Spine, in group two this was 5.1 and 82.9. Spearman's correlation test showed a significant correlation, in group one 0.83 and for the second group 0.87. RMDQ-24 and VAS Spine have a strong positive correlation in measuring disability in a group of patients with back pain because of a spinal fracture. In both non-operatively and operatively treated groups this correlation is significant.

Keywords Spinal fractures · Treatment outcome

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Introduction

To judge clinical outcome of patients with a traumatic thoracolumbar spinal fracture, functional scores are used. Judging back pain by comparing radiographs shows that clinical severity is not related to radiological parameters (e.g. local sagittal angle) [12, 16, 20]. Some authors even refer to radiological results as surrogate outcome [6, 8]. Clinical practice puts emphasis on pain, but pain is a complex physiological, psychological, and behavioural phenomenon that is difficult to evaluate and to quantify in the clinical situation [17].

Because of these limitations, outcome of treatment is evaluated by measuring physical impairment and disability. Physical impairment is an anatomical or pathological abnormality leading to loss of normal body ability. Disability is defined as the diminished capacity for everyday activities. Physical impairment is objective structural limitation; disability is the resulting loss of function, usually reported subjectively.

The Roland–Morris Disability Questionnaire (RMDQ-24) and the VAS spine score have been used regularly to measure and to monitor changes in functional outcome in patients with back pain [5, 11, 14]. Both scales were developed to assess functional disability in patients with

low back pain, the RMDQ-24 in degenerative disease, and the VAS Spine in trauma patients. This is the first study which compares both scores prospectively in a cohort of patients with a spinal fracture.

The aim of this study is to compare these scores and to see if there is a correlation in patients with a traumatic thoracolumbar spinal fracture. The assessment of this correlation and the strength and linearity of the relationship between these two functional disability scales were addressed in the present study. In spine research it is important to have objective measurements so that different studies can be compared. If there is a good correlation between the two scores, then it is possible to compare studies which assess functional outcome with one of these scales.

Materials and methods

The studied population was enrolled between October 1998 until October 2003. Thirty-four patients with a fracture of the thoracolumbar spine were included. Inclusion criteria were: traumatic fracture of Th10–L4, AO Comprehensive Classification type A, neurologically intact, and age 18–60 years [9]. Exclusion criteria were pathologic or osteoporotic fracture, patients with a history of operation on the back, type A.1.1 fracture, or accompanying injury which interferes with the functional outcome.

On admission all participants completed a 'pre-trauma' Roland–Morris Disability Questionnaire (RMDQ-24) and VAS spine score to asses any thoracolumbar dysfunction that they may have had before the injury. Every three months a questionnaire was send to the patients, until the end of follow-up.

The *RMDQ-24* was developed by Roland and Morris as a validated questionnaire to measure disability due to back pain. The disability questionnaire was constructed by choosing statements from the Sickness Impact Profile. The phrase 'because of my back' was added to each statement in order to distinguish disability due to other causes. The RMDQ-24 is validated for the German language [19]. Patients are given a score of one for each of the 24 items of the questionnaire that were ticked. A patient's score could thus vary from zero (no disability) to 24 (severe disability). The questionnaire is shown in Table 1.

The *VAS Spine Score* was developed in Hannover, Germany. The questionnaire is composed of 19 questions which are scored on a 10 cm visual analogue scale (VAS). A VAS scale is a 10 cm line with the left end being a low score and the right end being a high score. The line is not divided into parts. The VAS is a well excepted measurement tool for pain [10, 13, 15]. The patient's perception of pain and restriction in activities, related to problems of the back, is measured. The score is calculated by taking the average score of all questions and can be any value between zero (severe disability) and 100 (no disability). The VAS questionnaire is shown in Table 2. (Non-validated English translation).

Table 1 RMDQ-24: when your back hurts, you may find it difficult to do some of the things you normally do

1. I stay at home most of the time because of my back
2. I change position frequently to try and get my back comfortable
3. I walk more slowly than usual because of my back
4. Because of my back I am not doing any of the jobs that I usually do around the house
5. Because of my back, I use a handrail to get upstairs
6. Because of my back, I lie down to rest more often
7. Because of my back, I have to hold on to something to get out of an easy chair
8. Because of my back, I try to get other people to do things for me
9. I get dressed more slowly than usual because of my back
10. I only stand for short periods of time because of my back
11. Because of my back, I try not to bend or kneel down
12. I find it difficult to get out of a chair because of my back
13. My back is painful almost all the time
14. I find it difficult to turn over in bed because of my back
15. My appetite is not very good because of my back pains
16. I have trouble putting on my socks (or stockings) because of the pain in my back
17. I only walk short distances because of my back pain
18. I sleep less well because of my back
19. Because of my back pain, I get dressed with help from someone else
20. I sit down for most of the day because of my back
21. I avoid heavy jobs around the house because of my back
22. Because of my back pain, I am more irritable and bad tempered with people than usual
23. Because of my back, I go upstairs more slowly than usual
24. I stay in bed most of the time because of my back

This list contains some sentences that people have used to describe themselves when they have back pain. When you read them, you may find that some stand out because they describe you *today*. As you read the list. Think of yourself *today*. When you read a sentence that describes you today, put a ticket against it. If the sentence does not describe you, then leave the space blank and go on to the next one. Remember, only tick the sentence if you are sure that it describes you today

The questionnaires were used to evaluate the functional outcome of the studied population. All scores were measured by an independent observer. For statistical evaluation, the score for the RMDQ-24 was transformed to a percentage by the following formula: $(1 - (n/24)) \times 100$. This resulted in a score of 0 when the RMDQ-24 was 24, indicating severe disability, and a score of 100 when the RMDQ-24 was 0, indicating no disability at all. The VAS spine score is a score from 0 to 100 so no

Table 2 VAS spine score

1.	How often is your sleep disturbed by back pain?
2.	How often do you have back pain while you rest?
3.	When you have back pain in rest, how strong is this pain?
4.	How often do you have back pain with physical activities?
5.	When you have back pain with physical activities, how strong is this pain?
6.	How often do you have to take painkillers for back pain?
7.	How good are the painkillers then?
8.	How long can you sit without back pain?
9.	How much does back pain restrict bending forward? (e.g. when washing the dishes)
10.	How much restriction gives back pain in your profession?
11.	How much is lifting restricted by back pain?
12.	How much does back pain restrict your housekeeping?
13.	How long can you stand without back pain?
14.	How long can you walk without back pain?
15.	How much does back pain restrict running? (e.g. jogging)
16.	How much does back pain restrict your daily activities? (e.g. eating, washing)
17.	How long can you travel without back pain? (e.g. driving a car, travelling by train)
18.	How much does back pain restrict your sex life?
19.	How much does back pain restrict your weight bearing?

Questions are scored on a VAS

See Fig. 1

Non-validated English translation

Table 3 Demographic and clinical statistics

	Non-operatively treated ($n = 15$)	Operatively treated ($n = 17$)
Mean age (years)	37 (18–58)	46 (27–59)
Male:female	10:5	10:7
Cause		
MVA	5	3
Fall	10	10
Sports	–	2
Horse riding	–	2
Level of fracture		
Th12	6	2
L1	7	11
L2	1	1
L3	1	2
L4	–	1
CC-Type:		
A1	4	1
A2	–	2
A3	11	14

MVA motor vehicle accident, *CC* comprehensive classification

transformation was needed. To prevent bias because of therapy the group was divided in conservative and operative treated patients.

Statistical evaluation included the use of the Spearman rank correlation coefficient. The Pearson product–moment correlation coefficient makes the implicit assumption that the two variables are jointly normally distributed. When this assumption is not justified, a non-parametric measure such as the Spearman Rank Correlation Coefficient is more appropriate. A correlation of -1 means that there is a perfect negative linear relationship between variables, whereas a correlation of 0 means there is no linear relationship between the two variables. A correlation of $+1$ means that there is a perfect positive linear relationship between variables. The level of significance was set at $P < 0.05$. Considering that each scale is measuring the same construct, they would be expected to demonstrate a good correlation within both patient groups.

Results

Of the thirty-four patients, two patients were lost to follow-up and could not be contacted. Thus, thirty-two (94%) were followed. The patients were treated between 1998 and 2004. Mean follow up was almost four years (18 months–5.5 years). The most common etiology of the fracture was a fall from a height. More males were affected than females. Mean age was 42 (18–59). As expected most thoracolumbar fractures occurred at Th12 and L1. Most common fracture type was a burst fracture, AO type A3. The demographic and clinical statistics of the thirty-two patients are presented in Table 3.

The comparison of the two disability scores is presented in Table 4. Patients treated operatively had a lower mean score [5.1 (0–24)] on the RMDQ-24 than non-operatively treated patients [6.6 (0–24)] $P < 0.05$, indicating les disability for the operative treated group. The VAS spine score showed a similar pattern (82.9 [16 – 100]) for the operatively treated patients and (65.9 [9 – 100]) for the non-operatively treated group ($P < 0.001$) (Fig. 1).

The Spearmann rank correlation in the operatively treated group was 0.87 ($P < 0.001$) and in the non-operatively treated group 0.83 ($P < 0.001$). The plot reveals a strong positive relationship (see plot 1).

Discussion

Few studies have compared functional disability scales for patients with back complaints because of a traumatic spine fracture [6, 8, 11]. This is the first study to compare the RMDQ-24 and VAS Spine in spinal fracture patients. Most

Table 4 Disability scores

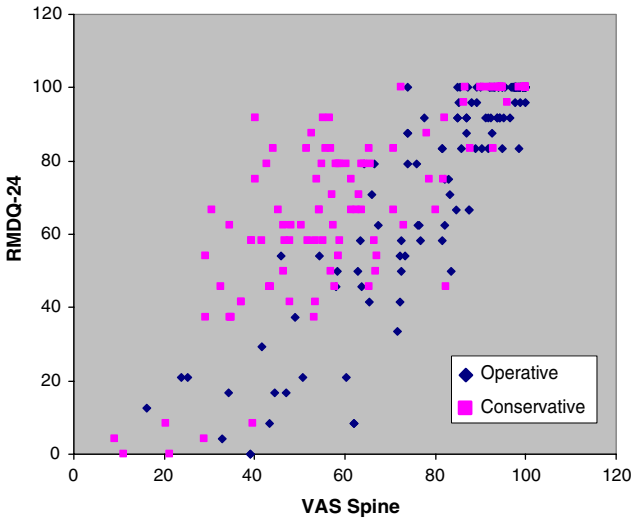
Disability scale		Non-operatively treated group ($n = 15$)	Operatively treated group ($n = 17$)
	Total number of questionnaires	118	140
RMDQ	Mean (range)	6.6 (0–24)	5.1 (0–24)
	SD	6.2	6.9
	Median	5.5	2
RMDQ transformed		$(1 - (n/24)) \times 100$	$(1-(n/24)) \times 100$
	Mean (range)	72.5 (0–100)	78.8 (0–100)
	Median	77.1	91.7
VAS spine	Mean (range)	65.9 (9–100)	82.9 (16–100)
	SD	24.5	19.2
	Median	61	91
Spearman's r_s		0.83*	0.87*

* $P < 0.001$

Attention: RMDQ-24: lower is better

VAS spine: higher is better

Fig. 1 Visual analogue scale



Plot 1 Scatter plot of conservatively and operatively treated group

studies have evaluated functional disability scales in patient groups with low back pain without a traumatologic cause [2, 3, 21]. In this study the scales were used for patients with low back pain because of a spinal fracture.

A spinal fracture can lead to severe long term impairment in a relatively young patient population [1, 4]. Effective management of these kind of injury, with limitation of functional impairment is therefore of utmost concern. The main goal of treatment is to maximize the functional outcome in these patients. For the evaluation of outcome specific and sensitive tools are needed. This study shows that the RMDQ-24 and VAS Spine have a significant positive correlation as well as in conservative treated patients as in operative treated patients.

We made a comparison with other groups that used the RMDQ-24 or VAS Spine score. Compared to prior results of Leferink in 19 operated patients, our operated patient collective showed a RMDQ-24 score only one point higher (5.1 instead of 4) [8]. In the non-operative group the RMDQ of 6.6 was a little less than the score of 5.2 found in the group of Post after a follow-up of 5 years [11]. Our results are favourable compared to other series which showed RMDQ-24 scores of 10.9–15.6 [6, 7, 18].

With regard to the VAS spine score the non-operative group performed comparable with the group of Knop (65.9 vs. 66.1) and less than a group of non-operative treated patients in a study of Post (65.9 vs. 79) but this was after 5 years of follow-up [11]. Our operative group showed comparable VAS Spine scores with the group of Leferink (82.9 vs. 79.4) [5, 8]. Considering this comparison our patient collective is a small but representative group in comparison with literature.

RMDQ-24 and VAS Spine have a strong positive correlation in measuring disability in a group of patients with back pain because of a spinal fracture. In both non-operatively and operatively treated groups this correlation is significant. This close correlation makes data pooling of studies for the purpose of meta-analysis possible.

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