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Research Progress on Functional Assessment of Non-specific Low Back Pain

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Abstract: Nonspecific low back pain (NLBP) is a prevalent condition in daily life with a notably high recurrence rate. It is particularly common among athletes, especially those involved in sports such as weightlifting and ice hockey. Assessment is crucial both before and after rehabilitation therapy for NLBP to evaluate its effectiveness. Functional assessment, as a common evaluation method, plays a significant role in understanding patients' functional impairments and quality of life, as well as guiding rehabilitation interventions and assessing treatment outcomes. There are numerous tools available for assessing NLBP. This paper summarizes recent domestic and international literature on nonspecific low back pain.

Keywords: Nonspecific low back pain; Functional assessment; Pain; Functional impairment

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1. Introduction

Low back pain refers to pain and discomfort located above the 12th rib and below the gluteal fold. It is the leading cause of global disability, with a lifetime prevalence rate as high as 84% [1–3]. Nonspecific low back pain (NLBP) is defined as low back pain that cannot be attributed to identifiable, known specific pathologies, involving neither nociceptor activation nor somatosensory nervous system damage or disease [1,4]. It accounts for up to 85% of all low back pain cases [5]. Each year, 5% to 10% of the workforce is absent due to low back pain, with most absences lasting less than seven days [6]. Additionally, the total wealth of individuals with low back pain is reduced by 87% compared to healthy individuals [7]. Low back pain not only affects personal wealth accumulation and quality of life but also imposes direct medical burdens and indirect social losses [7,8]. NLBP has a high prevalence rate, affecting individuals of all ages and posing a risk to nearly everyone, with almost everyone experiencing episodes of back pain [2]. This condition initially manifests as acute and subacute back pain and later progresses to chronic low back pain with high disability rates [2]. During the acute, subacute, and chronic phases of low back pain, clinicians use functional assessments to evaluate the degree of functional impairment, guide clinical rehabilitation

decision-making, and determine the effectiveness of various rehabilitation methods. Currently, there are numerous tools available for assessing the functional status of low back pain both domestically and internationally. This paper summarizes the introductions, reliability and validity, advantages, and disadvantages of functional assessment scales or questionnaires for low back pain based on domestic and international literature, providing a theoretical basis for future functional assessments.

2. Pain

2.1. Numeric pain rating scale

2.1.1. Introduction

The Numeric Pain Rating Scale (NPRS) requires patients to rate their pain on a scale from 0 to 10 (an 11-point scale) [9]. Pain intensity ranges from 0 (no pain) to 10 (extremely severe pain). The verbal NPRS asks patients to verbally state their pain intensity on a scale of 0–10. The minimal important difference for the NPRS is 2/10 or 30% of the baseline score [10].

2.1.2. Reliability and validity

The paper and electronic versions of the NPRS exhibit poor reliability (ICC = 0.49; 95% CI: 0.31, 0.64) among individuals with chronic lower back pain, and there is a lack of moderate- to high-quality literature evidence regarding its validity [11,12].

2.1.3. Advantages and disadvantages

This scale is suitable for a wide range of populations (e.g., elderly patients, patients with significant motor difficulties), easy to administer and score, simple, and relatively consistent [9].

2.2. Visual analogue scale

2.2.1. Introduction

The Visual Analogue Scale (VAS) consists of a line, typically 10 cm long, with one end marked as pain-free (0 mm) and the other end marked as extreme pain (100 mm) [9]. Patients are asked to indicate the point along the line that best represents their pain intensity. The patient's pain intensity score is the distance from the pain-free end to the marked point. The minimal important difference for the VAS is 15 percentage points or 30% of the baseline score [10].

2.2.2. Reliability and validity

The VAS demonstrates reliability and responsiveness in assessing individuals with chronic lower back pain, but there is a lack of moderate- to high-quality research evidence regarding its validity [12,13].

2.2.3. Advantages and disadvantages

This scale is a graphical scale that only assesses pain intensity and requires verbal expression, making it unsuitable for patients with motor or cognitive impairments [9].

2.3. McGill pain questionnaire

2.3.1. Introduction

The McGill Pain Questionnaire (MPQ) primarily consists of three categories of textual descriptions, including sensory, affective, and evaluative aspects, through which patients describe their subjective pain experiences [14]. The questionnaire includes four sections: pain location, pain descriptors, pain changes over time, and pain intensity, including a body pain distribution diagram. Pain descriptors summarize all items across the three dimensions. The sensory score ranges from 1 to 42, the affective score ranges from 1 to 14, and the evaluative score ranges from 1 to 5.

2.3.2. Reliability and validity

The MPQ is an assessment tool with good reliability, validity, and responsiveness, and it is extremely sensitive to changes in outcomes caused by interventions [15].

2.3.3. Advantages and disadvantages

The MPQ includes the additional advantage of nociceptive and neuropathic items in the sensory pain dimension, making it useful for assessing neuropathic lower back pain. It is comprehensive and easy to administer but time-consuming [15].

3. Common functional impairment questionnaires for low back pain

3.1. Oswestry disability index (ODI)

3.1.1. Introduction

The Oswestry Disability Index (ODI) was initially proposed by Fairbank et al. and has since been translated into various languages, with revisions and validations conducted in different countries [16–18]. The ODI comprises 10 items, one related to pain and nine related to daily living abilities, with each item scored from 0 to 5 (lifting, walking, social life, personal care, sitting, standing, sleeping, traveling, sexual life). The total score is derived by multiplying the sum of these scores by 50%, ranging from 0 to 100%. A higher score indicates a greater degree of functional impairment.

3.1.2. Reliability and validity

The revised ODI demonstrates the strongest correlation with the physical functioning and bodily pain subscales of the Short Form 36 (SF-36), with coefficients exceeding the 0.4–0.6 range [19]. The reliability and validity of the simplified Chinese version of the ODI for assessing low back pain in mainland China have been validated, showing significant correlations with eight subscales of the SF-36 ($r = 0.25–0.78$, $p \leq 0.001$), particularly in physical functioning ($r = 0.78$, $p < 0.001$), and a moderate correlation with the Visual Analog Scale (VAS) ($r = 0.69$, $p < 0.001$) [17].

3.1.3. Advantages and disadvantages

The ODI is a self-reported impairment questionnaire considered the “gold standard” for measuring functional outcomes of the lower back in clinical and research settings [20]. It is suitable for patients with mild to moderate functional impairment and those with persistent severe functional impairment due to low back pain [21]. According

to Dr. Brodke's report, a drawback of the ODI is its poor ability in unidimensional assessment [22]. The ODI's item structure evaluates different domains, such as pain and sleep, making it difficult for clinicians to clearly identify which domain is being measured and which domain influences changes in the ODI. Additionally, the ODI is not suitable for stratifying individuals with relatively high functional levels (i.e., low disability patients), potentially yielding poor test results when clinicians examine a diverse patient population.

3.2. Roland-Morris disability questionnaire (RMDQ)

3.2.1. Introduction

The Roland-Morris Disability Questionnaire (RMDQ) was first proposed by Roland and Morris in 1983 [23]. The original 24-item measure has been culturally adapted or translated and shortened to 18-item and 23-item versions for use in other countries [18]. The RMDQ consists of 24 self-reported items concerning patients' perceptions of low back pain and related functional impairments. These include 15 items on physical ability/activity, 3 on sleep/rest, 2 on psychosocial aspects, 2 on household management, 1 on eating, and 1 on pain frequency. Patients can report their current pain using a pain rating scale. Patients respond with "yes" or "no" (scored as 1 or 0, respectively), resulting in scores ranging from 0 (no disability) to 24 (maximum disability). Scores from 0 to 24 are then converted to percentage scores.

3.2.2. Reliability and validity

Both the paper and electronic versions of the RMDQ demonstrate good reliability (ICC = 0.85; 95% CI: 0.77, 0.90) [11]. The RMDQ also exhibits good validity, responsiveness, with a minimal important difference of 5/24 or 30% of the baseline score [10,13,24].

3.2.3. Advantages and disadvantages

The RMDQ is a self-reported outcome measurement tool with good psychometric properties and ease of administration [23,25]. It is suitable for assessing patients with mild functional impairment due to low back pain [21]. The questionnaire is relatively simple, with patients completing it in approximately 5 minutes, and responses are independent of age, gender, or social class [25]. According to Wang Xueqiang et al., the RMDQ has limitations in evaluating functional impairments caused by low back pain, particularly in assessing pain severity, mental health, and social well-being [26].

3.3. Quebec back pain disability scale (QBPDS)

3.3.1. Introduction

The Quebec Back Pain Disability Scale (QBPDS) questionnaire assesses how pain affects the daily lives of patients with low back pain. The questionnaire consists of 20 items related to functional impairments in basic daily activities, including sleeping, sitting/standing, walking, exercising, bending, and lifting heavy objects. Each activity is scored from 0 (no difficulty) to 5 (unable to perform). Responses to these 20 questions use a 6-point numerical rating scale indicating difficulty levels (0 points, "not difficult at all"; 1 point, "not difficult"; 2 points, "somewhat difficult"; 3 points, "quite difficult"; 4 points, "very difficult"; 5 points, "unable to do"). The QBPDS includes more content related to upper limb activities (pulling/pushing, throwing/catching, reaching) than other scales. If more than 50% of the 20 questions are answered, the QBPDS score (and scores for QBPDS subscales) is calculated. The proportional recalculation method involves dividing the raw total score by the highest possible

score (after considering missing answers) and multiplying by 100. The total score is the sum of all items, ranging from 0 (no disability) to 100 (maximum disability). The minimal detectable change for the QBPDS is 15 points, with a minimal important difference of 20 percentage points or 30% of the baseline score [10,27].

3.3.2. Reliability and validity

After cultural adaptation and translation, the QBPDS demonstrates good reliability, validity, and responsiveness [28–30]. The QBPDS shows moderate correlations with the physical functioning and bodily pain subscales of the SF-36 (-0.5–0.64) [19].

3.3.3. Advantages and disadvantages

The QBPDS is also a psychometrically sound tool for assessing functional impairments due to low back pain, utilizing a self-reported testing method. However, it is not widely used and only evaluates disability levels and sleep quality [15].

4. Summary

The objective of functional assessment for non-specific low back pain (NLBP) is to obtain highly correlated and responsive results using assessment tools with high reliability and validity, while minimizing patient discomfort. This is crucial for evaluating individuals in acute, subacute, and chronic stages. For pain assessment, the most commonly used tools globally are the Numeric Pain Rating Scale (NPRS), Visual Analog Scale (VAS), and McGill Pain Questionnaire (MPQ). No single scale can evaluate all populations effectively. NPRS and VAS are often regarded as the "gold standards" for pain assessment in both research and clinical settings [13]. Among them, NPRS is the most widely used, but it exhibits poor reliability for assessing chronic low back pain. VAS is also widely used, second only to NPRS, but it is not suitable for patients with motor or cognitive impairments. NPRS and VAS are unidimensional measurement tools, whereas MPQ is multidimensional, describing subjective pain experiences from sensory, affective, and evaluative perspectives. Although MPQ provides comprehensive evaluations, it is time-consuming and less widely used than NPRS and VAS. For assessing the degree of functional impairment due to low back pain, the Orthopaedic Section of the American Physical Therapy Association recommends the Oswestry Disability Index (ODI) and Roland-Morris Disability Questionnaire (RMDQ). These tools are effective in identifying baseline levels related to pain, function, and impairment in low back pain patients and can monitor changes during treatment [25]. ODI, widely regarded as the "gold standard" for measuring functional outcomes in clinical and research settings for low back pain, is extensively used but has limited ability to assess the impact of specific dimensions on patients [20]. It is suitable only for patients with mild to moderate functional impairments or persistent severe functional impairments. Compared to RMDQ, ODI demonstrates better test-retest reliability and smaller measurement errors in assessing physical function in NLBP [24]. RMDQ is also widely used, second only to ODI, and is a commonly employed tool for evaluating the degree of functional impairment in low back pain. However, it has limitations in assessing pain intensity, mental health, and social well-being, and is more suitable for evaluating patients with mild functional impairments. Both RMDQ and ODI exhibit good construct validity and reliability, as well as short responsiveness, and are often used in conjunction with quality-of-life assessment tools (e.g., SF-36). Compared to RMDQ and ODI, the Quebec Back Pain Disability Scale (QBPDS) is less widely used and assesses only functional impairment and sleep quality.

In summary, when selecting scales or questionnaires to assess pain or functional impairment in low back pain patients, clinicians or therapists should consider the content, reliability, validity, advantages, disadvantages, and applicability of the tools. They should make reasonable use of these tools based on the specific conditions of patients. If necessary, these scales or questionnaires can be used in combination to comprehensively evaluate patients' functional status from multiple dimensions.

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Disclosure statement

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