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Assessment of Patients with Neck Pain: The Most Valid Measurement Tools

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Review Article

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ABSTRACT

Several methods are proposed through literature to evaluate cervical pain. As a multi-dimensional phenomenon neck pain is associated to physical and psychological parameters which affect the measurements. A series of methods have been developed to measure pain such as questionnaires, diagnostic tests and devices. These tools are useful to evaluate the grade of pain but also to estimate the result of therapeutic interventions. The aim of this research is to present the most valid methods for the measurement of pain at the cervical area in adult population. Pain assessment includes pain scales, pain questionnaires, disability scales because of pain and pain devices. Because of the multi-dimensional nature of pain more than one method is used to have an integrated evaluation of the pain at the area of neck. The questionnaires, the scales and the devices which are used should be reliable, valid and there must be experience at their use. More research should be provided in order to strengthen the assessment of cervical pain.

INTRODUCTION

This study describes the methods which evaluate pain at neck area. Some of the methods evaluate pain in general and some are designed especially for the neck area. All these methods are going to be presented.

METHODOLOGY

Articles have been searched through internet from 1961 until December 2013 and were found 1585 through Pub med, 4415 through Scopus and 454 through Cochrane. Selection criteria were basically connected to the theme which is neck pain. Only articles in English were accepted, only full texts and those must have been published either in books or magazines with impact factor. In this research are included the articles which describe the methods which are used more often and show validity and reliability. Exclusion criteria were articles with target population like children or elderly people. We finally selected 58 articles.

METHODS OF PAIN ASSESSMENT AT NECK AREA

Several methods have been introduced to assess pain at the neck area. We moved to the classification of these scales according to what they measure.

Unidimensional Pain Scales

These scales measure only the intensity of pain and can be used also for measuring pain at the neck area.

Pain scales

The NRS (Numeric Rating Scale), VAS (Visual Analogue Scale) and VRS (Verbal Rating Scale) are the most used scales in research and clinical practice. These scales are reliable and valid[1,2,,3]. The VAS has more practical difficulties than the VRS or the NRS. For general purposes the NRS has good sensitivity and generates data that can be statistically analysed for audit purposes[4,5]. The VAS can be used in research to produce continuous scores which are more suited to parametric analysis than

NRS[5]. The SDS (Simple Descriptive Scale) shows low sensitivity in detecting small changes in pain intensity[6]. For simplicity patients prefer the VRS, but it lacks sensitivity and the data it produces can be misunderstood. The VAS and NRS detect small changes in pain intensity compared to verbal scales[4]. Statistically significant differences in pain intensity were presented after thermotests for each scale and the order of responsiveness was the following: NRS, VAS, VRS[5]. **(Table1)**

Table1. "Unidimentional Pain Scales."

	Measurement	Quality of measurement
NRS	Pain intensity	Good reliability/good validity/high responsiveness
VAS	Pain intensity	Good reliability/good validity/suited to parametric analysis/easy to use
VRS	Pain intensity	Good reliability/Good validity
SDS	Pain intensity	Lack of sensitivity

Multidimensional Pain Scales

These scales measure not only the intensity of pain but also other dimensions of pain connected to the quality of pain such as the character of pain and the perception of pain.

Mc gill pain questionnaire (mpq): The McGill Pain Questionnaire was designed to provide quantitative measures of clinical pain that can be treated statistically[7]. The MPQ provides reliable, valid, and consistent measurements. The short form also has proven to provide reliable and valid measurements when the intensity of pain is the primary subject of the examination. A major advantage of the MPQ is the fact that it has been validated in many multilingual versions[6,8]. The SF-MPQ was also shown to be sufficiently sensitive to demonstrate differences due to treatment at statistical levels comparable to those obtained with the standard form. The SF-MPQ is as a useful tool in situations in which the standard MPQ takes too long to administer, yet qualitative information is desired[9].

Brief Pain Inventory (BPI): The BPI measures both the intensity of pain (sensory dimension) and interference of pain in the patient's life (reactive dimension). It also queries the patient about pain relief, pain quality, and patient perception of the cause of pain. The BPI is a powerful tool and, having demonstrated both reliability and validity across cultures and languages, is being adopted in many countries for clinical pain assessment, epidemiological studies, and in studies of the effectiveness of pain treatment[10]. The BPI is a short, self-administered questionnaire that was developed for use in cancer patients. Results support the validity of the BPI as a measure of pain also for patients with pain because of arthritis and low back pain[11]. **(Table 2)**

Table 2. "Multidimentional Pain Scales."

	Measurement	Quality of measurement
MPQ	Pain intensity-pain descriptors	Reliable/valid
SF-MPQ	Pain intensity-pain descriptors	Reliable/valid/sensitive in changes
BPI	Pain intensity in different time-impact on mood/physical activity/sleep	Reliable/valid

Experimental Methods

The diagnostic tests for pain are Electrical Stimulation (ES), Pressure Pain Tests (PPT), EMG recording, Reflex Receptive Field (RRF) and Thermotests (TT). The majority of these methods evaluate pain thresholds and some of them evaluate pain tolerance[4,5,12]. The Quantitative sensory testing (QST) analyses perception in response to external stimuli of controlled intensity.

The TT allows the testing of quantitative evaluation of thermal thresholds such as heat, cold, and heat and cold pain sensation. There is a machine for the TT using radiant heat and contact heat. Patients with chronic neck pain also showed cold pain hypersensitivity as compared with patients with acute neck pain and controls. These results support the existence of different sensitization mechanisms between patients with acute and chronic mechanical insidious neck pain[13].

The ES test provides a quantitative measure of pain tolerance to a transcutaneous stimulation, neuroselective for large and small myelinated and unmyelinated nerve fibers[14]. The use of quantitative sensory testing (QST) has become more widespread, with increasing focus on describing somatosensory profiles and pain mechanisms. However, the reliability of thermal QST has yet to be established[15].

Elevated thresholds for perceiving the sensations of warm, cold, and mechanical and electrical stimuli are often used in assessing severity of neural damage, such that a high threshold indicates more severe neuropathic damage. Further, thresholds are not necessarily correlated with the pain experience patient under-go. The best example would be the painful diabetic neuropathy, where the patients demonstrate a combination of peripheral sensory loss and hyperalgesia at the initial stage of disease; in contrast, at the advanced stage the patients exhibit both sensory loss and hypoalgesia, as can be assessed via normative values of parameters related to pressure, heat and cold pain stimuli were determined[5,16].

The reflex receptive field (RRF) for a specific muscle denotes the cutaneous area from which a muscle contraction can be evoked by a nociceptive stimulus. A number of laboratory tests are critically important in the quest to diagnose presence or absence of organic neuropathic dysfunction and to establish the relevance of such to the subjective pain complaints. Some

articles support the validity of this method[17,18,19]. However, none of these tests has absolute diagnostic value and their results must be interpreted in the light of the clinical picture[20].

PPT is defined as the minimal amount of pressure that produces pain. A simple handheld pressure algometer with a plastic filament is commonly used, although more sophisticated electrical devices with a strain or pneumatic pressure gauge have been developed[21,22]. Pressure algometry provides a semi-objective method for estimation of pain. Algometry is a reliable reproducible method for quantification of local tenderness in clinical practice and research. Standardized methodology and equipment is crucial for reliable and valid measurement in algometry[23]. These identical results obtained over muscles of opposite sides proved the excellent reproducibility and validity of pressure threshold measurement[24]. It has been noted in pressure-pain threshold studies that the rate at which manual force is applied should be consistent to provide the greatest reliability and previous familiarization is precious[25]. The electronic algometer could be recommended for evaluation of the pressure pain threshold of human head and neck muscles in clinical and experimental studies[26]. There is widespread decreased PPT in patients with chronic, but not acute, mechanical neck pain as compared with controls. The results support the existence of different sensitization mechanisms between patients with acute and chronic mechanical insidious neck pain[13]. **(Table 3 & Table 4)**

Table 3. "Electrophysiological Tests."

	Measurement	Quality of measurement
Single Electrical Stimulation/ Repeated Electrical Stimulation(temporal summation)	Pain intensity	High reproducibility
Reflex Receptive/ EMG Recording	Pain intensity	Not confirmed diagnostic value

Table 4. "Psychophysical Tests."

	Measurement	Quality of measurement
Pressure Pain Stimulation	Pain intensity	Excellent validity/ excellent reproducibility / reliability depending on familiarization to the method
Thermal Pain Stimulation-heat and cold	Pain intensity	Not good reliability
Ice Pressure Test/Ice Water Stimulation	Pain intensity	Not good reliability

Disability Scales For Neck Pain

The disability scales evaluate the disability in everyday life activities which is caused by neck pain. Several scales evaluate different parts of everyday life activities such as work, study, sleep and many others.

Neck disability index (ndi): The Neck Disability Index (NDI) was developed to assess disability in patients with neck pain[27]. Most studies suggest that the NDI has acceptable reliability. A number of high-quality published and commercially supported translations are available[28]. The NDI appears to demonstrate adequate responsiveness based on statistical reference criteria when used in a sample that approximates the high percentage of patients with neck pain[29]. The NDI has sufficient support and usefulness to retain its current status as the most commonly used self-report measure for neck pain[30,31]. The NDI is relatively short instrument which can be easily applied. The NDI is the most widely used and most strongly validated instrument for assessing self-rated disability in patients with neck pain. It has been used effectively in both clinical and research settings in the treatment of this very common problem[32].

Neck Pain and Disability Scale (NPDS): The NPDS was designed to measure pain and disability in patients with neck pain and was developed using the Million Visual Analogue Scale as a template[31]. The results suggest a highly reliable instrument for evaluating neck pain with at least four underlying dimensions[33]. Scores are strongly correlated with NDI and it shows good content validity[6].

Northwick park neck pain questionnaire (npq): The NPQ was designed to measure the influence of nonspecific neck pain on daily activities[31]. The Neck Disability Index (NDI) and Northwick Park Neck Pain Questionnaire (NPQ) were developed to measure self-perceived disability from neck pain, including that which may arise from whiplash injury. However, there is little data specifically concerning their validity for whiplash-associated disorders such as emotional and social problems which are not evaluated[34]. The elements for validity and reliability of NPQ are inadequate and more research is needed.

Whiplash disability questionnaire (wdq): The WDQ was designed to measure disability in patients with WAD (whiplash associated disorders) and was derived from the NDI[31]. It is a scale especially for whiplash injury problems[6]. The WDQ as an outcome measure may be useful in clinical practice and especially in Primary Care[35]. The WDQ has excellent short- and medium-term reproducibility and responsiveness in a population seeking treatment for WAD[36].

Copenhagen neck functional disability scale (cnfds): The CNFDS was designed to measure disability in patients with neck pain[31]. The CNFDS indicates good construct validity and a moderately strong correlation to changes in pain scores after treatment. Scale scores correlated weakly to all physical measurements[37]. The NDI, CNFDS, and NPQ are similar in terms of structure and psychometric properties but only NDI has been revalidated in heterogeneous study populations and in many languages[6].

Aberden back pain scale (asps): The Aberdeen Back Pain Scale is a pain scale for the back but was extended to create a

set of interlocking outcome measures for the neck, upper and lower back[38]. The ASPS evaluates neck pain during activity and rest[6]. The Extended Aberdeen Spine Pain Scales for neck, upper and lower back pain, showed evidence of reliability, validity, responsiveness and acceptability. They can be used for single regions of the spine or combined as clinically necessary. They are particularly recommended for primary care patients[38].

Cervical spine outcomes questionnaire (csoq): The CSOQ is an instrument for assessing complaints of neck pain and evaluating the outcomes of treatments for these complaints[39]. It provides information on demographics, pain severity, functional disability, psychological distress, physical symptoms, health care utilization, and satisfaction[6]. It appears to be acceptable to patients, easy to administer, highly reliable, valid, and responsive[39]. The domain scores for functional disability and psychological distress provide similar information to that provided by the NDI and SF-36. The CSOQ domain scores for pain severity provide information that is more specific to cervical disc disease than does the physical health score of the SF-36[40].

Short Core Neck Pain Questionnaire, and the National Health and Nutrition Examination Surveys (NHANES ADL): The NHANES ADL scale effectively measures physical, social, and emotional disability in patients with a cervical impairment, and may be an efficient measure of perceived limitations from working and generalized daily physical activity[6]. The NHANES ADL scale appears to be a useful instrument in measurement of functioning and disability in patients with report of cervical pain. The newly created NHANES ADL scale demonstrates internal consistency, unidimensionality, and line item validity[41].

Fear-avoidance beliefs questionnaire (FABQ): The FABQ measures patients' fear of pain and consequent avoidance of physical activity because of their fear. The FABQ presents the patient's beliefs about how work and physical activity affect their pain[42]. The FABQ is a valid and reliable tool for patients with neck pain. It has been shown to demonstrate very good content validity, a high degree of test-retest reliability and internal consistency, good construct validity and medium responsiveness[6,43]. **(Table 5)**

Table 5. "Disability scales in persons with neck pain."

	Measurement	Quality of measurement
ASPS (extended)	Evaluation of neck pain during activity and rest	Good reliability/good validity/good responsiveness/ acceptability
CNFDS	Assessment of disability in patients with neck pain	Good construct validity/ moderate sensitivity to changes in pain
NDI	Assessment of disability in patients with neck pain	Good reliability/strong validity/most applied and translated among other neck pain questionnaires/ adequate responsiveness
NPQ	Measurement of the influence of nonspecific neck pain on daily activities	Inadequate elements of validity/reliability
WDQ	Assessment of disability in patients with whiplash associated disorders	High reproducibility/ high responsiveness
CSOQ	Demographics/ pain severity/ functional disability/ psychological distress/ physical symptoms/ health care utilization/ satisfaction	Acceptable to patients/ easy to administer/ high reliability/high validity/high responsiveness
NHANES-ADL (neck)	Evaluation of physical, social and emotional disability	Internal consistency/ unidimensionality/line item validity
FABQ (neck)	Measurement avoidance of physical activity/work because of their fear	Very good content validity/ high degree of test-retest reliability/high degree of internal consistency/good construct validity/medium responsiveness
NPDS	Measurement of pain and disability in patients with neck pain	Good content validity/high reliability

Psychological Scales

The following scales are chosen in order to assess stress and depression because people with neck pain tend to have high rates of these psychological disorders. The following scales are some of the most used scales and they are going to be evaluated for their strength as tools of assessment for people with neck pain.

Hamilton scale: The Hamilton Depression Rating Scale has been the gold standard for the assessment of depression for more than 40 years. Evidence suggests that the Hamilton Depression Scale is psychometrically and conceptually flawed[44].

Hospital Anxiety and Depression Scale (HADS): The HADS scale was found to perform well in assessing the symptom severity of anxiety disorders and depression in both somatic, psychiatric and primary care patients and in the general population[45]. The HADS gives clinically meaningful results as a psychological screening tool, in clinical group comparisons and in correlational studies with several aspects of disease and quality of life. It is sensitive to changes both during the course of diseases and in response to psychotherapeutic and psychopharmacological intervention[46]. The HADS presented high internal consistency.The Greek version of HADS showed good psychometric properties and could serve as a useful tool for clinicians to assess anxiety and depression in general hospital patients[47]. The HADS showed evidence of reliability and validity in population with neck pain[48]. There is some evidence, including through the use of change reliability indices, that the HADS is sensitive to change[49]. Weaknesses include some evidence of reduced validity in some populations, particularly in the elderly[50].

STAI: The State-Trait Anxiety Inventory (STAI) is a commonly used measure of trait and state anxiety. It can be used in clinical settings to diagnose anxiety and to distinguish it from depressive syndromes[51]. The Trait Anxiety Scale (T-Anxiety) evaluates relatively stable aspects of "anxiety proneness" including general states of calmness, confidence, and security[50]. State Anxiety and Trate Anxiety scores were significantly higher in the patients with pain (trigeminal neuralgia, neck-shoulder-arm pain syndrome, lumbago and psychological pain) compared with the patients without pain (sudden deafness and facial nerve palsy). Like other measures of anxiety, the STAI is also highly correlated with depression and, in some studies, the STAI did not differentiate anxious from depressed[52]. Study provided preliminary evidence concerning the reliability and the validity of the Greek translation of the STAI-form Y. Its properties are generally similar to those reported in the international literature, but further research is necessary[53]. It was concluded that the version containing items 1, 3, 6, 15, 16, and 17 of the State Anxiety scale was a reliable and valid instrument for this study sample[54].

Beck depression inventory scale-ii (bd-ii): The Beck Depression Inventory (BDI) is a self-report rating inventory that measures characteristic attitudes and symptoms of depression[55]. Beck Depression Inventory-II, which was reformulated according to the DSM-IV criteria for major depression, showed high reliability and high validity[56]. The Beck Depression Inventory-II shows can be easily adapted in most clinical conditions[55]. Versions include BDI-I, BDI-IA , BDI-II, και το BDI for Primary Care (BDI-PC), which is called now BDI Fast Screen for Medical Patients (BDI-FS). The BDI-FS contains 7 cognitive and affective items from the BDI-II to assess depression in individuals with biomedical or substance abuse problems[57]. In a sample of patients with chronic pain the BDI-FS showed good psychometric properties, strong agreement with the BDI-II and equal ability to detect clinical change in a pain clinic population. The BDI-FS has the practical advantages of faster administration and reduced patient burden[58]. **(Table 6)**

Table 6. "Psychological screening scales."

	Utility	Quality of measurement
BDI-II	Assessment of depression	High reliability/high validity/easily adapted in most clinical conditions
HS	Assessment of depression	Psychometrically and conceptually flawed
STAI	Assessment of stress	In some studies it does not differentiate anxious from depressed/its' reliability and validity depends on its' versions
HADS	Assessment of anxiety and depression	Reliable/valid/sensitive to changes/good psychometric properties

DISCUSSION

The multi-dimensional nature and the stage of neck pain-acute or chronic- differentiates the response to pain stimuli. This is why the quality of the result in every study with pain depends on the stage of pain, the psychological status of the patient and the method that is applied. The familiarization to the method is also important for the researchers who use devices for pain measurement. One limitation of this study is the fact that the research through the computer included only Pub med, Cochrane and Scopus. Although there was an effort to find articles with neck pain population, this didn't always happen and in some studies the population had musculoskeletal problems in general or other health problems. Another limitation was that were included only studies on adult population excluding children and elderly but the adults were the target population at this study. Another research must be done in order to evaluate neck pain assessment in children and elderly. In this study were included a few methods which are not valid or reliable and this comes to a contrast to the selection criteria which aimed to gathered only valid and reliable methods. However, this happened because some of these methods were used very often and we wanted to present their deficits and limitations.

CONCLUSION

The aim of every study indicates the method that will be selected to evaluate pain. Most of the time more than one method must be used to have an integrated evaluation of the pain at the neck area. The selection criteria for the study of neck pain is to use assessment methods which have been used to similar population with similar pathology and conditions and proved to be valid and reliable. Experience is also important when devices are going to be used.

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