

## RESEARCH ARTICLE

### Neck disability index, Visual analog scale, and Likert scale in patients receiving pharmacotherapy for neck pain: How good do they correlate?

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#### ABSTRACT

**Background:** Neck disability index (NDI) is a patient self-assessed outcome measurement tool to assess disability due to neck pain. Improvement in pain severity score by a pain intensity numerical rating scale may not necessarily produce a significant change in NDI after treatment. **Aims and Objectives:** This study was undertaken to study the correlation between the pain status rated by the patient using qualitative scales with the NDI in patients with neck related problems. **Materials and Methods:** It was prospective observational study conducted in Physical Medicine and Rehabilitation Department of Tertiary care Teaching Hospital in Kerala for duration of 6 months. 170 patients, with M: F ratio-1:2.9, having neck pain were included and treated with centrally acting muscle relaxants and analgesics for 2 weeks. Patients were assessed on their initial visit and followed up after 2 weeks. Patient rating of pain status was measured using visual analog scale (VAS) and a 5-item Likert scale varying from excellent to bad. Disability level due to neck pain was determined using NDI. Analysis was done with correlation coefficient, paired *t*-test and Wilcoxon signed ranks test using SPSS 20. **Results:** VAS and Likert scale rating showed a positive correlation with NDI, both before (correlation coefficient = 0.663, 0.589) and after (correlation coefficient = 0.845, 0.776) pharmacotherapy. Significant changes in NDI ( $t = 28.199$ ,  $P < 0.001$ ), Likert scale ( $Z$  value = 11.03,  $P < 0.001$ ), and VAS ( $t = 28$ ,  $P < 0.001$ ) were observed after pharmacotherapy. **Conclusions:** Study correlated patients rating of pain status themselves and NDI, and NDI can be used as an effective tool to evaluate pharmacotherapy.


**KEY WORDS:** Neck Pain; Neck Disability Index; Visual Analog Scale; Likert Scale Rating; Pharmacotherapy

#### INTRODUCTION

Many validated tools are available to assess the effectiveness of treatment for neck pain. These patient oriented instruments for outcome measurement include numeric scales, validated disease-specific functional outcomes measures, and quality

of life outcome measures. However, it is not clear whether all these patient reported outcomes are measuring different entities and whether all these should be measured after pharmacotherapy of neck pain.<sup>[1]</sup>

The neck disability index (NDI) is a commonly used, simple and validated outcome measurement tool, which is available in multiple languages to determine self-assessed disability in patients with neck pain. Many studies published so far had used NDI as an effective tool in assessing the difference in pre- and post-treatment condition of the patients.<sup>[2,3]</sup> The NDI consists of different functional items related to neck pathologies and it gives a visual template for collection of information.<sup>[4]</sup> It is a 10-item questionnaire that measures a

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patient's self-reported neck pain related disability. Questions include activities of daily living, such as: Personal care, lifting, reading, work, driving, sleeping, recreational activities, pain intensity, concentration, and headache. Each question is measured on a scale from 0 (no disability) to 5, and an overall score out of 100 is calculated by adding each item score together and multiplying it by two. A higher NDI score means the greater a patient's perceived disability due to neck pain.<sup>[5,6]</sup>

Visual analog scale (VAS) is another frequently used tool in clinical practice as an outcome measure. How VAS relates with neck pain and patient's self-reported disability still needs to be investigated. VAS is usually a horizontal line, 10 cm in length, anchored by word descriptors at each end like 0 represents no pain, 10 represent maximum pain. The patient was asked to mark on the line, the point that he/she feel represents the pain perception at that time. The VAS score was determined by measuring in centimeters from the left hand end of the line to the point marked by the patient.<sup>[7]</sup> In general, improvements of pain severity on a pain intensity numerical rating scale like VAS, may not be seen as improvement in disability.<sup>[8,9]</sup> The association between neck pain, the NDI, and VAS for pain was investigated in this study.

## MATERIALS AND METHODS

This was a prospective observational study conducted in the outpatient Department of Physical Medicine and Rehabilitation, in a Tertiary Care Hospital. Patients who were willing to participate in the comparative study of thiocolchicoside and tolperisone<sup>[7]</sup> were included. Pregnant and lactating women, those with history of epilepsy, and those with cognitive deficit were excluded from the study.

Study comprehended two patient visits: An initial visit and one follow-up visit after two weeks. In the first visit, information regarding patient demographics, clinical diagnosis, and medications he/she were on, was obtained from the patient/care giver and then recorded on the pre-validated proforma. Tools selected for assessing the effectiveness of pharmacotherapy were: VAS, 5-item Likert scale, and NDI. Patient's pain status was determined using VAS for pain and they were also asked to qualify their clinical situation using a 5-item Likert scale varying from excellent to bad. The possible qualifications of their situation were: Excellent, very good, good, moderate, and bad. The disability level of the patient due to neck pain was found out using NDI questionnaire and score was noted. All patients were treated with a skeletal muscle relaxant and analgesics for a period of 2 weeks. Skeletal muscle relaxants used for the treatment were either thiocolchicoside 8 mg two times daily or tolperisone 150 mg two times daily. All patients also received any one of the following NSAIDs such as diclofenac,

aceclofenac, ibuprofen, naproxen, or paracetamol. During the follow-up visit, pain status and disability level of the patient were assessed in a similar way as in the initial visit.

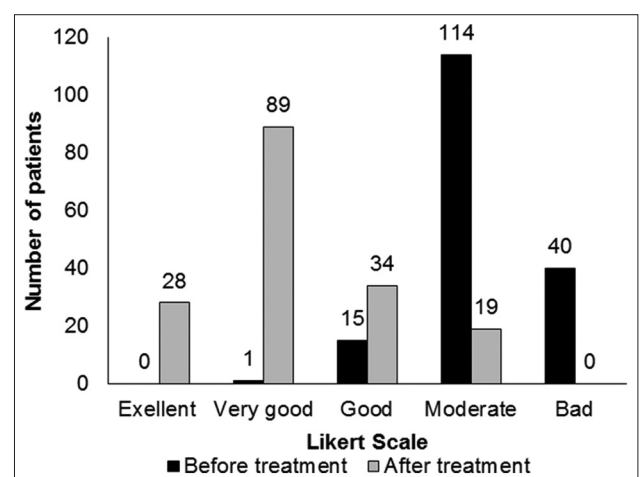
For statistical analysis SPSS version 20 (@IBM) was used. Continuous variables were depicted as mean  $\pm$  standard deviation (minimum-maximum). For analyzing change in Likert scale after pharmacotherapy Wilcoxon signed ranks test was used. For analyzing change in NDI and VAS after pharmacotherapy paired *t*-test was used. The correlation of VAS and Likert scale for qualification of neck pain with NDI was estimated before and after pharmacotherapy using correlation coefficient.

## RESULTS

A total of 170 patients attending physical medicine and rehabilitation department with neck pain were included in the study. The age range of patients included in the study was between 20 and 65 with a mean age of  $47.41 \pm 9.76$  years. 126 (74.1%) patients included in the study were females and 44(25.9%) were males. The majority of patients (85.9%) were diagnosed to have cervical spondylosis.

Effectiveness of pharmacotherapy in neck pain was assessed using qualitative Likert scale, VAS, and NDI. Before treatment majority of patients (67.1%) rated their clinical condition as moderate and after treatment majority rated it as very good with the Likert scale. After treatment, there was a significant change in Likert scale,  $Z=11.03$ ,  $P < 0.001$  (Figure 1). 16.5% of patients opined their clinical condition as excellent after pharmacotherapy.

VAS score of patients showed a significant change after treatment (Table 1). Mean VAS score of patients before treatment was  $7.82 \pm 1.09$  which was reduced by pharmacotherapy to  $3.85 \pm 1.78$ , which was statistically



**Figure 1:** Distribution of patients in relation to qualitative Likert scale rating

significant  $t = 28$ ,  $P < 0.001$ , 95% confidence interval (3.7-4.25).

NDI score of patients also was reduced by pharmacotherapy (Table 2). NDI mean score was  $69.58 \pm 13.32$  before treatment which declined to  $34.68 \pm 16.04$  which was significant.  $t = 28.199$ ,  $P < 0.001$ , 95 % confidence interval (32.46-37.34).

The NDI score was correlated with Likert scale rating of patients (Figure 2). There was a positive correlation between NDI and Likert both before ( $r = 0.589$ ,  $P < 0.01$ ) and after ( $r = 0.776$ ,  $P < 0.01$ ) pharmacotherapy. Positive correlation increased after treatment. NDI and VAS score also showed positive correlation before ( $r = 0.663$ ,  $P < 0.01$ ) and after ( $r = 0.845$ ,  $P < 0.01$ ) pharmacotherapy. The correlation was strongly positive after treatment (Figure 3).

## DISCUSSION

Currently, there are multiple tools to assess the effectiveness of pharmacotherapy. But most of the time the agreement

**Table 1: Distribution of patients in relation to VAS scale**

VAS	N=170 (%)	
	Before treatment	After treatment
1	0	4 (2.4)
2	0	37 (21.8)
3	0	49 (28.8)
4	1 (0.6)	30 (17.6)
5	2 (1.2)	17 (10)
6	13 (7.6)	14 (8.2)
7	46 (27.1)	12 (7.1)
8	68 (40)	7 (4.1)
9	28 (16.5)	0
10	12 (7.1)	0

VAS: Visual analog scale

**Table 2: Distribution of patients in relation to NDI score**

NDI	N=170 (%)	
	Before treatment	After treatment
0-10	0	1 (0.6)
11-20	0	36 (21.2)
21-30	0	50 (29.4)
31-40	3 (1.8)	29 (17.1)
41-50	8 (4.7)	24 (14.1)
51-60	36 (21.2)	16 (9.4)
61-70	45 (26.5)	9 (5.3)
71-80	40 (23.5)	4 (2.4)
81-90	24 (14.1)	1 (0.6)
91-100	14 (8.2)	0

NDI: Neck disability index

between these tools in measuring effectiveness is unclear. The effectiveness of skeletal muscle relaxants can be determined by using tools which measure difference in pain status and also by tools which measure the improvement in disability caused by the disease itself. In our study qualitative Likert scale, VAS for pain and NDI were the tools used to assess the effectiveness of pharmacotherapy for neck pain. Several studies have used the same tools for assessing the effectiveness of pharmacotherapy and surgical treatment.<sup>[2-4]</sup>

There was a significant change in the Likert scale rating of patients following pharmacotherapy. The majority of patients rated their condition as very good after the treatment. Previous studies also proved qualitative Likert scale as an effective tool to measure the improvement in clinical condition after treatment.<sup>[10,11]</sup>

VAS showed significant reduction in scores following treatment with skeletal muscle relaxants and analgesics in the study population. In their study, Lee et al. measured the change in VAS score associated with adequate pain control and a mean reduction in VAS of 30.0 mm was observed which represented a clinically important difference in pain severity with respect to patients' perception of adequate pain control.<sup>[8,9]</sup>

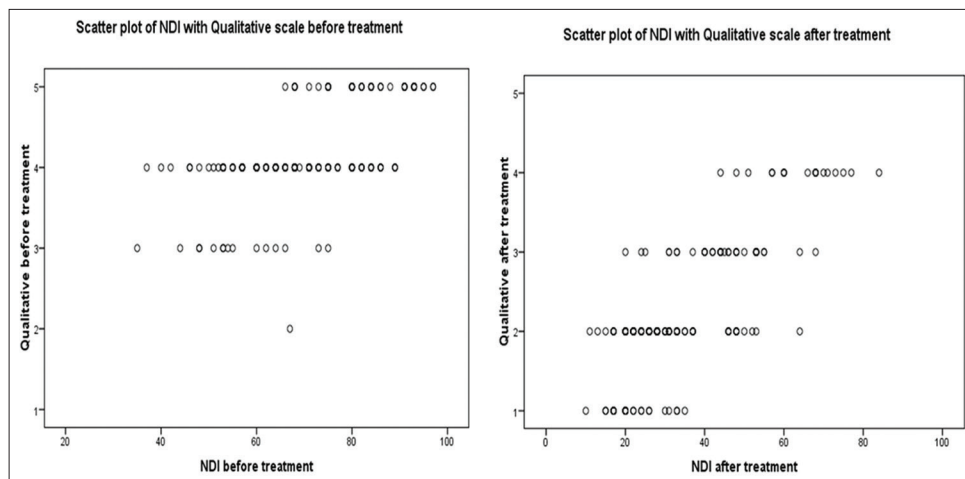
In this study disability of patients due to neck pain was assessed using NDI before and after treatment and a significant reduction in scores was observed posttreatment which represented reduction in disability. This goes in agreement with the findings of study done by Donk et al.<sup>[10]</sup>

Our study also showed that there is a correlation between NDI and qualitative Likert scale rating which confirmed that improvement in pain status is also associated with reduced disability of patients with neck pain. Donk et al. compared the qualification of outcome by patients after cervical spine surgery to the NDI and found that there was a correlation between qualification of the situation by the patients themselves and NDI. In their study, an NDI-7 corresponded to a good outcome according to the patients.<sup>[10]</sup>

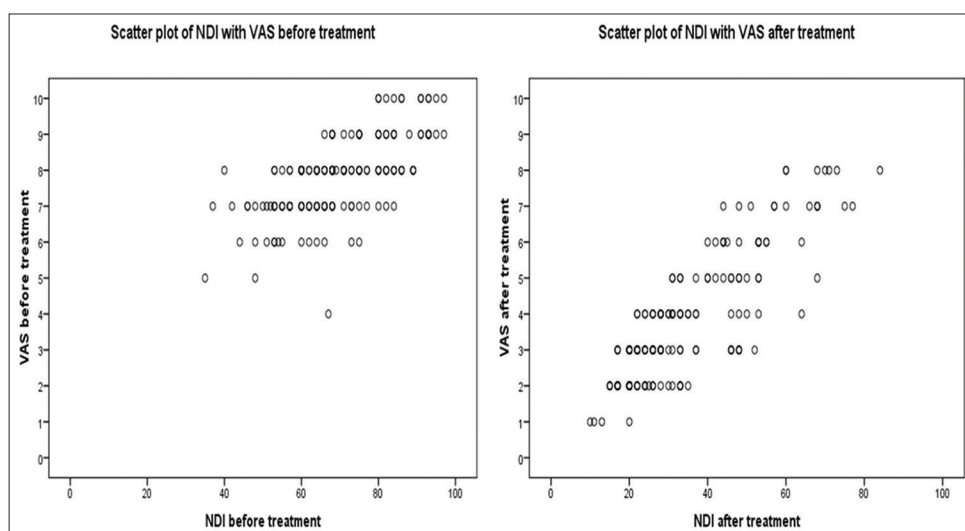
The correlation between NDI and VAS also was studied in this study which showed a positive correlation both before and after treatment. Strong positive correlation was observed after pharmacotherapy.

In their study, Cleland et al. observed that both the NDI and numeric rating scale for pain, exhibit fair to moderate test-retest reliability in patients with mechanical neck pain. Both instruments also showed adequate responsiveness in that patient population.<sup>[11]</sup>

In a similar study, En et al. evaluated the construct and content validity of the neck pain and disability scale (NPAD) along with NDI. The NDI and NPAD scores were



**Figure 2:** Correlation between neck disability index and qualitative Likert scale rating



**Figure 3:** Correlation between neck disability index and visual analog scale

strongly correlated ( $r = 0.86$ ,  $P < 0.01$ ), while the correlation between the problem elicitation technique and the fixed-item questionnaires was moderate (NDI:  $r = 0.62$ ,  $P < 0.01$ ; NPAD:  $r = 0.71$ ,  $P < 0.01$ ). Both the NDI and the NPAD include most of the functional problems common to this patient group, and display good content validity.<sup>[12]</sup> In another study done by Uthai khup et al.<sup>[13]</sup> used the Thai versions of NDI and NPDS and concluded that the NDI-TH, NPDS-TH, and NPDS-TH subscales were moderately correlated with the VAS (range,  $r = 0.61$ - $0.76$ ,  $P < 0.001$ ).

## CONCLUSION

The effectiveness of pharmacotherapy in patients with neck pain was evaluated using qualitative Likert scale rating by the patient, VAS for pain and NDI. There was a significant change in Likert scale rating and significant reduction in mean VAS and mean NDI after pharmacotherapy. Study showed a positive correlation between the qualification of the clinical condition with Likert scale and NDI as well as between VAS for pain and NDI. Hence, NDI can be

considered as an effective tool in evaluating the effectiveness of pharmacotherapy.

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