Comparison of Neck and Shoulder Strengthening Exercises with Weights, Traction Plus Physiotherapy, and Acupuncture in the Treatment of Patients with Chronic Cervical Disk Herniation

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Abstract. Neck pain is a common cause of visiting physicians, especially physiatrists, which has a prevalence ranged from 30% to 50%. Discopathy and radiculopathy are common etiologies among patients. Symptoms usually persist and may result in a chronic condition. Nowadays, there are different ways for decreasing neck pain.

Materials and Methods: In this randomized clinical trial, 105 patients between 20 to 55 years old with a definite diagnosis of cervical radiculopathy were selected through simple census method. People with no history of serious treatment or invasive medical procedures were included in the study. Patients with underlying diseases and indications for surgery were excluded from the study. Patients were treated by three different methods (physiotherapy with cervical traction, acupuncture, and strengthening exercise) for three weeks. Then they were evaluated for pain severity based on VAS score and amount of disability according NDI score immediately at end of treatment and three weeks after treatment.

Results: Finally, 105 patients including 64 (61%) male and 41(39%) female with a mean age of 50.32 ± 3.22 underwent analysis. The most common etiology of neck pain in participants was job-related issues. Paresthesia was the most common presenting symptom in patients following by reduction in the neck movements. Comparing the three groups, physiotherapy group showed a more significant decrease in pain severity and improving function in first follow up. In the second follow up, the strengthening exercise had more efficacy than other methods. Acupuncture group gets the least benefits from treatment.

Conclusion: In short time, physiotherapy is more effective than acupuncture and strengthening exercises in patients with cervical disc disease. After several weeks, strengthening exercises were more effective in reducing pain and disability.

Keywords: Cervical discopathy, physiotherapy, traction, acupuncture, strengthening exercise

1. INTRODUCTION

Neck pain is a common complaint, particularly, among working-aged women with a point prevalence of nearly 13%, [1-4] and prevalence of nearly 50% during the life time [5-7]. In a study in Canada [8], 54% of the general population had experienced neck pain during the past 6 months. Symptoms usually persist and may result in a chronic condition. The origin of neck pain is multi factorial; for example, micro trauma in connective tissues, and psychosocial stress may lead to excessive muscular tension [9].

Anatomy of the cervical spine can be affected by injuries and degenerative changes that causes multiple lesions [10, 11]. One of the most common causes of neck pain is occupational injuries and improper positioning of the neck. The cervical facet joint and its capsular ligament is a common source of pain in the neck in adults [12].

There are many treatments that are accepted as standard forms of practice including conservative strategies as medication, physical medicine methods, manual treatments, and education of patients [13,14] but some studies reported that there is lacking of evidence for many of the standard treatment approaches to neck pain [15].

As widely used complementary methods in Europe and UK, oral medication, physical therapy, acupuncture, exercise, manipulation, massage, epidural injection, and surgery acupuncture are beneficiary treatments for neck pain [16]. Most studies of acupuncture for the treatment of neck pain
evaluated its benefit shortly after treatment [17], while a few studies conducted on a follow up time of six months or more have shown that the outcome of acupuncture is more effective than the placebo treatment [18,19].

Cervical traction is a method in which a distracting force is administered to the neck so as to separate the cervical segments and relieve compression of nerve roots by intervertebral disk distraction [20]. However, a systematic review demonstrated no definite conclusion for the efficacy of cervical traction as a result of poor methodological quality [21]. No high quality evidence was found for indicating that there is still uncertainty about the effectiveness of exercise for neck pain [22]. Strengthening and endurance exercises have been shown to be effective in reducing cervico-scapulo-thoracic and shoulder pain as well as improving function [23]. Physiotherapy treatments include: Use of some modalities, Joint mobility and joint tension, Corrective exercises for improving joint flexibility, and using tools to modify activities [24].

Surgical treatments for vertebral disks are associated with higher risks of anesthesia complications and immobility during and after surgery which can develop complications such as pulmonary embolism [25]. Considering the side effects of surgery and high economic costs, we hypothesized that conservative and less invasive treatments (strengthening exercises, and physiotherapy with and acupuncture) are more effective than surgery. Given that these three methods have not been compared yet in a single study, this study was designed to assess the efficacy, advantages, and disadvantages of these three different methods in patients’ chronic cervical disc herniation.

2. METHODS

This randomized clinical trial was approved by our institutional review board. Hundred and five patients with age ranged from 20 to 55 years old were selected through simple census method. Then, they were referred to Physical Medicine and Rehabilitation Clinic of Baqiyatallah hospital with a definite diagnosis of cervical disc herniation by Magnetic resonance imaging (MRI). Entry criteria included those who had never seriously cured, and they did not do any invasive medical procedures. the patients with severe discopathy or severe functional impairment and the indications for surgery, severe protrusion, or extrusion disc in the spinal canal, patients with malignancies, acute fracture, acute septic arthritis, acute infectious disease, uncontrolled diabetic neuropathy, advanced osteoporosis, aortic aneurysm, heart disease, shoulder tendonitis, and patients who have previously received one of the treatments of this study, patients who were not able to do physiotherapy or traction, and those who were not willing to participate in the study were excluded. Participants were divided into three groups randomly with the help of a table of random numbers, and then Information about severity, unilateral or bilateral pain, underlying disease and MRI findings were recorded in a pre-designated questionnaire. Then, each group was cured by a different treatment method. Group one received neck and shoulder reinforcement exercises with weights of 500 to 1500g three times per week and each time 8 repetition for major muscle groups. Group two received physiotherapy with US, TENS & HP plus cervical traction with 7% of body weight for 15 minutes (3 times /week ), and group 3 underwent acupuncture in the specific areas including GB20, GB23, UB10, DU14, and SI3,9, 11, (3 times/ week, each time 1.5 min). Patients were treated for three weeks and they were followed immediately at the end of treatment and three weeks after treatment. Then, the effects of treatment method on neck and shoulder pain, according to the VAS and symptom severity based on NDI score, were recorded.

2.1. Data Analysis

Statistical Package for Social Sciences (SPSS) version 16 (SPP Inc., Chicago, Illinois, USA) was used to analyze the data and quantitative variables in three groups were studied by Repeated-Measures ANOVA test and the nonparametric equivalent (Friedman) as well as the pair test and Chi² test or Fisher's exact test were used for qualitative data.

3. RESULTS

Finally one hundred and five patients including 64 (61%) male and 41(39%) female with the mean age of 50.32±3.22 years underwent analysis. The minimum age of the patients was 24 years old and the maximum age was 55 years old. There was no significant difference between mean age of patients in the three groups (p = 0.66). The gender distribution of patients in the three groups showed no statistically significant difference (p = 0.20).

Among participants, 46 patients (43/8%) were employees and 34 patients (32/4%) were housewives. The remaining patients had other jobs. There was no statistically significant difference in distribution of jobs between the groups (p=0.59).

The onset of neck pain was 45 days minimum and maximum time of 180 months. The meantime to onset of neck pain in patients was 99/42± 3/46 months. The onset of neck pain in both groups showed no statistically significant difference (p = 0.22).
The cause of neck pain in 74.3% of patients that was the most common cause was job-related and incorrect situation of head and neck. Causes of neck pain among the three groups showed no statistically significant difference (p = 0.21).

As the Diagram shows, 84 patients (80%) consumed analgesic and 21 patients (20%) did not use any painkiller.

![Diagram 1: rate of analgesic consumption](image)

**Table 1: Distribution of Pain in Groups**

<table>
<thead>
<tr>
<th>Location</th>
<th>Neck</th>
<th>limb</th>
<th>shoulder</th>
<th>Limb and shoulder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>15(14.3%)</td>
<td>45(42.9%)</td>
<td>3(2.9%)</td>
<td>42(40%)</td>
</tr>
</tbody>
</table>

Table 1 shows the distribution of pain in groups. There was no significant difference in distribution of pain between groups (p=0.09). Paresthesia was the most common presenting symptom in patients’ respectively. Table 2 shows the frequency of symptoms in patients with neck pain. In examination, range of motion in 16 patients (15.2%) was normal and 30 patients (28.6%) had normal range of motion but with pain. The movements and painful in 59 patients (56.3%) were reduced (diagram 2).

**Table 2: Frequency of Symptoms**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Paresthesia</th>
<th>numbness</th>
<th>Reduction in motions</th>
<th>Morning stiffness</th>
<th>Head ache</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>94(89.5%)</td>
<td>57(54.3%)</td>
<td>78(74.3%)</td>
<td>45(42.9%)</td>
<td>47(44.8%)</td>
</tr>
</tbody>
</table>

![Diagram 2: range of motion](image)
Table 3 shows the mean of muscle strength. The
mean muscle force in physiotherapy group was
3.42±0.60, while it was 3.47±0.50 in acupuncture and
3.34±0.48 in exercise group. There was no significant
difference between three groups for muscle force
(p=0.60). Results of examination are summarized in
Table 4. The most common finding was vertebral
tenderness followed by muscle weakness.

### Table 3: Mean of Muscle Strength

<table>
<thead>
<tr>
<th>Groups</th>
<th>Physiotherapy</th>
<th>Acupuncture</th>
<th>Strengthening exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean of muscle strength</td>
<td>3.42</td>
<td>3.47</td>
<td>3.34</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.60</td>
<td>0.50</td>
<td>0.48</td>
</tr>
</tbody>
</table>

### Table 4: The Frequency of the Physical Examination Results

<table>
<thead>
<tr>
<th>examination</th>
<th>VT (%)</th>
<th>PM (%)</th>
<th>TK (%)</th>
<th>Scoliosis (%)</th>
<th>ICL (%)</th>
<th>DCL (%)</th>
<th>LD (%)</th>
<th>PAR (%)</th>
<th>DD (%)</th>
<th>MW (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>81(77.1)</td>
<td>60(57.1)</td>
<td>12(11.4)</td>
<td>16(15.2)</td>
<td>38(36.2)</td>
<td>56(53.3)</td>
<td>6(5.7)</td>
<td>33(31.4)</td>
<td>21(20)</td>
<td>64(61)</td>
</tr>
</tbody>
</table>

VT= vertebral Tenderness  
PM = the painful muscle  
TK = Thoracic kyphosis  
ICL = Increased cervical lordosis  
DCL = decreased cervical lordosis  
LD = Limb deformity  
PAR = Positive Arm abduction relief  
DD = Dysfunction in the DTR  
MW = muscle weakness

Comparing the three groups, at first follow up,
physiotherapy group showed a more significant
decrease in pain severity. Contents of table 5 indicate
that physiotherapy is more effective than acupuncture
and strengthening exercises in patients with chronic
cervical disc disease (P=0).

### Table 5: Pain Intensity in Different Times in Groups

<table>
<thead>
<tr>
<th>Pain severity</th>
<th>Before treatment</th>
<th>Three weeks after treatment</th>
<th>Three weeks after end of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiotherapy/traction</td>
<td>7.20</td>
<td>4.89</td>
<td>3.27</td>
</tr>
<tr>
<td>strengthening exercises</td>
<td>7.71</td>
<td>5.51</td>
<td>3.43</td>
</tr>
<tr>
<td>acupuncture</td>
<td>7.06</td>
<td>6.00</td>
<td>4.88</td>
</tr>
</tbody>
</table>

### Table 6: Percentage of Disability at Different Times

<table>
<thead>
<tr>
<th>Groups</th>
<th>Before treatment</th>
<th>Three weeks after treatment</th>
<th>Three weeks after end of treatment</th>
<th>P.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiotherapy</td>
<td>%54±3.02</td>
<td>%44±2.14</td>
<td>%35±2.14</td>
<td>0.62</td>
</tr>
<tr>
<td>Strengthening exercises</td>
<td>%54±1.72</td>
<td>%45±2.19</td>
<td>%28±1.81</td>
<td>0.58</td>
</tr>
<tr>
<td>Acupuncture</td>
<td>%53±2.63</td>
<td>%49±1.94</td>
<td>%39±2.43</td>
<td>0.90</td>
</tr>
</tbody>
</table>

4. DISCUSSION

Management of cervical radiculopathy is done by both
surgical and non-surgical methods. In non-invasive
methods oral medications such as Glucocorticoids,
anaesthesics and sedatives, exercise and physiotherapy,
traction, epidural Glucocorticoid injections,
acupuncture, and massage were applied. Lots of
studies have compared various methods of pain
control in the patients with neck pain but the results of
these studies are inconsistent. For example, Carlesso
et al. has been compared different methods that were
used to relieve neck pain. Finally, he has shown that
physiotherapy with manual therapy treatments are
most effective in reducing pain [26]. In another study,
Gross have reviewed 30 studies that focused on the
ways of controlling and reducing neck pain. Finally,
he have concluded that since most of the studies have
moderate levels of reliability, the results cannot be
generalized [27]. The intensity of neck pain at
baseline was similar in patients after three weeks of
treatment. Group 2 (physicaltherapy with traction)
showed a more significant decrease in symptoms
severity in comparison with other two groups. This
was supported by Sweeney et al who reported that the
manual physiotherapy and traction techniques have
the desired effects without serious complications [28].
Akinbo et al., reported that the best weight to exert
tension on the neck is 10% of total body weight [29].
Nanno et al. [30], also, showed that cervical
intermittent traction is effective in relieving pain. In
another study, Nadin et al. reported that cervical
traction have desired therapeutic effect with no
complication [31]. In the present study, strengthening
exercises have Long-term positive effect. In a similar
study, Young et al. demonstrated that muscle
strengthening exercises can improve the quality of life
in patients [32], while some studies have shown that,
in comparison with other therapies, exercise effects
are small [33]. MacDermid concluded that exercise,
stretching the neck, and physiotherapy have similar effects in the treatment of cervical radiculopathy [34]. Present study showed Acupuncture had fewer effects on relief pain and improve function. Vickers reported that acupuncture can be an effective method in reducing neck pain but its effectiveness is largely dependent on the person who applies this method [35].

5. CONCLUSION

It could be concluded that physiotherapy with traction is more effective than acupuncture and strengthening exercises in patients with chronic cervical disc disease. Although physiotherapy seems to work better in the short time, after several weeks strengthening exercises were more effective in reducing pain. In addition, it is recommended that patients be treated with physiotherapy in first line followed by acupuncture, and then the treatment be continued with strengthening exercises.

REFERENCES

7. Hult L. The Munkfors investigation: a study of the frequency and causes of the stiff neck-brachialgia and lumbago-sciatica syndromes, as well as observations on certain signs and symptoms from the dorsal spine and the joints of the extremities in industrial and forest workers. Acta Orthopaedica. 1954;25(S16):3-76.


**Online References**

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