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EFFICACY OF PHYSICAL THERAPY PROGRAM ON FEMORAL NEUROPATHY AFTER RENAL TRANSPLANTATION

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Abstract

**Background/aim:** After renal transplantation, both compression of as well as interruption of blood supply to the femoral nerve can thus play a role in the pathogenesis of femoral neuropathy. Moreover, diseases such as diabetes and uremia, often encountered in transplant recipients, can be regarded to be aggravating factors. The aim of this study was to investigate the therapeutic efficacy of exercises and interferential stimulation as physical therapy approaches in improving femoral neuropathy after renal transplantation.

**Material and methods:** Thirty patients of both sexes and suffered from femoral neuropathy after renal transplantation. The patients were selected and recruited randomly from different Hospitals (in urological surgeries units). Their ages was ranged from 45-60 years. In the present study, the patients were classified into two equal groups (15 patients for each group). Group (A) (Exercise therapy group): they received interferential therapy 30 minutes, three times per week, for 12 weeks and exercises plus medication. Group (B): they received only medical and nursing cares.

**Results:** This study showed a significant increase in the Nerve Conduction Velocity (NCV) (m/s) after twelve weeks of treatment application (post) of Exercise therapy group (group A) when compared with control group (group B)

**Conclusion:** Usage of Exercises and transcutaneous electrical nerve stimulation produce objective improvement on nerve conduction velocity after renal transplantation.

Key words: Renal transplantation / femoral neuropathy / Physical therapy / Exercises / transcutaneous electrical nerve stimulation.
1. Introduction

Femoral neuropathy is a complication after renal transplantation or after pelvic surgery in general. The clinical presentation varies according to the level of injury and may consist of paresis, paralysis, or atrophy of the iliopsoas and/or the quadriceps femoris muscle, the absence or diminution of the patellar tendon reflex, or sensory disturbances (mostly hypoesthesia of the anterior and medial part of the thigh and/or lower leg) (1).

Besides compression, interruption of the nerve’s blood supply was also found to play a role in the pathogenesis of femoral neuropathy, which was also described after aortic aneurysm surgery. In that retrospective survey, the overall incidence was 3.4%. The authors suggested that the transient disturbance of the blood supply to the femoral nerve during aorta clamping was responsible for an ischemic insult to the femoral nerve (2).

For its blood supply, the intrapelvic portion of the femoral nerve indeed depends on two very small arterial branches distally from the aortoiliac bifurcation: the iliolumbar artery (originating from the internal iliac artery) and the deep circumflexing iliac artery. (originating from the external iliac artery). This blood supply is regarded to be scantier on the left side compared with the right side, because more anastomoses with lumbar arteries are present on the right side, which may account for the observation that the left femoral nerve seems more susceptible to ischemic neuropraxia than the right side in the present series (2).

Painful sensory neuropathies with exclusive or preferential involvement of small sensory nerve fibers of the A-delta and C types are commonly encountered in clinical practice. Among the most prominent complaints of patients suffering from small-fiber neuropathy are burning pain and paresthesias, typically beginning distally in the feet and slowly progressing proximally in a length-dependent fashion. Unless there is associated large-fiber involvement, patients display few abnormalities on standard neurological examination and nerve conduction studies may remain within normal limits (3).
The principles of progressive resistance exercise (PRE) for increasing force production in muscles have remained virtually unchanged since they were described by DeLorme and Watkins1 almost 60 years ago. These principles are

(1) To perform a small number of repetitions until fatigue.

(2) To allow sufficient rest between exercises for recovery.

(3) To increase the resistance as the ability to generate force increases.

These principles are detailed in the guidelines of the American College of Sports Medicine (ACSM) where it is recommended that loads corresponding to an 8- to 12-repetition maximum (RM) be lifted in 1 to 3 sets, training 2 or 3 days each week. An 8RM to 12RM load is the amount of weight that can be lifted through the available range of motion 8 to 12 times before needing a rest (4).

Interferential current therapy is the application of alternating medium frequency (4,000 Hz) amplitude modulated at low frequency (0-250Hz). Interferential current therapy is the application of alternating medium frequency (4,000 Hz) amplitude modulated at low frequency (0-250Hz) (5).

Interferential current therapy included in a multimodal treatment plan seems to produce a pain relieving effect in acute and chronic muscleoskeletal painful condition compared with no treatment or placebo. Interferential current therapy combine with another intervention was shown to be more effective than placebo application at the 3-month follow up in subjects with pain. However, it is evident that under this scenario, the unique effect of IFC is confounded by the impact of other therapeutic intervention. Moreover, it is still unknown whether the analgesic effect of IFC is superior to that of these concomitant interventions (5).

TENS is non-invasive and should be differentiated from invasive techniques such as spinal cord stimulation (often used in the management of neuropathic pain) where patients undergo surgery to have an electrical device implanted in the spinal cord (6).
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TENS is used throughout the world to manage pain because it is safe, has few contraindications or side effects, and has no potential for overdose (7).

2. Materials and methods

Thirty patients of both sexes between 45 and 60 years of age selected and recruited randomly from different Hospitals (in urological surgeries units), who were complaining from femoral neuropathy after renal transplantation were enrolled in the study. Patients who were not examined by the physician before starting of the study, had any associated medical problems, or medically unstable were excluded from the study. Written informed consent was obtained from each patient. Age of the patients were recorded. The study was designed as a prospective randomised clinical trial. Patients were randomized into 2 groups, each group consisting of 15 patients. Group A was treated through interferential therapy 30 minutes, three times per week, for 12 weeks and exercises plus medication, group B was treated through medical and nursing cares only. All treatments were applied by the same physiotherapist.

Interferential current therapy is the application of alternating medium frequency (4,000 Hz) amplitude modulated at low frequency (0-250Hz) (5). The application of interferential three times / week for 30 min. at the course of femoral nerve.

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3 sets, training 2 or 3 days each week. An 8RM to 12RM load is the amount of weight that can
be lifted through the available range of motion 8 to 12 times before needing a rest.

Nerve Conduction studies were performed before and after treatments.

Statistics

A statistical package program was used to evaluate the data obtained from the study.
Descriptive statistical methods (mean, and standard deviation) were used in the evaluation of
research data as well as the Kolmogorov–Smirnov distribution test for examining normal
distribution. In comparing quantitative data, the unpaired samples t-test was used in intergroup
comparison of parameters. The Paired samples t-test was used for intragroup comparisons. The
results were calculated at the 95% confidence interval, P < 0.05 significance level and P < 0.01
advanced significance level.

3. Results

No study participant left the research project for any reason. No side effects or
complications were observed during the treatment. Baseline characteristics of the patients are
shown in Table 1. The average age was 55.73 ± 5.09 years in group A and 54.87± 5.9 years in
the group B.

No statistically significant difference was found between the two groups in terms of age
(P > 0.05).

Both groups showed a statistically significant increase in terms of Nerve Conduction
studies (m/s) at the end of the treatment in comparison to baseline values (P < 0.01), as shown
in Table 2.
The Nerve Conduction studies (m/s) increase in group B at the end of the treatment was significantly lower than in group A (P < 0.01). There was no statistically significant difference in the Nerve Conduction studies (m/s) between the both groups pre treatment, as shown in Table 3.

4. Discussion

Sensory (And / Or Motor) Disturbances in the thigh after kidney transplantation is a relatively prevalent complaint (8).

Kidney transplantation improves life quality among patients suffering end-stage renal disease. Still, some problems may occur after kidney transplantation that influences the life quality, presently an important facet of disease treatment. The lateral cutaneous nerve of the thigh (LCNT) originates from the roots of L2 and L3 progressing through the lateral anterior thigh from the inguinal ligament to the knee. Slight numbness, tenderness, and sometimes pain may occur when it is damaged. Touch and needle perception are decreased (9).

An efficient way to increase muscle strength in general is progressive resistance training (PRT), whereby loads of 70% or more of the maximum strength are used (10).

PRT induces higher levels of neuromuscular activation than functional exercises, and so is an effective method for improving muscle strength (11).

Interferential current therapy (IFC) is the application of alternating medium frequency current (4,000 Hz) amplitude modulated at low frequency (0-250 Hz). A claimed advantage of IFC over low frequency current is its capacity to diminish the impedance offered by the skin. Another advantage speculated for IFC is its ability to generate an amplitude modulated frequency (AMF) parameter, which is a low frequency current generated deep within the treatment area. Several theoretical physiological mechanisms such as "the gate control" theory, increased circulation, descending pain suppression, block of nerve conduction, and placebo have been proposed in the literature to support the analgesic effect of IFC (5).
In conclusion, both Exercises and transcutaneous electrical nerve stimulation or medical and nursing cares are effective in the treatment of femoral neuropathy after renal transplantation. However, there was greater improvement in nerve conduction velocity when repeated after 12 weeks in patients with femoral neuropathy after renal transplantation in favour to Exercises and transcutaneous electrical nerve stimulation.

References:


### Table 1. Baseline characteristics of the patients.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group A (n = 15)</th>
<th>Group B (n = 15)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years, mean ± SD)</td>
<td>55.73 ± 5.09</td>
<td>54.87 ± 5.9</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD or number of patients.
Table 2. Nerve Conduction Velocity (NCV) (m/s) for both groups.

<table>
<thead>
<tr>
<th>Nerve Conduction Velocity</th>
<th>Baseline</th>
<th>At the end of the treatment</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A (n = 15)</td>
<td>29.33 ± 2.5</td>
<td>36.93 ± 2.12</td>
<td>0.000**</td>
</tr>
<tr>
<td>Group B (n = 15)</td>
<td>29 ± 2.42</td>
<td>34.53 ± 2.56</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD or number of patients. **P < 0.01.
Table 3. Nerve Conduction Velocity (NCV) (m/s) between groups.

<table>
<thead>
<tr>
<th>Nerve Conduction Velocity</th>
<th>Group A (n = 15)</th>
<th>Group B (n = 15)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>29.33 ± 2.5</td>
<td>29 ± 2.42</td>
<td>0.713</td>
</tr>
<tr>
<td>At the end of the treatment</td>
<td>36.93 ± 2.12</td>
<td>34.53 ± 2.56</td>
<td>0.009**</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD or number of patients. **P < 0.01.