MICROCURRENT STIMULATION EFFICACY ON CHRONIC PANCREATITIS PAIN

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Abstract

Purpose: to evaluate the efficacy of the microcurrent electrical neuromuscular stimulation (MENS) on chronic Pancreatitis pain. Methods of evaluation: (Measurement of the serum cortisol level and calculation of the nalbuphine intake). Thirty patients (20 males and 10 females) were suffering from chronic Pancreatitis were divided into two groups. Study group (A) received true MENS plus the nursing and medical care and the control group (B) received placebo MENS plus the same previously mentioned nursing and medical care. The treatment was conducted for the two groups daily from the first hospitalization day along a treatment period of six days. Results showed that microcurrent electrical neuromuscular stimulation was effective in improving chronic Pancreatitis pain as evidenced by the highly significant decreases in serum cortisol level and nalbuphine intake.

Key words: Chronic Pancreatitis, Microcurrent electrical neuromuscular stimulation and Serum cortisol level.

INTRODUCTION

Pancreatitis is the inflammation of the pancreas. The pancreas secretes digestive enzymes, alkaline material (sodium bicarbonate) into the small intestine. Inflammation of the pancreas is thought to occur when digestive enzymes attack, destroy and digest the pancreatic tissues. This process is called auto digestion. Autodigestion causes swelling, hemorrhage and damage to the blood vessels. In addition to digesting pancreatic tissue, it is believed that the enzymes (especially trypsin) set off a chain reaction by activating other enzymes, thus increasing the number of enzymes eating away the tissue. There are two forms of pancreatitis; acute pancreatitis and chronic pancreatitis. Patients with chronic pancreatitis usually present with persistent abdominal pain or steatorrhea resulting from malabsorption of the fats in food. Causes of chronic pancreatitis: alcohol abuse, tropical, cystic fibrosis, trypsinogen and inhibitory protein defects and hypercalcemia, S.A Aden et al., (2009)1, P.B. Banks and M.D. Freeman,(2006)2, P.B. Banks, (2005)3, L.A. Basse et al., (2002)4: A.M. Belie and I.R. Segal,(2004)5.

The major cause of chronic pancreatitis is alcohol abuse (in 90 percent of all cases). In the other 10 percent of all cases, chronic pancreatitis is a result of hemochromatosis (excess iron in the body) or heredity. In October 1996, researchers from the University of Pittsburgh Medical Center identified the gene, trypsinogen, as the basis for hereditary pancreatitis. Patients with acute pancreatitis may have one or several attacks. These attacks last from one to several days, and may include the following symptoms: abdominal pain in the upper abdomen which may include and be accompanied by increases in severity and may last for several days, may be constant and localized, or radiate to the back and other areas, may be swollen and extremely tender, and sometimes a lump can appear in the area, may be worse when lying flat on the back, may be worse by eating or drinking (within minutes following meals), especially greasy foods or foods with a high fat content, may be worse after drinking alcohol, nausea, vomiting, low-grade fever, increased pulse rate, jaundice (yellowing of the skin), pleurisy (inflammation of the pleura - the membrane lining the lungs and chest cavity), shortness of breath, dizziness, weakness, sweating and anxiety, M.J. Benson, et al, (2004)6, M.A.

The use of electricity, electrical stimulation, and electromagnetic fields is not new in medicine. Studies have shown that by externally imposing an electrical field or electrical current the electrical potentials present in and between cells, in soft tissues, promote biological and physiological changes of these tissues. Microcurrent electrical neuromuscular stimulation (MENS) is a new physical therapy modality and it’s current at micro ampere which has advantage of whispering to the body instead of shouting with milliampere. Micro current increase in muscle metabolism, oxygen uptake and carbon dioxide and other metabolites production, as well as raised local temperature and greater local blood flow and intramuscular blood flow and as a consequence of regular muscle contraction and relaxation which provides muscle pumping action and lead to raising the rate of flow in venous and lymphatic vessels. Microcurrent improves blood flow, inhibits bacterial growth, and enhances phagocytosis by attracting macrophages, and neutrophils. Thus, the influence of stimulation goes beyond events occurring at the skin cell level, Y.T. Becker, (2008)¹³, C.C. Byl and J.J. McKenzie, (2009)¹⁴, C.C. Byl, J.J. McKenzie, and H.L. Scheuenstuhl, (2008)¹⁵, J.D. Chapman and D.Z. Hill, (2002)¹⁶.

MATERIALS AND METHODS

Subjects: Thirty patients (20 males and 10 females) suffering from chronic pancreatitis, selected from the surgery departments of Kasr-El-Ani (Cairo University hospitals) and Om-Al-Misreen hospital (Ministry of Health). Diagnosis was confirmed with ultrasound abdomen and full blood count, liver function tests, serum calcium, serum amylase and lipase. Subjects were subdivided into two equal groups in number: study group and a control one. Group I: That was received true MENS plus the nursing and medical care (administration of the prescribed medications). Group II: That was received placebo MENS plus the same previously mentioned nursing and medical care (administration of the same prescribed medications), A.N. Steven, (2006)¹², A.A. Gersh, (2009)¹⁷, G.T. Haar, (2002)¹⁸, A.S. Leffmann and R.R. Cornwall, (2010)²¹.

Instrumentation:

Measurements equipment and tools:
Serum cortisol level measurement: (SCL):
Normal cortisol level ranged from 9-25 µg/dL at morning. Patients with painful conditions tended to have higher than normal SCL. Estimation of serum cortisol level was carried out before MENS application (First record) and after 6 days of MENS application (second record). A venous blood sample of 8 ml was taken at the morning, centrifuged and stored at 20°C till analyzed, P.B. Banks, (2005)³, A.N. Steven, (2006)¹², A.S. Kjartansson and J.K. Lundeberg, (2006)²⁰.


Treatment: Position of subject and the MENS electrodes placement: The subject was relaxed in supine position with the hips were adjusted in slightly flexed and laterally rotated position, knees were adjusted also in slightly flexed position (only 10⁵) and slightly planter flexed ankles, with a pillow under the subjects head and so the comfortable patient’s position was obtained. Four electrodes from two channels were used. Two electrodes from one channel were positioned on the epigastric region in the middle above the umbilical region paramedian while the other two electrodes from the other channel were positioned on the left hypochondriac region above the left lumbar region paramedian the anterior-axillary line, the electrode surface area must be equal to or greater than 4 cm² to minimize heat produced beneath electrodes to prevent skin burns. Also the interelectrode distance must not be less than the cross-sectional diameter of the electrode, to minimize current density between electrodes, so heat produced either beneath or between must not exceed the safe limits to avoid skin burn, the 4 electrodes were of the adhesive type and if not of the adhesive type they were moistened with jelly and firmly fixed by a relevant adhesive tapes over the recommended areas. MENS stimulation was initiated from the first hospitalization day. It was recommended that the stimulation was continuous every 6 hours (stimulation 4 times daily), 20 minutes for each session for 6 days as a total period of treatment. MENS application was applied to decrease the pancreatitis pain, decrease the need for narcotics and opioid central analgesics (nalbuphine), increase the patient’s mobility, obtain a more uneventful recovery and shorten the hospital confinement. Stimulation parameters of the MENS.
application in the study group were the following: The parameters were, modified square DC biphasic pulses of frequency usually 0.3 – 80 Hz provides the best pain relief with changing polarity at intervals of 1 seconds, while MENS application for the control group (B) was placebo MENS in the same position of subject and MENS electrodes placement, Y.T. Becker, (2008)\textsuperscript{13}, C.C. Byl and J.J. McKenzie, (2009)\textsuperscript{14}, C.C. Byl, J.J. McKenzie, and H.L. Scheuenstuhl, (2008)\textsuperscript{15}, J.D. Chapman and D.Z. Hill, (2002)\textsuperscript{16}, A.A. Gersh, (2009)\textsuperscript{17}, G.T. Haar, (2002)\textsuperscript{18}, Hooker, (2005)\textsuperscript{19}, A.S. Kjartansson and J.K. Lundeberg, (2006)\textsuperscript{20}.

**Data analysis**

SCL and NPI records were measured before treatment and after cessation of the treatment program in both groups. Collected data were fed into computer for the statistical analysis; descriptive statistics as mean, standard deviation, minimum and maximum were calculated for each group. The t-test was done to compare the mean difference of the two groups before and after application and within each group. Alpha point of 0.05 was used as a level of significance\textsuperscript{23}.

**Results**

In the present study, the effect of MENS on SCL and NPI in chronic pancreatitis pain was investigated. As shown in table (1) and figure (1), the mean value of the SCL before treatment was (36.330 ± 0.430) ug/dL in the study group, while after treatment was (22.666 ± 0.212) ug/dL. These results revealed a highly significant reduction in SCL, (P<0.0001). But in the control group, the mean value of the SCL, before treatment was (36.659 ± 0.209) ug/dL, while after treatment was (36.592 ± 0.198) ug/dL, and these revealed non-significant difference in SCL, (P > 0.05).

<table>
<thead>
<tr>
<th>Before treatment</th>
<th>After treatment</th>
<th>Mean difference</th>
<th>T.value</th>
<th>P.value</th>
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<tbody>
<tr>
<td>Mean in ug/dL</td>
<td>± SD</td>
<td>Mean in ug/dL</td>
<td>± SD</td>
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<tr>
<td>Study group (True MENS group)</td>
<td>36.330</td>
<td>0.430</td>
<td>22.666</td>
<td>0.212</td>
</tr>
<tr>
<td>Control group (False MENS group)</td>
<td>36.659</td>
<td>0.209</td>
<td>36.592</td>
<td>0.198</td>
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Also as shown in table (2) and figure (2), the mean value of the NPI, before treatment was (19.500 ± 2.090) mg in the study group, while after treatment was (4.414 ± 1.220) mg. These results revealed a highly significant decrease in NPI (p < 0.0001). But in the control group, the mean value of the NPI, before treatment was (19.400 ± 2.085) mg, while after treatment was (19.300 ± 2.080) mg and these revealed non significant difference in the NPI, (P > 0.05).

<table>
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**DISCUSSION**

The pancreas receives regulatory innervation via hormones in the blood and through the autonomic nervous system. These two inputs regulate the secretory activity of the pancreas. The most common cause of acute Pancreatitis and can occur within hours or as long as 2 days after consuming alcohol. Other causes of acute pancreatitis include abdominal trauma, medications, infections, tumors, and genetic abnormalities of the pancreas. Acute pancreatitis usually begins with gradual or sudden pain in the upper abdomen that sometimes extends through the back. The pain may be mild at first and feel worse after eating. But the pain is often severe

Treatment for acute pancreatitis requires a few days' stay in the hospital for intravenous (IV) fluids, antibiotics, and medication to relieve pain. Unless complications arise, acute pancreatitis usually resolves in a few days. In severe cases, the person may require nasogastric feeding. In some cases, the cause of the pancreatitis is clear, but in others, more tests are needed after the person discharge. Chronic Pancreatitis is inflammation of the pancreas that does not heal or improve; it gets worse over time and leads to permanent damage. Chronic pancreatitis, like acute pancreatitis, occurs when digestive enzymes attack the pancreas and nearby tissues, causing episodes of pain. Chronic pancreatitis often develops in people who are between the ages of 30 and 40. The most common cause of chronic pancreatitis is alcohol abuse. The chronic form of pancreatitis can be triggered by one acute attack that damages the pancreatic duct. The damaged duct causes the pancreas to become inflamed. Scar tissue develops and the pancreas is slowly destroyed, Benson, et al, (2004)⁶, M.A. Bess, et al., (2009)⁷, E.A. Bhatia, et al., (2008)⁸.

Other causes of chronic pancreatitis are hereditary disorders of the pancreas, cystic fibrosis (the most common inherited disorder leading to chronic Pancreatitis), hypercalcemia; hyperlipidemia or hypertriglyceridemia; some medicines, certain autoimmune conditions and unknown causes. The principal symptom of chronic pancreatitis is abdominal pain. The pain may range from occasional postprandial discomfort to debilitating persistent pain associated with nausea, vomiting, and weight loss. Pain control can be difficult in some cases. However, when considering the appropriate strategy to relieve pain, it should be recognized that placebo alone is effective in up to 30 percent of patients in most studies. When possible, treatment should be directed at the underlying etiology. Pain is associated with pancreatic hyperstimulation, ischemia and acidosis, obstruction of larger or small ducts, inflammation or neuropathic mechanisms. Patients with chronic pancreatitis are at increased risk of pancreatic cancer which may cause a change in pain pattern, and often have extra pancreatic sources of pain associated with maldigestion, Benson, et al, (2004)⁶, M.D. Bishop, et al., (2005)⁹, B.A. Boom, et al., (2005)¹⁰, M.G. Broom, et al., (2005)¹¹.

Low intensity stimulation was once called microcurrent electrical neuromuscular stimulation (MENS) and was later referred to as microcurrent electrical stimulation (MES) or microamperage stimulation (MS). Low intensity stimulation (LIS) is now the preferred term for stimulation using less than 1 mA. Low intensity stimulator currents are defined as those of less than 1 mA or 1000 μA. Generators that produce low intensity stimulator (LIS) were originally called microcurrent electrical stimulator (MES) , Y.T. Becker, (2008)¹², C.C. Byl and J.J. McKenzie, (2009)¹³, C.C. Byl, J.J. McKenzie, and H.L. Scheuenstuhl, (2008)¹⁴, J.D. Chapman and D.Z. Hill, (2002)¹⁵, A.A. Gersh, (2009)¹⁶, G.T. Haar, (2002)¹⁷.

Low intensity stimulator is the most recent and currently used term in an ongoing evolution of terminology relative to this type of stimulator. If the current generator can be adjusted to allow increases of intensity above 1000 μ A, the current becomes like the standard equipment. Microcurrent electrical neuromuscular stimulation (MENS) is better in enhancing cellular physiology processes than other current of higher amplitude, microcurrent is effective in the management of open wounds microcurrent therapy uses extremely small amounts of electrical current to help in relieving pain and healing of the soft tissues of the body, and is an alternate, noninvasive approach for healing of the acute and chronic medical conditions, D.N. Hooker, (2005)¹⁸, A.S. Kjartansson and J.K. Lundeberg, (2006)¹⁹, A.S. Leffmann and R.R. Cornwall, (2010)²⁰, A.J. Lennox, et al., (2002)²¹.

Findings of the present study showed that there was a highly significant decrease between the means of the second record SCL (2) (after six days of the true MENS application) and the first record SCL (1) (pre- application of the true MENS). Findings of the present study showed that there was non significant differences between the means of the second record SCL (2) (after six days of the placebo MENS application) and the first record SCL (1) (pre- application of the placebo MENS).

Comparison between the means of the first pre-treatment records of the SCL in the two groups revealed that there were non-significant differences. But comparison between the means of the second records of the SCL in the two groups showed that there was a highly significant decrease in the second records of SCL, between the study and control groups.

Findings of the present study showed that there was a highly significant decrease between the means of the second record NPI (2) (after six days of the true MENS application) and the first record NPI (1) (pre- application of the true MENS). Findings of the present study showed that There was non significant differences between the means of the second record NPI (2) (after six days of the placebo MENS application) and the first record NPI (1) (pre- application of the placebo MENS).

Comparison between the means of the first pre-treatment records of the NPI in the two groups showed that there were non-significant differences. But comparison between the means of the second records of the NPI in the two groups revealed that
there was a highly significant decrease. These significant differences, between the study group (True MENS application) and the control group (Placebo MENS application), were in the form of a highly significant decrease in SCL and NPI, were consistent with those observed and recorded by Aden et al., 2009; Banks, 2005; Becker, 2008; Byl and McKenzie, 2009; Byl et al., 2008; Chapman and Hill, 2002; Kjartansson and Lundeberg, 2006; Leffmann and Cornwall, 2010; Gersh, 2009 and Lennox et al., 2002.

Eventually, after the discussion of the results and according to reports of the previous investigators in fields related to this study, it can be claimed that application of the microcurrent electrical neuromuscular stimulation (MENS) had a valuable effects on chronic pancreatitis pain as evidenced by the highly significant decreases in serum cortisol level and nalbuphine intake.

CONCLUSION
Microcurrent electrical neuromuscular stimulation (MENS) is valuable in improving chronic pancreatitis pain as evidenced by the highly significant decreases in serum cortisol level and nalbuphine intake.

Conflict of interest: None.

REFERENCES: