Transcutaneous Electrical Nerve Stimulation Efficacy On Chronic Pancreatitis Pain

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ABSTRACT

Purpose: *to evaluate the efficacy of the transcutaneous electrical nerve stimulation on chronic Pancreatitis pain.* ***Methods of evaluation:*** *(Measurement of the serum cortisol level and calculation of the nalbuphine intake). Thirty patients (18 males and 12 females) were suffering from chronic Pancreatitis were divided into two groups. Study group (A) received TENS plus the nursing and medical care and the control group (B) received placebo TENS 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 transcutaneous electrical nerve 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, transcutaneous electrical nerve stimulation, serum cortisol.*

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 [4.5.15].

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. Since the discovery of electricity, and even before, current has been applied to the human flesh by a variety of methods to cure a multitude of afflictions[16]. Electrical discharges from the black torpedo fish (Electric eels) were known to the Ancient Egyptians as well as to Hippocrates, for the treatment of headache and gout. The word electric was first used by William Gilbert (1544-1603), who was the first to classify and generalize the phenomenon of electricity. Kratzenstein (1746) wrote the first report on the use of electricity in medical therapy. In the course of the nineteenth century, electrical and mechanical stimulation were employed as a therapy for many diseases by a large number of practicing physicians, but in the twentieth century, with the increased number of efficient analgesics, interest turned away from peripheral stimulation as a pain relieving mode until Melzack and wall (1965) published their gate-control theory of pain, which reawakened interest in the use of peripheral stimulation as a mode of pain control again[18]. Transcutaneous electrical nerve stimulation (TENS) was introduced as a test for the gate-control theory of pain by (Melzack and wall, 1965). Wall went to recruit Sweet, who was head of neurosurgery at Harvard medical school to propose an experiment about the temporary abolition of pain, first on themselves and then, if that worked, on patients, Wall and Sweet published their work in 1967 (Wall and Sweet, 1967). TENS has rapidly been accepted as a standard modality in the treatment of pain and was introduced to the profession in the early 1970th. Practitioners, who have utilized TENS, properly have reported excellent results in many aspects of practice as pre and postoperative pain, non-united fracture pain

and healing, obstetrics, dental and tempro-mandibular joint pain and other aspects[16.18].

MATERIAL AND METHODS

Subjects

Thirty patients (18 males and 12 females) suffering from chronic pancreatitis, selected from Al-Haram hospital and October 6 University hospital. Diagnosis is 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 TENS plus the nursing and medical care (administration of the prescribed medications). Group II: That was received placebo TENS plus the same previously mentioned nursing and medical care (administration of the same prescribed medications)[3,4,8].

Measurements equipment and tools:

Cs-210 NMES unit manufactured by Enraf-Holland was used to administer the neuromuscular electrical stimulation (NMES) in this study.

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 TENS application (First record) and after 6 days of TENS application (second record). A venous blood sample of 8 ml was taken at the morning, centrifuged and stored at 20ºC till analyzed [10.13].

Calculation of nalbuphine Intake (NPI) in mg: was done before TENS application (First record) after 6 days of TENS application (second record)[2,5,11,16,17].

Treatment

Position of subject and the TENS 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 10^{o}) 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 cm^2 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. TENS stimulation was initiated from the first hospitalization day. It was recommended that the stimulation was continuous every 6 hours (stimulation 4 times daily), 30 minutes for each session for 6 days as a total period of treatment. TENS 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[8,10,13].

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[6,11,18].

RESULTS

In the present study, the effect of TENS 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 (36.320 ± 0.417) ug / dL in the study group, while after treatment was (22.733 ± 0.704) 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 (36.320 ± 0.399) ug/dL, while after treatment was (36.320 ± 0.412) ug/dL, and these revealed non significant difference in SCL, (P > 0.05).

Table (1): Comparison of the mean values of the SCL, before and after treatment in both groups.

	SCL Before treatment		SCL After treatment		P. value
	X	SD	X	SD	
Study Group	36.320	0.417	22.733	0.704	<0.0001
Control Group	36.320	0.399	36.320	0.412	> 0.05

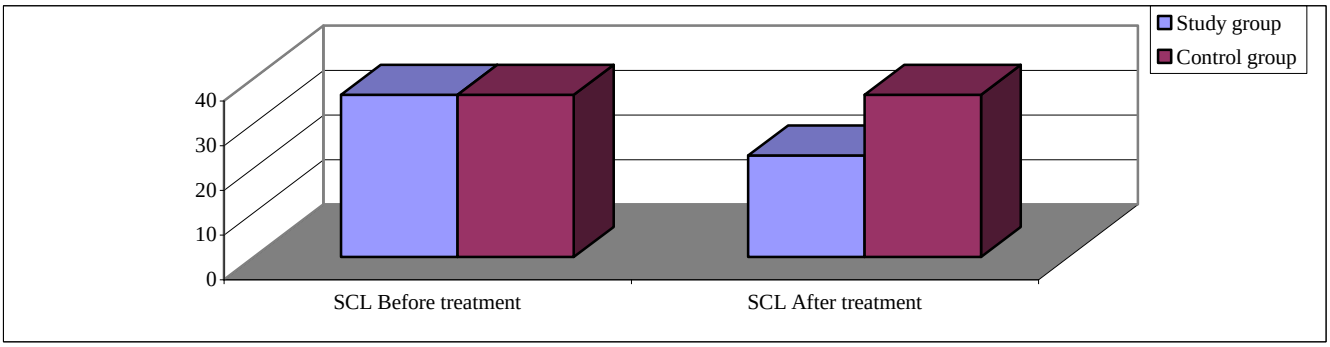

Fig. (1): Mean values of SCL before and after treatment in both groups.

Also as shown in table (2) and figure (2), the mean value of the NPI, before treatment was (19.000 ± 2.070) mg in the study group, while after treatment was (3.333 ± 2.440) 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 (19.000 ± 2.070) mg, while after treatment was (18.333 ± 2.440) mg and these revealed non significant difference in the NPI, (P > 0.05).

Table (2): Comparison of the mean values of the NPI before and after treatment in both groups.

	NPI Before treatment		NPI After treatment		P. value
	X	SD	X	SD	
Study Group	19	2.07	3.3	2.44	< 0.0001
Control Group	19	2.07	18.33	2.44	> 0.05

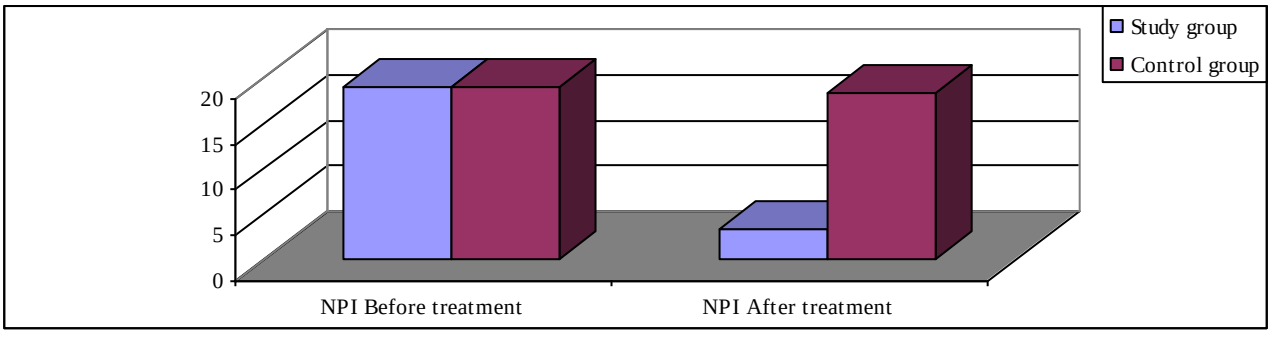

Fig. (2): Mean values of NPI before and after treatment in both groups.

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[12].

The most common cause of acute pancreatitis is the presence of gallstones. Chronic, heavy alcohol use is also a 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[14]. 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 and may become constant and last for several days[12,14,17].

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[14,15].

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. 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[3,8,17].

TENS is an effective, noninvasive, nonaddictive method of managing pain, muscle guarding and dysfunction of the pain cycle. The internal changes that accompany the pain cycle can be managed or at least reduced by TENS application. As pain produces a state of muscle tension that results in a diminished blood supply within the painful area (a state of ischemia), increased metabolites, decreased oxygen supply, decreased lymphatic clearing, decreased nutrient supply, increased muscle fatigue, inflammation and edema. All these internal changes can lead to the progressive amplification of the pain cycle which can be prevented or reduced by TENS[8,10,13].

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

Comparison between the means of the first pre-treatment records of the SCL in the two groups revealed that there were non-significant differences in the first pre-treatment records of SCL, between the study and the control groups. 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 three days of the true TENS application) and the first record NPI (1) (pre-application of the true TENS). Findings of the present study showed that There was non significant differences between the means of the second record NPI (2) (after three days of the placebo TENS application) and the first record NPI (1) (pre- application of the placebo TENS).

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

These significant differences, between the study group (True TENS application) and the control group (Placebo TENS application), which were in the form of a significant highly decrease in SCL and NPI, were consistent with those observed and recorded by Yates and Serrett, 2006; Walsh, 2000; Verlinden et al., 2008; Tang and White, 2007; String, 2008; Steer et al., 2005; Somers and Clemente, 2006; Solomon and Long, 2008; Shimazu et al., 2005; Schonberg et al., 2003 and Roberts, 2007.

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 transcutaneous electrical nerve stimulation had a valuable effects on chronic pancreatitis pain as evidenced by the highly significant decreases in serum cortisol level and nalbuphine intake.

Conclusion

Transcutaneous electrical nerve stimulation is valuable in improving chronic pancreatitis pain as evidenced by the highly significant decreases in serum cortisol level and nalbuphine intake.

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الملخص العربي

فاعلية التنبيه العصبي الكهربي عبر الجلد على آلام التهاب البنكرياس المزمن

كان الهدف من البحث هو تقييم آلام التهاب البنكرياس المزمن من خلال تتبع التغيرات التي تطرأ علي مستوى كورتيزول الدم ومأخوذ النالبيوفين لمرضى التهاب البنكرياس المزمن بعد تلقيهم التنبيه العصبي الكهربي عبر الجلد بمجموعة الاختبار و التنبيه الكاذب للمجموعة الضابطة والمقارنة بينهما . اشترك في هذه الدراسة ثلاثون مريضا من مرضى التهاب البنكرياس المزمن ، وكانت أعمارهم تتراوح من ثلاثين إلي خمسة وأربعين عاما ولقد تم تقسيمهم عشوائيا إلي مجموعتين متساويتين في العدد (مجموعة اختبار ومجموعة ضابطة) تتلقى مجموعة الاختبار العلاج بالتنبيه العصبي الكهربي عبر الجلد وتتلقى المجموعة الضابطة التنبيه الكاذب. ولقد أظهرت النتائج أن هناك نقص ذو دلاله إحصائية عالية في كلا من مستوى كورتيزول الدم ومأخوذ النالبيوفين بعد تطبيق العلاج بالتنبي ه العصبي الكهربي عبر الجلد بمجموعة الاختبار بعد ستة أيام من إجراء العلاج المذكور مقارنة بالمجموعة الضابطة ، ولذا يمكن القول بان العلاج بالتنبي ه العصبي الكهربي عبر الجلد له القدرة فـي تحسين آلام التهاب البنكرياس المزمن كما هو مثبت بالنقص ذو الدلال ة الإحصائية العالية في كلا من مستوى كورتيزول الدم ومأخوذ النالبيوفين .