Effect of Physiotherapy with A Digital Electronic Acupunctoscope on Preventing The Intensive Care Unit-Acquired Muscle Weakness

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Abstract

Background: Intensive care unit-acquired muscle weakness (ICU-AMW) is one of the recurrent complications of bed rest among patients in the intensive care units (ICUs). The digital electronic acupunctoscope neuromuscular stimulation can be utilized as an alternative physiotherapy option to mobilize critical ill patients passively in early rehabilitation program. **The study aim:** This study aimed to assess the effect of physiotherapy with a digital electronic acupunctoscope on preventing the intensive care unit-acquired muscle weakness and improving limbs muscles strength. **Research Design and setting:** From March to September 2022, this prospective, non-randomized controlled trial was done in two critical care units. **Sampling:** 60 patients were split evenly between the control and intervention groups, with 30 patients in each. **Study tools:** Four tools were used in this study**;** patient characteristics, the Medical Research Council (MRC) Scale, the Sedation Agitation Scale (SAS), and the duration of mechanical ventilation (MV) and the length of stay in ICU. **Results:** The MRC mean score of the upper and lower limbs of the intervention group significantly improved in comparison to the control group on the seventh day with $p<0.001$. Incidence of ICU-AMW, the duration of MV and ICU length of stay were significantly lower in the intervention group versus in control group with $p<0.001$.**Conclusion**: The continuous application of digital electronic acupunctoscope neuromuscular stimulation sessions for patient in ICUs can effectively enhance muscle strength; prevent the occurrence of ICU-AMW. Therefore, the future studies should concentrate on the effect of digital electronic acupunctoscope neuromuscular stimulation on respiratory muscles.

Key words: Digital electronic acupunctoscope stimulation, limbs muscles strength, ICU acquired weakness, and critically ill patients

Introduction

Various complications may result from bed rest for patients in intensive care units (ICU) as acquired muscles weakness, joint contractures, thromboembolic disease, and insulin resistance which may negatively effect on recovery from acute illnesses **(Berney et al., 2013; Huang et al., 2016;Yang et al., 2018)**. ICU-acquired weakness is neuromuscular dysfunction has no obvious cause other than the acute illness and its treatment **(Damian and Wijdicks, 2019; Vanhorebeek et al., 2020).** ICU-acquired muscle weakness is generally effect on limb muscles and

respiratory muscles**.** ICU-AMW is associated with the severity of illness, the interval on mechanical ventilation, using neuromuscular blockers. ICU-AMW may lead to failure of weaning from mechanical ventilation, paresis or quadriplegia, reduced reflexes and permanent muscle weakness **(Fan et al., 2014; Jolley et al., 2016; Latronico, 2016; Liu et al., 2020)**. ICU-acquired muscle weakness is indirectly related with higher morbidity, mortality, and cost **(Hermans and Berghe, 2015; Wieske et al., 2015; Van et al., 2020; Wang et al., 2020).**

Early mobilization or physical-therapy practice conducted by the critical care nurses is effective and safe method to avoid physical complications of immobilization for critically ill patients as passive limb mobilization, limb and respiratory muscle training, and bed cycling. On the other hand, utilizing of sedatives or disturbance conscious level not allow all patients in intensive care units to actively participate in early mobilization **(Nydahl et al., 2014; Jolley et al., 2015)**. The neuromuscular electrical stimulation can be utilized as an alternative option to mobilize critical ill patients passively **(Garzon-Serrano et al., 2010; Poulsen at al., 2011; Vanpee et al., 2014; Kho et al., 2015).**

Digital electronic acupunctoscope neuromuscular stimulation is the application of therapeutic electrical stimuli applied to muscle tissue through a sound peripheral nervous system in order to restore motor and sensory functions. Muscle contraction induced by electrical activation occurs differently from physiologically induced muscle contraction. In voluntary contraction, the recruitment order comes in accordance with Henneman's principle, that is, slow motor units (type I) are used for small efforts, while rapid motor units (type II) are gradually recruited when there are greater levels of strength production. During NMES, recruitment occurs inversely: the rapid fibers are the first to be recruited, and this phenomenon happens because the electrical stimuli are applied externally to the -, nerve endings and because the larger cells, with low axonal input, are more excitable **(Jolley et al., 2015; Leite et al., 2018)**.

Through digital electronic acupunctoscope neuromuscular stimulation, it is possible to evoke muscle contractions, which can

increase local circulation, reduce edema, and maintain muscle mass, without requiring the collaboration of patients. Digital electronic acupunctoscope neuromuscular stimulation can provide an increase in muscle mass and regional blood flow, as well as an improvement in oxygenation of stimulated tissues in critically ill patients and improve systemic and peripheral circulation **(Gruther et al., 2010; Farhan et al, 2016; Liu et al., 2020)**.

Significance of the study

About 13–20 million people around the world admitted to ICUs per year **(Adhikari et al., 2010)**. The medical institutions around the world documented the prevalence of ICU-acquired muscle weakness around 25 to 31% per year. The ICU-AMW is an acquired neuromuscular disorder, which is one of the most common complications among critical ill patients and manifested as profound muscle weakness and decreased or absent deep tendon reflexes. The ICU-AMW is also associated with an extended period of mechanical ventilation and a prolonged weaning period, which may indicate a relationship between the limb and respiratory neuromuscular involvement. The syndrome is linked to prolonged hospital stay as well as increased mortality. The diagnosis of ICU-AMW hinges on the patient's cooperation and best effort during a bedside muscle strength examination. ICU-related muscle weakness has not yet been associated with any specific preventive measures or treatments **(Kasotakis et al., 2012; Connolly et al., 2013; De Jonghe et al., 2014; Gruther et al., 2017; Wolfe et al., 2018)**. **Therefore,** this study aimed to assess the effect of physiotherapy with a digital electronic acupunctoscope on preventing the intensive care unit-acquired muscle weakness and improving limbs muscles strength of critically ill patients, and its effect on the duration of mechanical ventilation and the intensive care unit's length of stay.

Study aim:

General objective: The main objective of this study to assess the effect of physiotherapy with a digital electronic acupunctoscope on preventing the intensive care unit-acquired muscle weakness.

Specific objectives:

- To assess the effect of assess the effect of physiotherapy

with a digital electronic acupunctoscope on improving limbs muscles strength of critically ill patients.

- To assess the effect of physiotherapy with a digital electronic acupunctoscope on the duration of mechanical ventilation
- To assess the effect of physiotherapy with a digital electronic acupunctoscope on the intensive care unit's length of stay.

Research Hypotheses:

- Limbs muscles strength in the interventional group would be significantly higher than the control group.
- The interventional group would have a significantly lower incidence of intensive care unit-acquired weakness than the control group.
- The duration of mechanical ventilation in the interventional group would be significantly less than in the control group.
- The intensive care unit's length of stay for the interventional group would be significantly less than the control group.

Subject and Methods

Research Design:

Prospective, non-randomized controlled trial was conducted in this study to explore the effect of digital electronic acupunctoscope neuromuscular stimulation (independent variable) on limbs muscles strength, incidence of intensive care unit-acquired muscle weakness, duration of mechanical ventilation, and intensive care unit's length of stay (dependent variables) of critical ill patients. Prospective, non-randomized controlled trial is an experimental clinical trial in which people are allocated to different interventions using methods that are not random. In this trial, a defined group of people is followed over time, to examine associations between different interventions received and subsequent outcomes **(Polit D, Beck CH, 2012).**

Setting

From March to September 2022, this study was done in two critical care units (general and trauma intensive care units) Assiut University Main Hospital. The general ICU has 20 beds spread over four rooms, 8 head nurses, 40 nurses, 4 assistant nurses, and a nurse-patient ratio of 1:3, while the

trauma ICU has 17 beds spread across three rooms, 5 head nurses, 28 nurses, 6 assistant nurses, and a nurse-patient ratio of 2:3.

Sampling:

The Epidemiology Information 2000 statistical software was utilized to calculate the sample size. The calculation was done utilizing the expected frequencies of ICU-acquired weakness from prior studies with a 95 percent confidence interval, 80 percent study power, 95 percent frequency of ICU-acquired weakness, and worst acceptable result 5%. A purposive sample size of 70 patients was estimated. These patients were adult male or female between the ages of 18 and 60 who had been on mechanical ventilation for more than 2 days and had stayed in the previous setting for more than 7 days.

Ten patients were excluded: five patients died, and five disconnected from mechanical ventilation before two days. Therefore, 60 subjects were split evenly between the control and intervention groups, with 30 patients in each. The control group received routine range of motion exercises, while the intervention group received electrical muscle stimulation in addition to range of motion.

Patients who met the following criteria were not allowed to participate in the study: pregnant women, obese patients, and patients with abnormal musculoskeletal and/or skin conditions such as femur fracture and skin disease, patients with a permanent pacemaker or implanted cardiac defibrillator, and patient in the final stages of cancer.

Study tools:

Four tools were used to collect the study data:

Tool one: Patient characteristics that were involved (age, gender, and medical diagnosis).

Tool two: The Medical Research Council (MRC) Scale was utilized to evaluate muscular strength, disease progression, and effectiveness of treatment. The Medical Research Council firstly published in 1943, whereas **(Kleyweg et al., 1991)** created The MRC sum score in 1991 **(Hough et al., 2011; Hermans et al., 2012; Karatzanos et al., 2012).** On a scale of 0 to 5 in relation to the maximum expected for that muscle. In a recent comparison to an analogue scale the MRC scale is more reliable and accurate for clinical assessment in

weak muscles (grades 0-3) while an analogue scale is more reliable and accurate for the assessment of stronger muscles (grades 4 and 5). Wrist flexion, forearm flexion, shoulder abduction, ankle dorsiflexion, knee extension, and hip flexion are the six muscles functions in the upper and lower limbs that are evaluated on both sides. The overall score varied from 60 to 0, with 0 denoting quadriplegia and 60 denoting normal muscle strength. Clinically, the MRC score 48 was diagnosed as ICUAW **(Sidiras et al., 2013)**.

Tool three: The Sedation Agitation Scale (SAS), created by **(Riker et al., 2001)** and used by **(Wang et al., 2020)** to assess the patient's level of sedation at the start of each digital electronic acupunctoscope neuromuscular stimulation session. One for an alert, calm state and further levels for quality of sedation, which consist of a ten point, with four levels of anxiety or agitation from +1 to +4 [combative]), one level to denote a calm and alert state (0), and 5 levels of sedation from −1 to −5culminating in unarousable (−5). Three sequential steps are used: observation, response to verbal stimulation and response to physical stimulation.

Tool four: Patients outcomes: This part developed by researchers to evaluate the duration of MV and the length of stay in the intensive care units.

This study was carried out in three stages

❖ **The first stage (preparation)**

- **Literature screening:** The researchers searched the study aim and method in databases and examined the full text of the articles.
- **Ethical approval**: The Ethics Committee of Faculty of Nursing approved the research protocol. The approval was then sought from the responsible hospital authorities. After explaining the study's purpose to each patient’s relatives, they signed a consent form. To protect confidentiality, patient’s relatives were assured that they could refuse or withdraw from the study at any time.
- Seven experts reviewed the tool's face and content validity; four experts from critical care and emergency nursing department and three experts from critical care medicine department.

- Cronbach's alpha was used to assess the tool's consistency and stability(r = 0.989), and there was no statistical significant difference between the responses two weeks apart, according to the Statistical Package for Social Sciences (SPSS).
- **A pilot study**: Before beginning the data collection process, a pilot study was conducted on 10% of the sample size; patients (n=6), to assess the tool for relevance, clarity, and applicability; to determine the mean time required for data collection; and to recognize the various barriers that could develop during data collection.

❖ **The second stage (intervention)**

Control and study groups received the following intervention:

- Critical care nurses and a physiotherapist in the ICU performed daily upper and lower extremities range of motion (ROM) exercises on participant's patients in the control and study groups. Range of motion exercises involved shoulder abduction, elbow flexion, wrist extension**,** hip flexion, knee extension and ankle dorsiflexion.
- In addition to upper and lower extremities range of motion exercises, digital electronic acupunctoscope neuromuscular stimulation was delivered to both upper and lower extremities of participant patients in the study group by the researchers.
- Each of digital electronic acupunctoscope neuromuscular stimulation session was applied once every day and lasted 30 minutes. The application of digital electronic acupunctoscope neuromuscular stimulation began on the second day of ICU admission and lasted for seven days.

Neuromuscular electrical stimulation application for the study groups:

- Patients were placed in a supine position. A pillow was placed in the back of the knee to allow for knee extension.
- Digital electronic acupunctoscope neuromuscular stimulation is carried out with Dr. Eldakr's digital electronic acupunctoscope Model: PM -1002, which is manufactured by 2D trading company. Its components are: a hard carrying case, a Dr. Eldakr Digital

electronic acupunctoscope, a 3.5 mm plug connecting wire of alligator type (4 pieces), a pointer probe with handgrip electrode, and a 9 V battery.

- The electrodes were placed as the following:
  - Two active electrodes were placed, the first over the motor points of the supraspinatus while the other over medial or posterior bundle of deltoids for stimulation of shoulder abduction.
  - Two active electrodes were placed over belly of the biceps brachii muscle aiming for stimulation of forearm flexion.
  - Two active electrodes were placed over the surface of wrist flexor tendons: flexor carpi radialis muscle (FCR) and flexor carpi ulnaris muscle (FCU) for stimulation of wrist flexion.
  - Two active electrodes were placed longitudinally on the rectus-femoris muscle belly aiming for stimulation of hip flexion,
  - Two active electrodes were placed over the vastus-medialis muscle belly for stimulation of knee extension.
  - Two active electrodes were placed over the surface of tibialis anterior muscle for stimulation of ankle dorsiflexion
  - The intensity of the stimulation was gradually increased from 0 to 120 Hz until the muscles were visible and the patellar ligament tension was palpable.
  - Before beginning the training session, a five-minute sub-maximal ES warm-up trial was performed with the following parameters: maximum tolerance or apparent contraction; frequency (20-50 Hz); pulses duration (300-600msec); 10 sec on, 20 sec off **(Meesen et al., 2010; Doucet et al., 2012)**.

The third stage (evaluation): In this stage the research was assessed:

- The Medical Research Council Scale was used to determine the level of muscle strength and intensive care unit- acquired weakness.
- The duration of mechanical ventilation and the length of stay in the critical care units were evaluated by the researchers.

Statistical analysis

The one-sample Kolmogorov–Smirnov test was used to check the numerical variables' normality distribution. The mean and standard deviation of continuous variables with

a normal distribution were given. To assess the differences between groups, independent t-tests were used. Numbers and percentages were used to represent categorical variables. The differences between groups were assessed using the 2 test. For statistical analysis; researchers used Statistical Package for the Social Sciences (SPSS) version 21. A statistically significant p-value of 0.05 was used.

Results

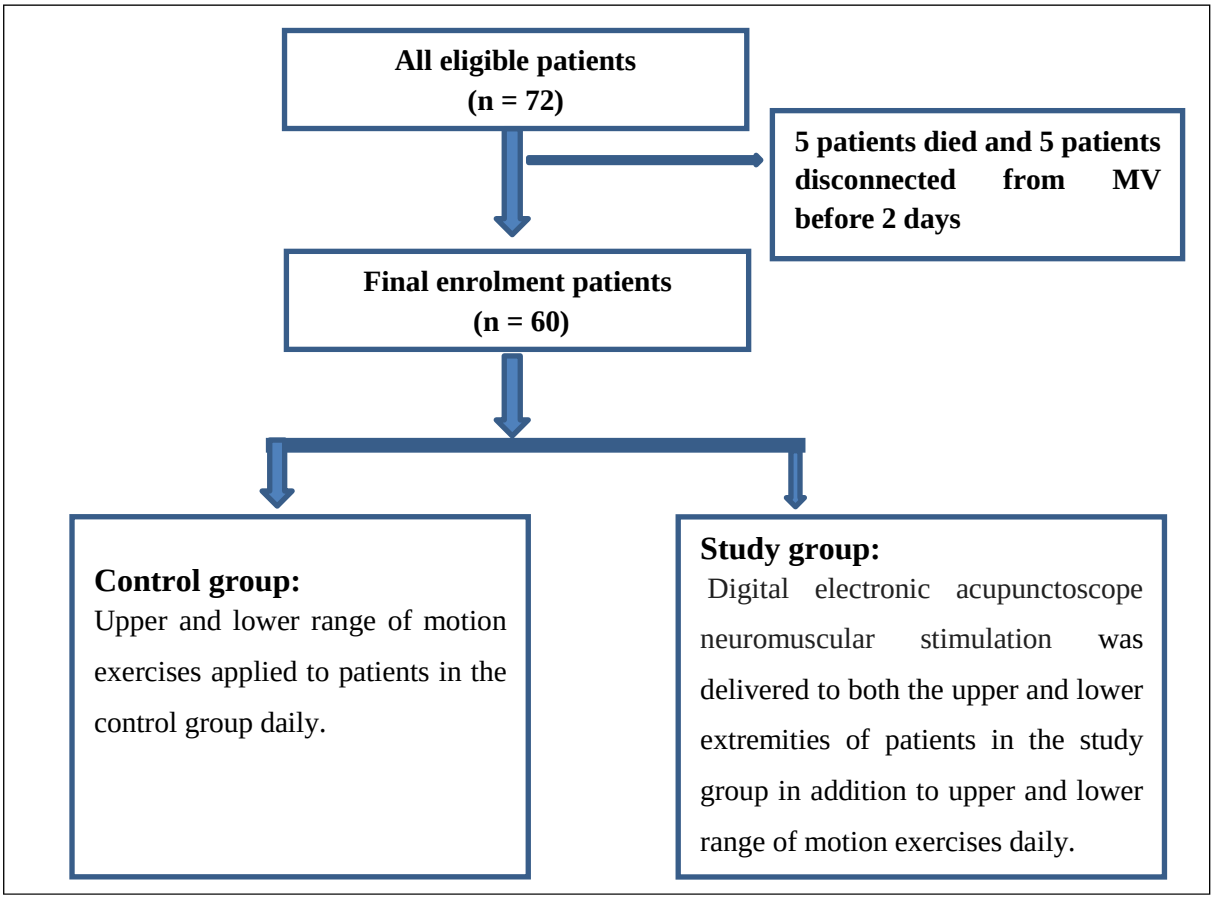

Table 1: The mean age of control group was 32.86 ± 8.65 and 31.86 ± 10.04 for intervention group. A total of (86.7%) participants of the control group were male compared to (73.3%) of the intervention group. (70 %) of the control group versus (53.4%) of the intervention group were diagnosed with neurological disorders.

Table 2 shows that on the first and seventh days, the intervention group's medical research council mean score of the upper limbs (shoulder abduction, forearm flexion, wrist flection, and total upper right limb MRC score)

significantly improved when compared to the control group (p 0.001).

Table 3 shows that the medical research council mean score of the lower limbs (hip flexion, knee extension, ankle dorsiflexion, and total upper lower limb MRC score) of the intervention group significantly improved when compared with the control group on the seventh day with a p value of 0.001.

Table 4 reveals that there were no significant differences in the total medical research council mean score of upper and lower limbs among the 60 patients included in the two groups on the first day (p = 0.43), while it significantly improved on the seventh day for the intervention group (p 0.001).

Figure 1: This figure reveals that (40%) of the intervention group and (90%) of the control group had intensive care unit acquired weakness at 7^{th} day with statistical significant differences p<0.001.

Table 5: The duration of mechanical ventilation was significantly lower in the intervention group when compared with control group with statistical significant differences p<0.001. Intensive care unit length of stay was less in the intervention group, with significant difference between the two groups p<0.001.

Table (1): The study sample characteristics (N: 60)

Patient characteristics	**Control group (N=30)**	**Intervention group (N=30)**
Age(year)	**32.86 ± 8.65**	**31.86 ± 10.04**
Sex		
▪ Male	26 (**86.7%**)	22 (**73.3%**)
▪ Female	4 (13.3%)	8 (26.7%)
Diagnosis		
▪ Neurological diseases	21 (**70 %**)	16 (**53.4%**)
▪ Respiratory diseases	4 (13.3%)	1 (3.3%)
▪ Other	5 (16.7%)	13 (43.3%)

- **Significant difference p .value < 0.05.**
- **Chi-square test is used for qualitative variables**
- **Independent samples t-test is used for comparing Mean and SD between the two groups.**

Table (2): Comparison between the two groups in relation to medical research council mean score of the upper right and left limbs at the first, and seven day of admission (N: 60)

*MRC	Control group		Interventional group		P value	
	1st day	7nd day	1st day	7nd day	1st day	7nd day
Upper right Limb						
▪ **Shoulder abduction**	0.66±0.36	1.80±1.32	0.77±0.53	3.56±1.71	0.37	**< 0.001***
▪ **Forearm flexion**	0.66±0.36	1.80±1.32	0.77±0.53	3.56±1.71	0.37	**< 0.001***
▪ **Wrist flection**	0.66±0.36	1.80±1.32	0.77±0.53	3.56±1.71	0.37	**< 0.001***
Total upper right limb MRC score	2.37±1.23	5.53±4.18	2.32 ± 1.60	10.70 ±5.14	0.54	**< 0.001***
Upper left Limb						
▪ **Shoulder abduction**	0.66±0.36	1.8±1.32	0.77±0.53	3.8±1.69	0.37	**< 0.001***
▪ **Forearm flexion**	.077±0.40	1.8±1.32	0.77±0.53	3.8±1.59	0.50	**< 0.001***
▪ **Wrist flection**	0.66±0.36	1.8±1.32	0.77±0.53	3.8±1.59	0.37	**< 0.001***
Total upper left limb MRC score	2.09±1.13	5.40±3.97	2.31 ± 1.6	11.46 ±4.86	0.41	**< 0.001***

- **MRC: Medical Research Council score**
- *** Significant difference at p.value < 0. 05**
- **Independent sample T-test**

Table (3): Comparison between the two groups in relation to medical research council mean score of the lower right and left limbs at the first, and seven day of admission (N: 60)

*MRC	Control group		Interventional group		P value	
	1st day	7nd day	1st day	7nd day	1st day	7nd day
Lower right Limb						
▪ **Hip flexion**	0.66±.036	1.93±1.37	0.77±0.53	3.56±1.71	0.37	**< 0.001***
▪ **Knee extension**	0.66±.036	1.86±1.38	0.77±0.53	3.56±1.71	0.37	**< 0.001***
▪ **Ankle dorsiflexion**	0.66±.036	1.90±1.37	0.77±0.53	3.56±1.71	0.37	**< 0.001***
Total lower right limb MRC score	2.09±1.13	5.50±4.21	2.32 ± 1.60	10.70 ±5.14	0.41	**< 0.001***
Lower left Limb						
▪ **Hip flexion**	0.66±.036	1.8±1.32	0.77±0.53	3.56±1.71	0.37	**< 0.001***
▪ **Knee extension**	0.66±.036	1.8±1.32	0.77±0.53	3.56±1.71	0.37	**< 0.001***
▪ **Ankle dorsiflexion**	0.66±.036	1.8±1.32	0.77±0.53	3.56±1.71	0.37	**< 0.001***
Total lower left limb MRC score	2.006±1.10	5.40±3.97	2.32 ± 1.60	10.70 ±5.14	0.37	**< 0.001***

- **MRC: Medical Research Council score**
- *** Significant difference at p.value < 0. 05**
- **Independent sample T-test**

Table (4): Comparison between the two groups in relation to the total medical research council score mean score of upper and lower limbs in the different days (N: 60)

*MRC score	Control group		Interventional group		P value	
Days	1st day	7nd day	1st day	7nd day	1st day	7nd day
Mean±SD	8.52 ± 4.60	21.83±16.01	9.31 ± 6.40	43.56±19.60	0.43	**<0.001**

- **MRC: Medical Research Council score**
- *** Significant difference at p.value < 0. 05**
- **Independent sample T-test**

Figure (1): Frequency distributions of the intensive care unit acquired weakness in the seven day for the two groups (N: 60)

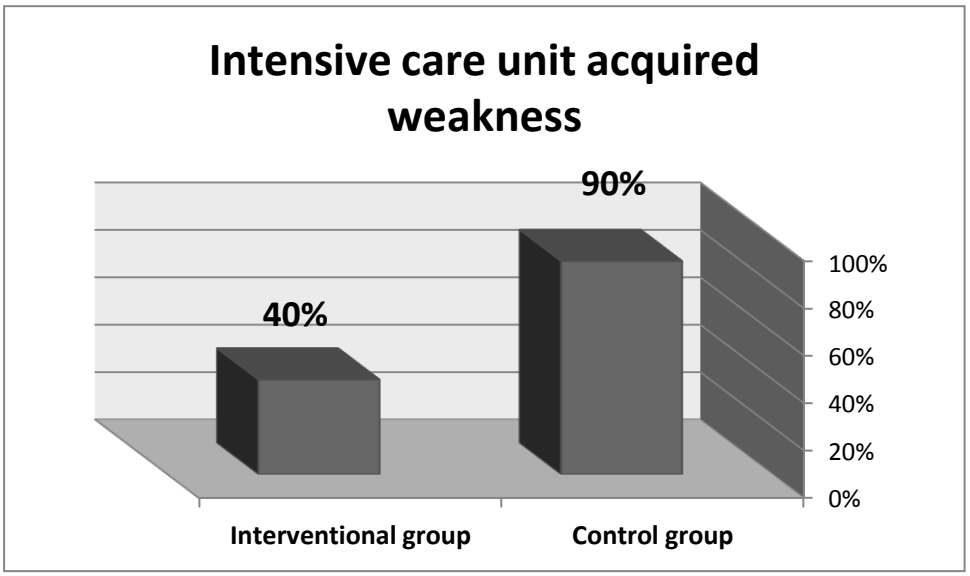

Table (5) Comparison between the two groups regarding patients out comes (N: 60)

Patient out comes	Control group	Intervention group	P value
***MV duration (days)**	12.8±4.42	6.2±1.9	**<0.001**
***ICU length of stay (days)**	10.4±3.2	3.26±1.59	**<0.001**

- **MV: Mechanical ventilation**
- **ICU: Intensive Care Unit**
- *** Significant difference at p.value < 0. 05**
- **Independent sample T-test**

Discussion

Critically ill and mechanically ventilated patients frequently need strict bed rest, and they are occasionally entirely immobile due to the severity of their condition and the use of medications as sedatives and neuromuscular blocking agents**.** In critically ill patients, limb and respiratory muscle problems are prevalent. Patients in the intensive care unit who need mechanical ventilation for more than seven days develop muscle weakness **(Şenduran et al., 2012; Kayambu et al., 2015; Roberson et al., 2018)**.

The study results revealed that the highest percentage of the studied patients were young males. The most common diagnosis of the studied patients is neurological diseases. This finding could be explained by the fact that young males are more likely to be involved in accidents due to the nature of physical activity and community culture. These findings are supported by **(Karatzanos, et al., 2012)** who reported that more than three-fourths of the studied subject were male.

In relation to limb muscle strength, the total medical research council mean score of the upper and

lower limbs was statistically significantly improved in patients assigned to the interventional group compared to patients in the control group. This could be attributed to the fact that applying digital electronic acupuncture and neuromuscular stimulation sessions to the patients in the interventional group within the seven-day period increases the muscle strength of their limbs. The current findings were consistent with those of **(Rodriguez et al., 2012; Wageck et al., 2014; Anekwe et al, 2020)** who documented that the medical research council scale was higher in the electrical muscles stimulation group than the control group.

The study results revealed that there was a statistically significantly decrease in the number of patients who had ICUAW in interventional group versus control group. This may be due to effect of digital electronic acupunctoscope neuromuscular stimulation in improving limbs muscle strength, and it's systemic, which works as an anabolic stimulus to the limbs muscles. It's probable that IL-6, which suppresses insulin-like growth factor 1 synthesis, has a role in chronic inflammation, inhibiting hormonal anabolic action and affecting growth. The current findings are in line with **(Abu-Khaber et al., 2013)** showed that MRCS values in the both groups were below 48 from the second day on mechanical ventilation, which is the cut-off value for diagnosing ICUAW.

Concerning the duration of mechanical ventilation, the current study findings demonstrate that the patients in the intervention group had a statistically significantly shorter mechanical ventilation duration than those in the control group. This can be attributed to the fact that digital electronic acupuncture with neuromuscular stimulation can effectively improve muscle strength and shorten the duration of MV. These results are supported by **(Leite et al., 2018),** who reported that daily consecutive electrical stimulation sessions improved MV duration and functional status for the electrical muscles stimulation group when compared with the control group. Furthermore, **(Routsi et al 2010**) highlighted that patients in the EMS group had a shorter duration of mechanical ventilation compared with patients in the control group.

In relation to the intensive care unit length of stay (days) of the study sample, the findings of the current study revealed that the duration of the ICU length of stay was significantly shorter in the interventional group when compared with the control group. This can be attributed that improving muscle strength shortens the duration of MV and consequently the ICU length of stay. The current results are consistent with **Routsi et al. (2010)** who highlighted that patient in the EMS group had a shorter duration of ICU stay compared with patients in the control group. Also, these results are in line with **(Leite et al., 2018),** who reported that electrical muscle stimulation sessions shorten MV duration, which decreases the length of stay in the ICU.

Concerning mortality rate, there were no additional studies on a digital electronic acupunctoscope muscles stimulation in critically ill patients evaluated the mortality as an endpoint for evaluating the advantages of this technique, but it makes sense that reducing duration of mechanical ventilation and facilitating rapid weaning will reduce the overall complications and may have a positive impact through lowering mortality. While using electronic muscles stimulation, no serious complications were faced.

Limitation of study

The study was conducted on small sample size in one hospital.

Conclusion

The continuous application of thirty-minute digital electronic acupunctoscope neuromuscular stimulation sessions for patient in ICU can effectively enhance muscle strength, prevent the occurrence of ICUAW, assist in successful weaning from the MV, shorten ICU length of stay and, subsequently, total length of hospitalization.

Recommendations

The future studies should concentrate on the effect of digital electronic acupunctoscope neuromuscular stimulation on respiratory muscles, as well as critical care nurse education on the importance of electrical simulation for immobile patients and how to apply it.

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Conflict of interest

Authors declare no conflict of interest

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Author contributions

Dr Ghada was the owner of the idea of research. Dr Ghada and Dr Asmaa Atiaa conceptualized and designed the study. All authors contributed to data analysis, drafting the manuscript, gave approval of the final version to be published, and agreed to be accountable for all aspects of the work.

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