Effect of Neuromuscular electrical stimulation on postoperative complications after artificial abortion —A retrospective study

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Research

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Abstract

Background: The complications after induced abortion are the important factors that endanger female reproductive health. The effective prevention way of postoperative complications after induced abortion and protection of female reproductive tract health is now a hot issue. This retrospective study aimed to evaluate the effect of neuromuscular electrical stimulation (NMES) on postoperative complications after artificial abortion.

Methods: A total of 148 patients were randomized into 2 groups in this study. 76 patients were assigned into a treatment group which also called group A, and underwent NMES therapy, while 72 women were assigned into a controlled team named group B. The duration of postoperative uterine contraction pain, the amount and duration of postoperative vaginal bleeding, the endometrial thickness on the 14th and 21st day after the operation, the time of postoperative menstruation recovery, and the incidence of intrauterine adhesion on the 1st and 3rd month after operation were compared and observed.

Results: Compared with group B, in group A, The duration of postoperative uterine contraction pain was significantly shorter($P<0.001$); The amount and duration of postoperative vaginal bleeding were less after treatment by the NMES ($P=.016$); There was no significant difference in endometrial thickness on the 14th day after the operation($P=.05$), Whereas it was thicker in the observation group than in the control group on the 21st day($P=.01$); The menstruation recovery time was shorter after treatment ($P=.017$); The incidence of intrauterine adhesions was significantly lower at the third months after operation ($P=.03$)while at the first month, there is no difference($p>0.99$).

Conclusion: Neuromuscular Electrical stimulation therapy is effective for improving patients with postoperative complications after artificial abortion.

1. Introduction

Induced abortion refers to the use of artificial methods to terminate the pregnancy due to unexpected pregnancy, disease, and other reasons, which is one of the remedial measures of contraceptive failure[1]. Recently, due to the continuous increase of unprotected sexual life, the rate of unintended pregnancy among women has increased sharply, and the number has been climbing year by year[2]. Negative pressure suction is a common technique of induced abortion, but it is also accompanied by uterine perforation, intraoperative and postoperative bleeding, postoperative tissue residue, intrauterine adhesions, thin endometrium, and even secondary infertility and other complications, which seriously endanger female reproductive health[3] and even physical and mental health[4, 5].

Neuromuscular electrical stimulation(NMES), also known as biomimetic electrical stimulation, refers to the use of low-frequency pulse current to stimulate muscle or nerve, cause muscle contraction, increase blood circulation and nutrition supply, promote the recovery of nerve function, and then achieve the purpose of repair[6]. Previous researches have shown that neuromuscular electrical stimulation has positive effects on alleviating postpartum lumbar and back pain[7], the recovery of postpartum rectus

muscle strength[8], and the improvement of endometrial thickness in pregnant patients[9],and reduce the pain of patients with endometriosis[10], etc. However, there are few studies on the prevention of complications after artificial abortion. In this retrospective study, we aim to analyze the effect of NMES (neuromuscular electrical stimulation) in patients after induced abortion.

2. Materials And Methods

This retrospective study was approved by the Medical Ethical Committee of The First Hospital of Nanchang (ID 2020047), Nanchang, China (All patients had provided the written informed consent).

2.1. Population

146 eligible female patients aged from 18 to 35 were enjoined at our departments from January 2020 to June 2020. The inclusion criteria: The selected patients were confirmed to be pregnant for 6–10 weeks by B-ultrasound. There were no intraoperative complications such as uterine perforation during the abortion. No medical and surgical diseases and abortion contraindications, and those who could be followed up. The main exclusion criteria included patients with a history of intrauterine operation and the reproductive system of acute inflammation, mediastinum uterus, double angle of the uterus, uterine fibroids, endometriosis, uterine adenomyosis uterine abnormal morphology, combined with medical and surgical diseases such as diabetes, hypertension, local skin ulcer or damage, and contraindications of electrical stimulation.

2.2. Treatment and study design

All patients were given routine preoperative examinations, including blood routine, blood group, blood coagulation function, vaginal secretion examination, B ultrasound, and electrocardiogram. Patients were informed of intraoperative and postoperative risks and complications before surgery, and informed consent for surgery was signed at the same time. The induced abortion was performed by the same senior attending physician. All 76 patients in the treatment group received oxytocin and NMES by using the NMES device (Melander Medical Technology Co., Ltd, Nanjing, Jiangsu Province, China) after artificial abortion. The patient was placed in the supine position after the operation, and the electrode was placed at 3cm below the navel and in the second position of the sacral bone. The uterine involution module and the three-stage treatment plan were selected. The corresponding parameters were set as follows :(1) frequency 5Hz and pulse width 200 μ s; (2) Frequency 80Hz, pulse width 200 μ s; (3) Frequency 5Hz, pulse width 200 μ s; Each parameter lasted for 15s, rested for 1s, and the current intensity was 0-120mA in three stages of continuous circulation, lasting for 30 minutes, starting immediately half an hour after the operation, once a day, a total of 7 days as a course of treatment. The 72 patients in the control group were only given oxytocin to promote uterine contraction after induced abortion.

2.3. Outcome measurements

Five indicators were observed in the two groups.

(1) The duration of postoperative uterine contraction pain: The uterine contraction pain outcome was measured by the reduction in pain intensity which is also called VAS[11]. Visual analog scale (VAS) was used to score the pain on the day and the first day after operation, and the score was 0–10 based on the pain degree, 0 for painless and 10 for severe pain.

(2) The amount and duration of vaginal bleeding after induced abortion: All patients were asked to follow up after the operation to evaluate the amount and duration of vaginal bleeding. Compared with normal menstruation, the amount of vaginal bleeding was recorded as more than menstruation and less than menstruation, and the proportion of the amount of excessive amount was used to compare the amount of vaginal bleeding in the two groups[12]. Normally, an interview was needed to assess the quantity of vaginal bleeding after the operation. Induration, as brief (< 5 days), average (5–10 days), or prolonged(> 10days), and in amount, as heavy(> periods), moderate(= periods), or mild (< periods)[13].

(3) The thickness of the endometrium on the 14th and 21st days: Endometrial thickness (the thickest part of the longitudinal axis of the endometrium) was measured in both groups on 14 and 21 days postoperatively[9, 14]. The measurements were performed by the same investigator using a computerized vaginal ultrasound with an integrated pulsed Doppler vaginal scanner. The implementer was blind to the conditions of the patients.

(4) The time of menstruation recovery period: The duration from the operation day to the 1st menstrual period[15].

(5) The incidence of uterine adhesions at the first and third months: The incidence of postoperative intrauterine adhesions was confirmed by hysteroscopy, and the diagnostic criteria were a cumulative intrauterine range of IUA[16], type of adhesions, and menstrual pattern. The scores were 1–4 for mild, 5–8 for moderate, and 9–12 for severe[17].

2.4. Statistical analysis

All the outcome data were analyzed by using SPSS 22.0 software (SPSS, Chicago, IL). The comparisons of all categorical data were analyzed by the Pearson Chi-square test or Fisher exact test, and $P < 0.05$ was regarded as the statistical significance between the two groups. Continuous data were analyzed by the t-test or Mann–Whitney rank-sum test.

3. Results

Figure 1 is given showing the flowchart of subject disposition in this trial, group A, n = 76; group B, n = 72. For various reasons, 6 patients in Group A and 4 patients in Group B were lost to follow-up. The characteristics of all patients before treatment are summarized in Table 1. There were no significant differences in age($p = 0.54$), race, body mass index($p = 0.77$), gestational age ($p = 0.53$) and pregnancy times($p = 0.42$) between the two groups. *F* test showed significant differences in the duration of postoperative uterine contraction pain, the proportion of vaginal bleeding more than menstrual volume, and the time of vaginal bleeding in both groups (Table 2)

After treatment, there was no significant difference in endometrial thickness between the two groups on the 14th day after the operation(p = .051), but it was thicker in the treatment group than in the control group on the 21st day(p = 0.01). Retrospective analysis showed that the average menstrual recovery time of the observation group was 29.34 ± 1.05 days while the control group was 33.76 ± 1.43 days, which was significantly shorter(p = 0.017) and the results demonstrate the statistical difference (Table 3). No difference in the incidence of uterine adhesions was observed between both groups after induced abortion at the 1st month, whereas the proportion of uterine adhesion climbing up in the two groups at the 3rd month. The incidence of intrauterine adhesion in the observation group (1/70) was significantly lower than that in the control group (7/68), and the difference was statistically significant (p = 0.031).

4. Discussion

Induced abortion is one of the remedial measures for unintended pregnancy and contraceptive failure[18]. At present, the most used method is negative pressure suction. The main complications of this operation include intraoperative and postoperative bleeding[19], uterine perforation, leakage of aspiration or incomplete aspiration leading to postoperative re-clearance of the uterus, chronic pelvic inflammatory disease, postoperative intrauterine adhesions[20], and even secondary infertility[21], which seriously endanger the physical and mental health of women[22] and thus have an impact on society and family [23]. The number of abortion patients in China is climbing stably year by year[24], especially the proportion of young and childless women. Therefore, it is of positive clinical significance to actively prevent and early intervention complications after induced abortion, promote the rehabilitation of patients after abortion, reduce and avoid reproductive tract damaged.

Neuromuscular electrical stimulation is a kind of low-frequency electrical stimulation that uses an electrical stimulator to activate or inhibit excited cells by acting on biological tissues with specific parameters of pulsed current in a controlled way, thus causing functional changes of the organs and tissues[25]. It is also called biomimetic electrical stimulation because its stimulation frequency is 1000mz, compared with the normal human body, 1ms of the absolute refractory period of the motor nerve is low frequency. It is characterized by exciting neuromuscular tissue, destroying membrane polarization state by electrical stimulation, thus causing neuromuscular excitation, promoting blood and lymphatic circulation, and playing the role of repairing injured muscle tissue and nerve. Clinically, it can relieve muscle tension, improve the pain threshold to relieve pain, facilitate the repair of nerve-muscle and improve tissue blood supply and lymphatic circulation[26]. Neuromuscular electrical stimulation was first applied in the clinic in the 1970s. Now it plays a vital role in the recovery of the body after trauma, the recovery of spinal cord injury[27], the neuromuscular rehabilitation of paralyzed patients[28], and even improving the motor function of children with cerebral palsy[29].

The earliest application of neuromuscular electrical stimulation in the field of gynecology and obstetrics is mainly in the rehabilitation of the pelvic floor muscles[30]. It has been previously believed that NMES can stimulate the shallow and deep pelvic floor muscles and nerves of the pelvic floor through low-frequency pulses, promote the contraction of muscle groups, especially the contraction and muscle

strength of the shallow and deep I and II muscle groups, which has a positive effect on postpartum urinary incontinence[31] [32]and after cervical cancer operation[33]. Besides, other studies believe that it plays a positive role in promoting the blood supply and lymphatic circulation of pelvic floor tissues and organs which can effectively reduce the pain caused by uterine contractions[10]. On the other hand, NMES can promote the smooth muscle relaxation of the uterine artery, reduce the resistance of uterine artery blood flow, accelerate the blood flow velocity, thus promoting the growth of endometrium or improving the local blood flow perfusion of the uterus, which is conducive to the repair of the endometrium. It has been reported that NMES before embryo transfer can accelerate the growth of the endometrium and prepare for embryo implantation[9].

Based on the previous research, NMES after artificial abortion is combined with electrical stimulation treatment on the comprehensive characteristic, generate low-frequency pulse electrical stimulation therapy apparatus, stick in the lumbar di ministry, through the projection area of the uterus and other specific parts of the skin, make the multiple electrode percutaneous import in the target area, making specific parts of a biological membrane polarization cell vibrations, To improve the muscle contraction in the region, accelerate blood circulation, clinically strengthen uterine contraction, reduce postoperative vaginal bleeding time, help repair the endometrium, reduce postoperative intrauterine adhesion. Finally, it can effectively reduce the complications of induced abortion.

5. Conclusion

The results of this study demonstrated that NMES is effective in the prevention of complications after induced abortion. More research with sufficient samples and long-term follow-ups is still needed in the future.

Abbreviations

NMES = neuromuscular electrical stimulation,

VAS = visual analogue scale

Declarations

Ethical Approval and Consent to participate: The research was approved by the Human Ethics Committee of The First Hospital of Nanchang (ID 2020047), Nanchang, China. Written informed consent was obtained from individual or guardian participants.

Consent for publication: Written informed consent for publication was obtained from all participants.

Availability of supporting data: All data generated or analysed during this study are included in this published article.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions

Junjun Shu carried out the acquisition of data, analysis and interpretation of data and writing of the manuscript. ShiXin Lin has been involved in drafting the manuscript and revising it critically for important intellectual content. Yu Wu, Xiaojiao Wang,physical therapist, carried out the neuromuscular electrical stimulation therapy after operation. Jun Gao and Hong Zhu conceived of the study, and participated in its design and coordination, helped to draft the manuscript and have given final approval of the version to be published. All authors have read and approved the final version of the manuscript.

Competing interests

The authors declare that they have no competing interests.

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Tables

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Figures

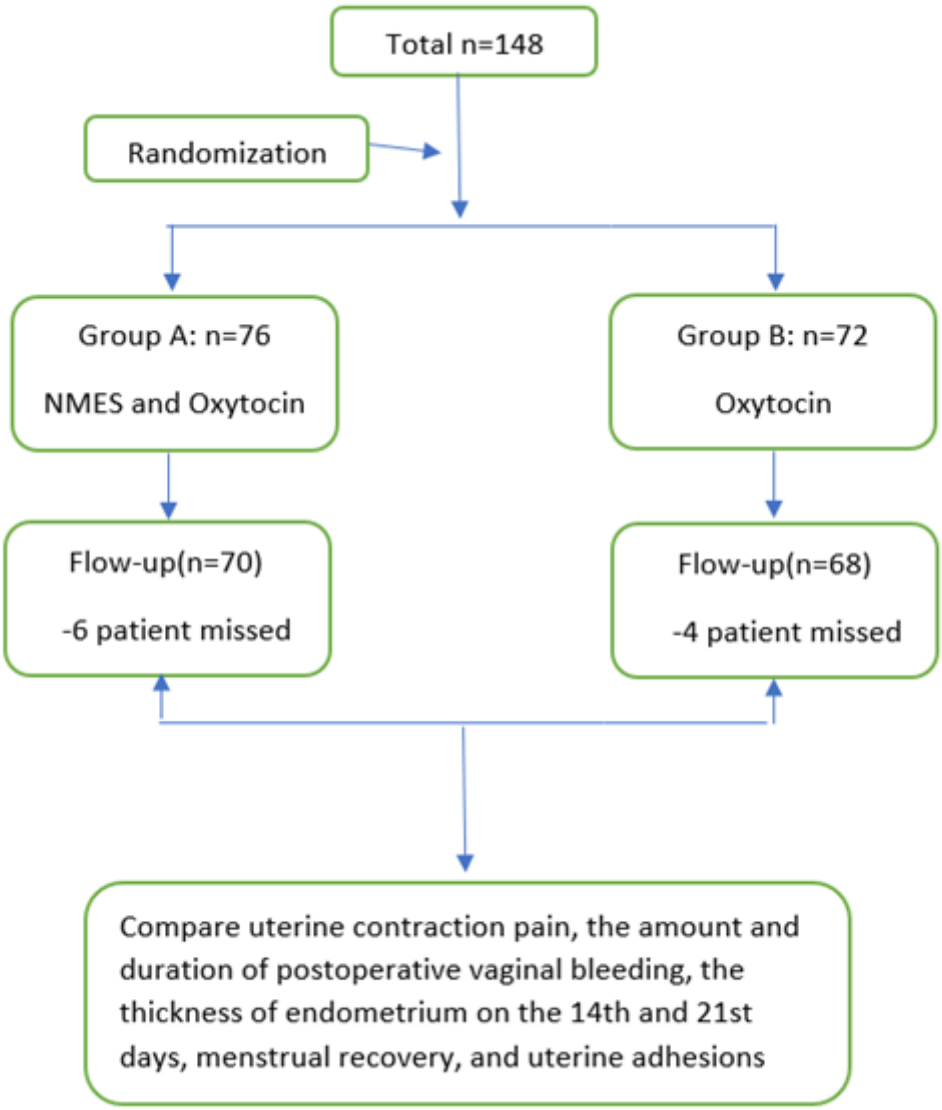

Figure 1

Flowchart of subject disposition in the trial. Compare the uterine contraction pain, the amount and duration of postoperative vaginal bleeding, the thickness of the endometrium on the 14th and 21st days, menstrual recovery, and uterine adhesions at the first and third months after operation were observed in both groups.

Supplementary Files

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