EFFECT OF MICROCURRENT SKIN PATCH ON THE EPIDURAL FENTANYL REQUIREMENTS FOR POST OPERATIVE PAIN RELIEF OF TOTAL HIP ARTHROPLASTY

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Abstract

Introduction: Major orthopedic surgery that cause considerable pain like total hip arthroplasty, requires good post operative pain management. Microcurrent therapy (MCT) is a new therapy whereby electric current is provided in literally millionth of an ampere. MCT comes as two self adherent active electrode patches linked by a cable Efficacy of MCT in the management of musculoskeletal pain and enhancement of wound healing has been reported.

Aim of the work: To study the effect of microcurrent therapy (MCT) on the epidural fentanyl requirements and degree of wound healing after total hip arthroplasty.

Materials and Methods: Twenty eight patients undergoing total hip replacement (THR) were randomly allocated into two groups.

Group I: had micro current skin patches (two adhesive electrode) attached above the site of operation in addition to the lumbar epidural catheter. Post operative epidural fentanyl infusion with a syringe pump given at a rate ranged between 25 and 75 microgram per hour to keep visual analogue pain score (VAS) less than 3/10. Group II had only continuous epidural infusion with fentanyl at the same range to keep VAS less than 3/10 without MCT.

Results: There was statistically significant lower mean epidural fentanyl requirement in Group I (23.24 microgram) when compared to Group II (58.36 microgram).

There was 23% incidence of dermatitis in Group I due to application of micro- current skin patch which resolved by treatment.

There was statistically significant higher frequency of grade 1 of wound healing in the microcurrent group (41.3 %) when compared to Group 11 (7.2%). Grade 2 and 3 were more frequent in Group II)

Conclusion: The microcurrent skin therapy lead to reduction in the requirements of the post operative epidural fentanyl with improvement of degrees of wound healing but with considerable incidence of skin dermatitis after total hip arthroplasty.

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Introduction

Major orthopedic surgery that cause considerable pain like total hip arthroplasty requires good post operative pain management. Several techniques have been used for that purpose such as: intermittent injection of systemic opioids, epidural opioids and or local analgesia drugs, non steroidal anti-inflammatory drugs ($NSAID_{S)}$, patients controlled analgesia (PCA) with opioids with different reports of efficacy and adverse effects[1,2,3,4,5.]

Non pharmacological treatments and alternative approaches are less widely accepted, they span over physical therapy, cryotherapy, continuous passive motion, transcutaneous electric nerve stimulation (TENS) and patient education, an individualized approach of one or more of the above mentioned approaches[6,7,8,9,10].

Microcurrent therapy (MCT**)** is a totally new physical treatment method for electrotherapy[11]. It is a therapy used whereby electric current is provided in literally millionth of an ampere. It works on a cellular level to help stimulate the healing process. It is based upon the theory that the body's electrical balance is disrupted when one is injured, so that the natural electrical current of the body changes course. Microcurrent stimulation restores this balance[12].

In fact, microcurrent therapy can relieve pain, stimulate wound healing, help stimulate the regeneration of injured tissue, provide relief to myofascial trigger points, increase protein synthesis, and stimulate lymphatic flow. Microcurrent stimulation is produced in therapy at literally one millionth of an ampere, because this is believed to be the body's own natural current strength. This therefore restores the body's own natural current[11].

When microcurrent stimulation is provided, it cannot be felt, because the sensory receptors are not stimulated. Other electrotherapy pain relief methods, such as TENS, are provided at higher occurrence in milliamps, thereby causing muscle contraction[12].

With microcurrent therapy, ATP production increases by 500%. ATP is the primary molecule our bodies use to produce energy and is found in every cell of the body. In fact, it has been found that ATP production increased fivefold after microcurrent therapy was administered. As stated previously, protein synthesis also increased, and so did amino acid transport[11].

When microcurrent therapy is used to help heal injured tissue, it restores the natural current flow to the tissue. This in turn allows the cells to regain their own natural energy flow. When injury occurs, the area that has been injured has a higher electrical resistance than the surrounding tissue does. This in turn decreases and perhaps even stops electrical flow through the injured area, which impedes the healing process and promotes inflammation. When microcurrent therapy is used, this resistance is reduced, which allows electricity to flow through and therefore restore normal function. This, in turn, helps stimulate natural healing[12].

In addition, microcurrent therapy can be used at specific frequencies for a variety of tissues and conditions. This can often soften tissue and decrease pain, which provides long-lasting pain relief that may even be permanent. This has some promising benefits that may be applicable to current chronic pain conditions as well[13].

MCT comes as a two self adherent active electrode patches linked by a cable, self generate the necessary current of approximately 10 micro amber required for stable galvanism.. The treatment however lasts 100 times longer than usual. Crucial for galvanic treatment is the quantity of charge carries Q (ions), which are being moved in the body tissues in the electrical field between the therapeutic electrodes as a measure of the degree of stimulation of electric active body structures (Gillert), in accordance with the equation for the physiologic galvanization effect:

Q(carrier) = I (current)x t(times).

An equal quantity of ions are moved during the course of 24 to 48 hours treatment with the microcurrent skin patch as with the more usual electrotherapy involving approximately an I (current) of I m A for a t (time) of 15 to 20 minutes[13].

Recent reports on the efficacy of micro current therapy (MCT) in the management of musculoskeletal pain may offer a new non pharmacological approach for post operative pain relief of major orthopedic surgery.

Aim of the work

To study the effect of micro current therapy (MCT) on the requirements of epidural fentanyl for post operative pain relief of total hip arthroplasty.

Patients and Methods

This study was a prospective randomized study included 28 patients who underwent total hip replacement (THR). After approval by local Ethical Committee, informed written consent were taken from all patients included in the study, they were randomly allocated into 2 groups of 14 patients each.

Group I: had micro current skin patches (Fig. I) (two adhesive electrode) attached above the site of operation just away from the wound, in addition to the epidural catheter that was inserted at L4-L5 lumbar interspace. Post operative fentanyl infusion was given at a rate ranged between 25 and 75 microgram per hour, using a syringe pump to keep visual analogue pain score (VAS) less than 3/10.

Fig. 1
Micro current skin Patches

Group II. had only continuous epidural infusion with fentanyl at the same rate and range to keep VAS less than 3/10 without MCT.

Measurements

1 -Visual Analogue Scale (VAS) before starting post operative pain treatment and every one hour for the first 36 hours.

2 -The mean dose of epidural fentanyl in both groups after 36 hours of post operative period.

3 Side effects and complications.

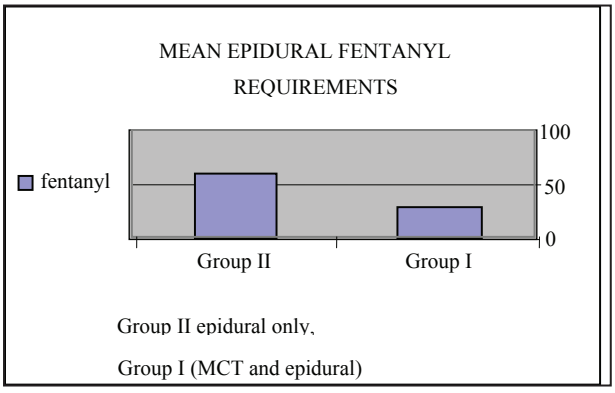
4 Degree of wound healing measured at the end of follow up period and categorized into grade 1,2 and 3 (grade 1: dry suture line, no redness around suture line, normal skin texture around suture line, grade 2: wet suture line, no or minimal redness, normal skin, grade 3: wet or draining suture line, redness and surrounding skin changes of edema or bullae).

Results

There was no statistically significant differences on the Visual Analogue Scale (VAS) on both groups at all time of measurements.

There was statiscally significant lower mean epidural fentanyl dose in Group I (micro current skin therapy group) (23.24 microgram) when compared to Group II (58.36 microgram) (Fig. 2).

Fig. 2
Mean post operative epidural fentanyl requirements in both Groups



There was 23% incidence of dermatitis in Group I due to application of micro- current skin patch which resolved by treatment.

There was statistically significant higher frequency of grade 1 of wound healing in the microcurrent Group (41.3 %) when compared to Group 11 (7.2%). Grade 2 and 3 were more frequent in Group 11 (Table 1).

Table 1
Healing in both groups Wound

Grade	MCT	Group II
1	41.3%	7.2%
2	47.7%	58.8%
3	12%	34%

Discussion

Orthopedic procedures such as total hip arthroplasty (THA) is an ongoing challenge regarding post operative pain control, as current pain management techniques often result in undermedication and/or complications[1,2].

The standard approach depends on systemic opioids given in bolus IV or IM or in patient controlled analgesia (PCA), epidural analgesia with narcotics with or without local analgesia and $NSAID_S$.

Non pharmacological methods are less widely accepted in the management of severe pain induced by this group of operations, they include physical therapy, cryotherapy, continuous passive motion (CPM), transcutaneous electric nerve stimulation (TENS) and patient education[8]. Reports on the efficacy of cryotherapy[5,6,7] and TENS[8] are generally disappointing, while the use of CPM to control pain is controversial[9].

Several reports support a favourable effect of MCT as related to pain control and tissue healing, through the modification and recruitment of cell membrane ATP (adenosine triphosphate)[11,12,,14,15,16,17], but this was mostly reported in chronic painful conditions.

Microcurrent stimulation to the body causes radically increased production of adenosine triphosphate (ATP) levels. This allows the body to perform whatever healing process it has undertaken in an accelerated fashion. It may even allow one to get over the proverbial "hump" that was unachievable, due to insufficient ATP concentrations to perform the changes needed.

The result of the present study showed efficacy of MCT patches in reduction of the epidural fenatnyl requirements after THR, demonstrating its efficacy in contribution of post operative pain relief. The present study shows that reduction of analgesic dose post operatively goes with that of El-Husseini et al[18] during their study of the effect of microcurrent skin patches (MCT) for post operative pain relief in total knee arthroplasty which demonstrated reduction in the post operative tramadol dose with MCT patches.

Result of our study showed marked acceleration of wound healing with the microcurrent therapy which goes also with that of El-Husseini et al[18].

Microcurrent therapy, which is used from one to 600 uA clinically, is the modality of choice for increased tissue healing. Research and clinical trials[19] have shown that the microcurrent stimulation, there is a 40-50% reduction in healing time of ulcers and sprain/strains ; fracture heal faster and stronger; that bad scarring (keloid scars) remodel to become a healthier, stronger scar. Other ATP related microcurrent stimulatory effects include decrease inflammation ,edema and swelling[20].

Conclusion

The microcurrent skin therapy lead to reduction in the requirements of the post operative epidural fentanyl with improvement of degrees of wound healing but with considerable incidence of skin dermatitis.

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