

Effects of EMS on Foot Drop associated with Grade III Wound- Case Report

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Abstract

A 51 year old lady; known case of diabetes mellitus, post wound debridement i.e. 4 open wounds of grade III presented to us with foot drop, with prominent sensory deficit over right lower leg/foot i.e. 0 on Nottingham scale for impaired sensation, marked pedal edema and 5/10 – 6/10 pain on VAS during day and night respectively. Wounds were poorly granulated and foul smelling. Physiotherapy sessions were planned including twice a day electrical muscle stimulation sessions, strategies to decrease edema and improve muscle action which resulted in noticeable improvement in motor and sensory ability, pain levels, edema and psychological status of patient. Thus, this study gives evidence of the effect of Electrical muscle stimulation in grade III open wounds associated with motor/sensory weakness post-surgery.

Introduction

Electrical stimulation is a frequently used electrotherapy tool in physical therapy settings of Pakistan [1]. It may use for a wide range of impairments and disabilities from pain to sensory/ motor impairments [2]. Electrical stimulation promote the process of wound healing via attraction of negatively or positively charged cells into the wound area, such as neutrophils, macrophages, epidermal cells and fibroblasts that in turn will contribute to wound healing processes [3]. Studies [4] suggest that current of injury significantly initiates repair, this current is generated by epithelial rupture leading to “skin battery” effect that ensures flow of charges through the wound site.

Electrical Stimulation usually use for acute foot drop with intact skin or soft tissue and to address the sensory impairment separately either to manage foot drop or sensory impairment at a time. We found a patient who had established foot drop post debridement of the grade III wound at the respective lower leg in association with impaired sensation in surgery ward of Madinah Teaching Hospital (MTH), it was thought provoking for us to observe the results of Electrical stimulation on foot drop associated with impaired sensation and wound.

Case Presentation

A 51-year old woman presented with post debridement foot drop at General surgery ward. She was a known case of diabetes mellitus from 15 year and a history of carbuncles 1 year back. She presented to general surgery department with pain in right lower leg, swelling and difficulty in walking. The patient was diagnosed with cellulitis and surgery was planned. First operation i.e. Release incision on Right leg was performed on 8/12/2014 resulting in the findings of necrotic patch and abscess in medial and lateral aspect of right lower leg. Followed by second operation i.e. debridement of wound on 17/12/2014 which led to right foot drop in patient.

There were 4 open wounds on patient’s right lower leg including (a) Antero-lateral aspect ;proximal 2/3rd [L×W/cm i.e. 15.4×6.6] (b) Medial aspect; mid shaft [11.9×3.8] (c) Medial malleoli [3.3×6.8] (d) Lateral malleoli [10.4×4.7]. These wounds were of 3rd degree, 3rd degree, 2nd degree and 3rd degree respectively. There was marked pedal edema and right lower leg edema. Patient reported 5/10 pain on Visual analogue scale (VAS) during day and 6/10 VAS during night. Pain was relieved temporarily after Diclofenac sodium 50mg dose given twice a day. There was marked sensory deficit in whole right lower leg i.e. of score zero (0) on Nottingham scale for impaired sensations. There was a diminished soft touch sensation in L4/5 dermatome i.e. whole shin and dorsum of foot. However crude/hard touch was intact over toes. Moreover, there was 0 degree of dorsi-flexion of Right foot and

extension of right toes. Plantar flexion of right foot was WNL. Patient can flex knee 30-40 degrees (due to bandage) but prefer extended position due to pain and open wound/edema. There was tendo-achilies adaptive shortening, floppy lower leg muscles (posterior). There was poor granulation at wound, foul smell and discoloration present at wound margins (Figure 1.1 and 1.2).

Management and Outcome

Following thorough patient assessment, physiotherapy plan of care was formulated. Total 14 sessions of physiotherapy were planned between two successive debridement surgeries. Physiotherapy sessions were planned twice a day focusing on primary of addressing sensory/ motor deficit right lower leg and edema. Each physiotherapy session consisted of 30 minutes of electric muscle stimulation (EMS) along elevation and effleurage massage plus passive tendo-achilies stretching. Exercise plan was also guided to attendant for post-physiotherapy sessions.

Three motor points were selected for EMS placement; Direct application of ES through electrodes near the wound site was adopted [5]. Inactive electrode was placed at intact skin on head of fibula while active electrode was placed for 10 minutes at each (pre-selected) motor point on antero-lateral aspect of right lower leg. Parameters related to EMS dosage are briefly described in Table 1.1. As the sensations continue to improve with on-going physiotherapy sessions, output intensity was gradually reduced. Secondly passive tendo-achilies stretching was performed for 20 times in each session. Leg was placed on a rounded pillow of 4-6 inches height during treatment (and after treatment too with periodic lowering of leg), along with effleurage massage to decrease edema.

Foul smell and yellowish white discharge leaked out of wound during first 6 physiotherapy sessions. Improvement in sensations begin

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Figure 1.1: Wound status at 1st physiotherapy session.



Figure 1.2: Wound condition at 14th physiotherapy session.

from 5th session onwards, as sensations improved more at distal motor points as compared to proximal motor points, output intensities were decreased accordingly. At 7th session improved muscle activity was noted with visible muscle contractions. Active toe curls and extension of toes was initiated and noted at 8th session plus wound margins were clear except at proximal/medial border of a wound at proximal 2/3rd of leg. After 9th session re-evaluation marked granulation was seen at all 4 wounds, pitting edema was markedly reduced; wound margins were clear and sharp, sensations improved at dorsum of toes and foot i.e. improved to 1 on Nottingham scale for impaired sensations (both crude and soft touch). Moreover sensations kept on improving during next sessions of treatment. At the beginning of 13th session; assessment revealed improved crude touch sensations at shin (intact skin) too.

In addition, Patient reported marked pain relieve after EMS sessions and decrease in night pain episodes too i.e. 2/10 on VAS. Pain was aggravated by supported ambulatory effort. At the 4th session onwards patient reported 0/10 pain on VAS throughout the day. Inconsistent and varying levels of Random blood sugar are elaborated in Table 1.2.

Discussion

The outcome of the foresaid patient treatment was imperative and suggested the efficacy of Electrical muscle stimulation (EMS) in patient with foot drop associated with open wounds. EMS is evidenced to be effective in foot drop with intact skin/integumentary system. However, this case report gives evidence that electrical muscle stimulator is effective in grade 2 & 3 open wounds, including; the marked improvement in sensations i.e. light touch and crude touch after 14 EMS sessions. This sensory improvement begin from 5th physiotherapy session from crude to light touch and scored 1 on Nottingham scale for impaired sensations.

As the patient was a known case of diabetes from around 15 years and on medications to control blood glucose levels. The outcome of this case report suggested imperative effects of EMS in diabetic patient with impaired sensations similar to the result of a study [6]. In addition to sensory improvement; the result was supportive for EMS in motor recovery in foot drop patients with open wounds. By 7th physiotherapy session evident muscle activity was identified which was represented grade 1 on Manual muscle testing.

Moreover, effect of EMS on wound healing is also evident [4,7,8]. While studies reporting the effectiveness of EMS on open wound healing is deficient. In this case report process of granulation increased in all 4 wound sites with clear margination of the wounds. There was also reduced foully smell at the 14th session, further evidencing the anti-bacterial effect of EMS. However, this aspect was not ruled out completely in the given case and recommended to be studied as a separate avenue of EMS. An *in-vitro* study [9] reports the effectiveness of high voltage pulsed current in anti-bacterial/microbial activity and promotion of post-surgical wound healing while our case report can give evidence of anti-bacterial effect of EMS *in-vivo*. Further physiotherapy sessions resulted in marked decrease of pedal edema similarly, a study conducted by Young S [10] which showed that electrical stimulation effectively reduced 60% of peri-wound edema.

Day	Random Blood sugar levels (mg/dl)
Session 1	96
Session 2	96
Session 3	95
Session 4	95
Session 5	127
Session 6	127
Session 7	160
Session 8	160
Session 9	201
Session 10	201
Session 11	385
Session 12	385
Session 13	242
Session 14	242

Table 1.1: Levels of random blood sugar during the days of physiotherapy management

Day	Pulse rate (Hz)	Timer (sec)	Output Intensity (mA)	Pulse width (ms)
Session 1	30	10	44.8	400
Session 2	30	10	44.8	400
Session 3	30	10	44.8	400
Session 4	30	10	44.8	400
Session 5	30	10	42.24	400
Session 6	30	10	42.24	400
Session 7	30	10	39.68	400
Session 8	30	10	39.68	400
Session 9	30	10	32 (2P*) 19.2 (1D*)	400
Session 10	30	10	32 (2P*) 19.2 (1D*)	400
Session 11	30	10	32 (2P*) 14.08(1D*)	400
Session 12	30	10	29.44(2P*) 14.08(1D*)	400
Session 13	30	10	14.08(2P*) 11.52(1D*)	400
Session 14	1	20	14.08(2P*) 11.52(1D*)	400

Table 1.2: EMS parameters selected per session, *2P stands for intensities at two proximal motor points and *1D stands for output EMS intensity at 1 distal motor point.

According to Cameron, 2012 [11] EMS is effective in reducing pain. Similarly, pain reduction was noticed by the patient and hence reported right after 1st physiotherapy session. Patient reported marked decrease in night pain episodes and improved psychological status post-EMS. By the end of all 14 physiotherapy sessions; resting and night pain decreased to 0/10 VAS while pain was only associated with assisted walking attempts i.e. 2/10 on VAS.

Surprisingly, RBS charts during the course of physiotherapy management showed a gradually higher values, although RBS is not the only gold standard for blood glucose monitoring, even then this may be alarming and should be considered by the physiotherapist whenever EMS sessions are planned for diabetic population. As this raise in RBS values may be due to some bio electric stimulation at certain physiological process that directly lead to increase blood sugar levels this topic is a potential option for upcoming studies. Due to time constraints only fourteen physiotherapy sessions were planned as patient refused to undergo any further surgical procedure. Thus, physiotherapy management could not lead to further patient rehabilitation and functional independence.

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