Cuban Journal of Physical Medicine &Rehabilitation
RNPS 2244- FOLIO 148- ISSN 2078-7162
Rev Cub MFR v.2 n.1 City of La Havana Jan-June 2010

ORIGINAL WORK (English Translation)

Value of deep oscillation therapy in the healing of AB burns

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ABSTRACT

Objective: To evaluate the efficacy of therapy with deep oscillations in the healing of burns.

Method: A prospective longitudinal explanatory experimental study, with deliberate intervention in two independent samples of patients, between November 2008 and October 2009.

Results: Clinical healing time of AB skin burns in patients in the group with deep oscillation therapy was 10.8 days (SD 0.55) whereas in the group treated with silver sulfadiazine it was 16.2 days (SD 0.76). The signs test to verify the healing of individuals before and after treatment differed significantly. We found that in the group treated with deep oscillation therapy there were significant differences before and after treatment for $p < 0.05$ ($Z = -4.81$, $p = 0.00$).

Conclusions: Deep oscillation therapy combined with 1% silver sulfadiazine is effective in the treatment of burns, with a shorter healing time when compared with treatment with silver sulfadiazine.

Key words: Burns, deep oscillation therapy, healing

INTRODUCTION

Burns are a significant cause of morbidity and mortality. Each year, approximately two million persons suffer burns, up to 80,000 are hospitalised with burns and more than 6,500 die from this injury in the US alone[1]. At least 1% of the world's population suffers burns each year and of this 4% require hospitalisation. Approximately 9 million persons are disabled each year througout the world as a result of burns. These are frequent and in many cases fatal and they have a huge impact on the wellbeing of those affected. Recovery is often slow, response to treatment may be slow due to sepsis and poor healing.

Burn treatment and rehabilitation is a difficult challenge. Most burns are produced by heat: flames, explosions or contact with hot liquids.[2] In Cuba, 30,000 burns are reported each year and more than 95% are thermal burns, which also constitute a major cause of death in the ages between 15 and 49 years.[3,4]

Locally, the burn wound tends to extend in the acute phase of the lesion, as a consequence of microvascular changes, massive leukocyte and platelet activation and the incidence of oedema. Many small vessels coagulate immediately as the heat is applied, whilst others may suffer thrombosis and produce tissue dehydration.[5]

The systemic response to a burn is characterised by interstitial oedema in distant organs, secondary to a combination of mediators liberated by the wound and hypoproteinemia.[6]

There are different classes of burns, depending on various criteria: the agent that produces them, the size of the area burned, the depth and location of the lesions. Depending on the causing agent, these may be classed as thermal, electrical, chemical and radioactive. In accordance with the burned body surface area (BBSA): Serious burn (also called a "large burn"), where a patient has a BBSA in excess of 15%. A mild burn is where the BBSA is less than 15%. Within this classification other important aspects need to be considered, such as the age of the patient, depth of the lesion, existence of other illnesses, etc.[7]

Depending on depth, burns may be classed as epidermal where they affect the epidermis respecting the basal or germinative layer. These are characterised by erythema and hyperesthesia, and they heal spontaneously. Dermal A burns involve the papillary layer of the dermis, and produce fine blisters containing a clear liquid, which are pink in colour and are extremely painful. These heal in 7 to 14 days. AB dermal burns wound the dermis as far as the reticular layer, present thick blisters with a cloudy fluid, which are cherry red in colour,

painful, heal in between 15 to 21 days and finally, hypodermal burns produce total destruction of the skin, may damage other tissues including bone, they are dry, painless, they are from pearly white to golden or blackish in colour when carbonised and these require skin grafts.[8]

Clinical assessment, generally, depends on the appearance of the burn; paleness, capillary backflow, presence and degree of fixed capillary staining, evaluation of sensitivity to touch and pinprick. Tissue perfusion and, consequently, the depth of the burn may be measured using objective assessment instruments such as, for example, laser-based flow meter. Thermal agression on the tissues triggers a series of physiopathological phenomena in the circulatory, nervous, endocrine, renal systems amongst others. As a product of the direct action of the agent causing the burn an inflammatory lesion is produced with cell death together with a prolongad secondary ischaemia caused by intravascular coagulation.

Burns are a difficult treatment challenge. Various types of procedures to promote healing have been described and worthy of particular note are the use of temporary partial-thickness skin substitutes, antimicrobials, silver sulfadiazine, epidemic growth factor, amongst others.[9, 10]

Use of silver sulfadiazine, due to is anti-infectious effect, has been an habitual topical treatment. The appearance of new topical use therapies, dressings and bioactive compresses have led to a decline in its use. Nonetheless, in many countries silver sulfadiazine is still maintained as an alternative for consideration and in practice it is still widely used.[11, 12]

From the point of view of treating with therapeutic physical agents the literature reviewed has referenced treatment with laser, magnetotherapy, hyperbaric oxygen therapy, topical negative pressure (TNP). The principle of deep oscillation therapy is based on the generation of a pulsed electrostatic field, the movement of one of the electrodes leads to an intensive resonant oscillation in the strip of affected tissue, that is, dumping effect throughout its entire depth, which leads to an improvement of the drainage channels and tissue repair.[19] The therapeutic effects of deep oscillation therapy may lie in the positive influence on the equilibrium of the interstitial fluids and in the blood capillaries. This alleviates pain and promotes healing. Deep oscillation therapy acts fundamentally on the micro circulation in the interstitial connective tissue area producing normalisation of

homeostasis.[20] Amongst the benefits attributed to deep oscillation therapy is its use in the treatment of acute traumatism in pre and post operative periods, which is tolerated well by the patient, in the prophyaxis of thrombosis in intensive or geriatric medicine, and the possibility of treatment in open wound areas with sterile covering, in addition to its excellent effect in relation to depth, which revealed to be approximately 8cm, in our own ecographic image recordings.

METHOD

The search strategy was developed accessing the Heath Information Locator from the Cuban Rehabilitation Medicine portal in Infomed, searches were conducted in the online databases in EBSCO, LILACS, Medline and Cochrane Library, supported by the personal database manager EndNote 7. MESH search terms were: burn, deep oscillation, skin burns.

The sample constituted 50 patients with burns that were treated and referred as outpatients to the burn therapy department which stated that it was intereseted in participating in the study with informed consent. For the inclusion criteria in both groups a maximum age of 20 and patients with AB type burns affecting less than 15% of the body area were taken into consideration. Patients with diabetes mellitus and burn sepsis were excluded. The agent causing the burn was not taken into consideration. A record model was created which contributed to a database for gathering the data of the clinical and physiatric examination and the results of the study carried out on each patient.

The clinical evaluation was based on the appearance of the burn, blanching, capillary return, presence and degree of fixed capillary staining and the evaluation of sensitivity.

The existence of prolongation of the epithelium between the lesion and the healthy adjacent skin was established as a healing criterion, and the evaluation was carried out in each treatment by an observer, in order that all considerations would be made in accordance with the validated criterion until final discharge. Taken into consideration were clinical re-epithelisation, 95% or more closure of the wound, point at which adequate re-epithelisation was achieved to suspend occlusive treatment. The research design strategy involved the use of two treatment programmes. 1) Group I or study, received deep oscillation therapy with the Hivamat® 200 system, made in Germany (see annex 2). A strip

of sterile plastic foil was used as an insulation system between the burn and the therapist's glove. The following dose was applied: First 10 minutes at a frequency of 25 Hz, next 10 minutes at a frequency of 150 Hz with an intensity of 80% I/P and impulse/ pause ratio of 1/3. Therapist applies a gentle massage around the edges of the burn for a total of 20 minutes, sessions were given on alternate days for a total of 15 applications 2) Group II received occlusive treatment with 1% silver sulfadiazine, treatments were administered on alternate days. For qualitative variables the results were expressed in percentages. A hypothesis of homogeneity and independence between the groups was considered using x^2 considering the value $p<0.05$ as the statistical significance level. For quantitative variables mean, average and standard deviation were used.

RESULTS AND DISCUSSION

Of the 60 patients that formed the study group, 54 fulfilled the inclusion criteria. Of these only 52 patients, corresponding to 96.15% of the selected sample, were studied as 2 abandoned treatment. The patient age range was between 21 and 63 years of age (average 14 years). There were no BBSA differences between the subgroups Case (average 9.4%) and Control (average 9.6%). The patients included in the research were predominantly female with 56.6% female and 43.3% male patients. In the literature reviewed, gender differences play a significant role in the risk of lesions caused by burns, through a spectrum, with a majority of women injured in kitchen and fuel fires in developing countries and industrial accidents that mainly affect men in developed countries. Another study finds that both sexes show a similar distribution up to 41-50 years, with a subsequent increase in women and 21 decrease in older men.[21]

Of the most frequent causes of burns 72.07% of those recorded are attributed to accidents in the home, 19.23% to an accident in the workplace, and 7.69% are due to motor vehicle accidents. Studies reviewed coincide with these findings, one of which was conducted on 1,564 patients treated in a UCI Burns Centre. 75% of all lesions caused by burns were attributed to accidents in the home. [22-25] The most frequent etiological agent was hot fluids at 71,15% and direct fire at 19.20%, these coincide wtih the literature reviewed where domestic accidents are predominated by direct fire and hot fluids. Another study carried out references burns caused by electric arc in accidents in the workplace. [21-23]

Graph I reflects the healing time of AB dermal burns in patients in the deep oscillation therapy group, which was 10.8 days (SD 0.55) and that of the group treated with silver sulfadiazine which was 16.2 days (SD 0.76).

Studies exist that deal with the use of physical therapeutic agents to accelerate the healing process. Worthy of note are laser, electrostimulation, electromagnetic fields and negative topical pressure (NTP) therapy. A systematic review of treatment with hyperbaric oxygen for thermal burns covered average informed times to cure and showed promising results, with shorter times in patients exposed to HBOT. However, a definition of “cure” was not provided nor was a description of the size of the wound and the depth presented. [26] Another study reports central and peripheral circulation normalisation, positive effects in the capillaries in vascular diseases of the lower limbs, increase of the intramuscular vascular bed, as well as acceleration in the development of lymphatic collaterals using electromagnetic fields in experiments.[19] By means of a controlled clinical study to evaluate the efficacy of local application of powdered quitine at 100% in 118 patients affected by A and AB termal burns up to 2% of the body surface area, treated as outpatients, showed that the average cicatrisation time for the control group was 16.4 days (SD 5.8) and 14.3 days (SD 3.1) for the test group. The patients treated with chiton showed a significant decrease in healing time of 4.1 days.[29]

The results with the use of deep oscillation therapy are attributable to the positive effect of reducing pain, anti-inflammatory effect, antifibrótico effect, tissue regeneration effect [19, 20], with the mild effect of the massage on the lesion, vasodilation is achieved, which promotes blood flow and an adequate nutritional supply of tissue oxygen.

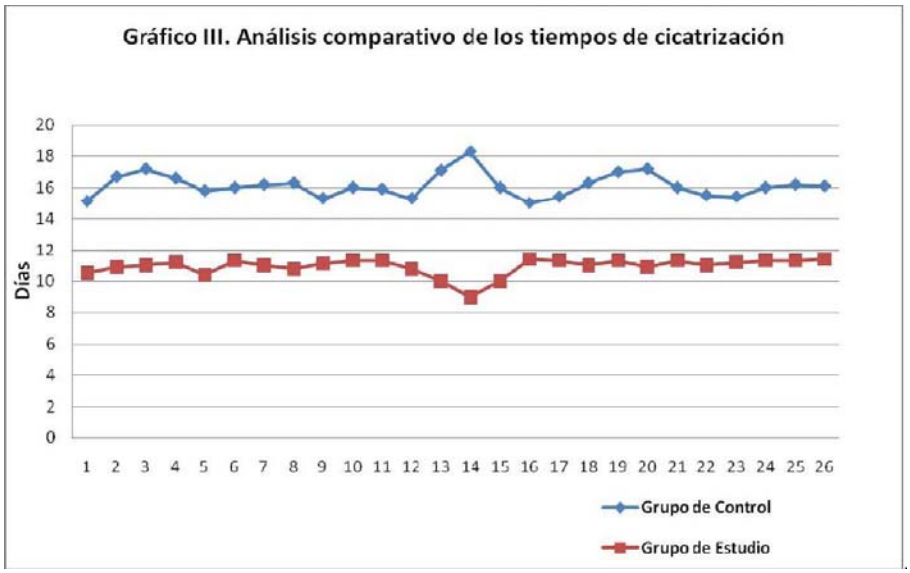
Patients in the study group treated with deep oscillation therapy showed a significant decrease in the healing time of 5.4 days compared with those treated with silver sulfadiazine alone. In all the variables analysed the differences were statistically significant, before and after completing treatment.

CONCLUSIONS

Deep oscillation therapy combined with 1% silver sulfadiazine is effective in the treatment of burns, with a shorter healing time when compared with treatment with silver sulfadiazine.

ANNEX

ANNEX 1 Comparing analysis of healing time of AB burns



- **Control**
- **Therapy group**

Días = days

Annex 2 Deep oscillation therapy with the Hivamat® 200 (Physiomed, Germany) treating a burn patient

REFERENCES

1. (Brigham PA, McLoughlin E. Burn incidence and medical care use in the United States: Estimates, trends, and data sources. Journal of Burn Care Rehabilitation 1996; 17 (2):95-107. Available in: http://www.ncbi.nlm.nih.gov/pubmed/8675512

2. Lidal IB, Huynh TK, Biering-Sørensen F. Return to work following spinal cord injury: a review.Disabil Rehabil. 2007 Sep 15; 29(17):1341-75. Available in: http://www.ncbi.nlm.nih.gov/pubmed/17729082

3. Pérez F, Vázquez E, Cepero R, Pina E, Ramírez E, Características epidemiológicas de las quemaduras asistidas en la Unidad de Quemados del Hospital Provincial de Ciego de Ávila. Revistas Mediciego. 2005; 19(11). Disponible en: http://bvs.sld.cu/revistas/mciego/vol11_02_05/articulos/a19_v11_0205.html

4. Francisco Valdés Lazo et al. Encuesta nacional de accidentes en menores de 20 años en Cuba: La Habana: Editorial Ciencias Médicas, 2009. 7 30. Disponible en: http://files.sld.cu/dne/files/2010/03/encuesta-nacional-deaccidentes.pdf

5. Boykin JV, Eriksson E, Pittman RN. In vivo microcirculation of a scald burn and the progression of postburn dermal ischemia. Plastic and Reconstructive Surgery 1980; 66(2):191-8. Available in: http://www.ncbi.nlm.nih.gov/pubmed/7403309

6. Broche Valle F, Céspedes Miranda E,Saldaña Bernabeu A,Cruz Pérez A. La enfermedad por quemaduras como modelo de respuesta inflamatoria sistémica. Rev Cubana Invest Biomed v.18 n.2Ciudad de la Habana. may.-ago.1999.Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-03001999000200002

7. Frías Méndez Eloy. QUEMADURAS: Diagnóstico y tratamiento en las primeras 72 horas. Rev Cubana Cir . 2006 Jun [citado 2010 Abr 13] ; 45(2): Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0034-74932006000200012&lng=es

8. Serra MC: O Processo de cicatrizacao. En Tratado de Queimaduras, cap 77. Editra Atheneu, Sao Paulo. 2004. Available in: http://www.scielo.cl/scieloOrg/php/reflinks.php?refpid=S0370-41062007000700060015&pid=S0370-41062007000700006&lng=esDemling

9. RH.Burns: what are the pharmacological treatment options? Expert Opin Pharmacother. 2008 Aug;9(11):1895-908.Available in: http://www.ncbi.nlm.nih.gov/pubmed/18627328

10. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. Clinical study on repair of burn wounds of degree II with recombinant human epidermal growth factor in elderly patients 2010 Apr;24(4):462-4.available in: http://www.ncbi.nlm.nih.gov/pubmed/20459012

11. Fresia Solís F, Liliana Cortés P, Rolando Saavedra O, Efectividad de la sulfadiazina de plata en reepitelización de heridas por quemaduras con líquidos calientes en zonas neutras en niños. Rev. chil. pediatr. v.78 n.6 dic. 2007 disponible en: http://www.scielo.cl/scielo.php?pid=S0370-41062007000700006&script=sci_arttext

12. *Costagliola M, Agrosi M:* Second-degree burns: a comparative, multicenter, randomized trial of hyaluronic acid plus silver sulfadiazine vs. Silver sulfadiazine alone. Curr Med Res Opin 2005; 21 (8): 1235-40. Diponible en: http://www.scielo.cl/scieloOrg/php/reflinks.php?refpid=S0370-41062007000700060013&pid=S0370-41062007000700006&lng=es

13. Villanueva E, Bennett MH, Wasiak J, Lehm JP. Tratamiento con oxígeno hiperbárico para las quemaduras térmicas (Cochrane Review). In: *LaBiblioteca Cochrane Plus,* Issue 3, CD004727.

14. Brannen AL, Still J, Haynes M. A randomized prospective trial of hyperbaric oxygen in a referral burn center population. American Surgeon 1997; 63(205-8).

15. Wasiak J, Cleland H. Presión negativa tópica (PNT) para las quemaduras de espesor parcial (Cochrane Review). In: *La Biblioteca Cochrane Plus,* Issue 3, CD006215.

16. Adamkova M, Tymonova J, Zamecnikova I, Kadlcik M, Klosova H. First experience with the use of vacuum assisted closure in the treatment of skin defects at the burn center. Acta Chirurgiae Plasticae 2005;47(1):24-7.

17. Moisidis E, Heath T, Boorer C, Ho K, Deva AK. A prospective, blinded, randomized, controlled clinical trial of topical negative pressure use in skin grafting. Plastic and Reconstructive Surgery 2004;114 (4):917-22.

18. Hüseyin Demir, MD; Halil Balay, MD; Mehmet Kirnap, MD. A comparative study of the effects of electrical stimulation and laser treatment on experimental wound healing in rats. Journal of Rehabilitation Research & Development. Volume 41, Number 2, Pages 147–154 2004. Available in:

http://www.rehab.research.va.gov/jour/04/41/2/pdf/Demir.pdf

19. Jahr S, Schoppe B, Reisshauer A.Effect of treatment with low-intensity and extremely low-frequency electrostatic fields (Deep Oscillation) on breast tissue and pain in patients with secondary breast lymphoedema.J Rehabil Med. 2008 Aug;40(8):645-50.Available in: http://www.ncbi.nlm.nih.gov/pubmed/19020698Mmmm

20. Aliyev R.Clinical effects of the therapy method deep oscillation in treatment of sports injuries.Sportverletz Sportschaden. 2009 Mar;23(1):31-4. Epub 2009 Mar 20.available in: http://www.ncbi.nlm.nih.gov/pubmed/17971017

21. Majori S, Ricci G, Capretta F, Rocca G, Baldovin T, Buonocore F. Epidemiology of domestic injuries. A survey in an emergency department in North-East Italy. J Prev Med Hyg. 2009 Sep;50(3):164-9. Available in: http://www.ncbi.nlm.nih.gov/pubmed/20411650

20. Dissanaike S, Rahimi M. Epidemiology of burn injuries: highlighting cultural and sociodemographic aspects. Int Rev Psychiatry. 2009 Dec;21(6):505-11.

21. Indian Journal of Community MedicineAll Medical Journals Issues Contents Editorial Board& InformationEpidemiology and Mortality of Burns in JNMC Hospitlal, AMU Aligarh: A 5 year Study Author(s): V. Mago, M. Yaseen, L.M. BariarVol. 29, No. 4 (2004-10 - 2004-12)

22. John D. MacArthur, MD; Francis D. Moore, MD. Epidemiology of BurnsThe Burn-Prone Patient. JAMA. 1975; 231(3):259-263.

23. Panatto D, Gasparini R, Vitale A, Sasso T, Lugarini J, Cremonesi I, Sensi S, Badolati G.Survey of domestic accidents in the elderly in the Province of Genoa (northern Italy). J Prev Med Hyg. 2009 Mar; 50(1):53-7.

24. Villanueva E, Bennett MH, Wasiak J, Lehm JP. Tratamiento con oxígeno hiperbárico para las quemaduras térmicas (Revisión Cochrane traducida). En: *La Biblioteca Cochrane Plus*, 2008 Número 4. Oxford: Update Software Ltd.

25. Beato Canfux A, Pedroso Garriga T, González Planas G, González-Quevedo Rodríguez M. Tratamiento de las quemaduras de espesor parcial con quitina en polvo. Rev Cubana Med Milit 1996;25(1). Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0138-65571996000100003&lng=es&nrm=iso&tlng=es

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