Ozonetherapy in complex treatment of neuropathy in burn patients.

Rasterayeva M.[1], Struchkov S[1]., Belova A.[1], Peretaygin S[1]., Khroulev S[1].

[1] Research Institute of Traumatology and Orthopaedics, Russian Burns Center
Russia, Nizhny Novgorod

Abstract

Neuropathy in burned patients is frequently overlooked. This problem is reported in the literature very poorly. The nature and the pathogenesis of the peripheral nerves impairment after burn trauma are not well known. No specific medical treatment is known to be of value in the prevention or cure of neuropathies in these patients.

20 patients with thermal burns complicated with nerves impairment were included into the study. All patients had thermal burns, the total body surface area burned ranged from 5% to 35% with most of these burns arranged on legs. Control group (20 patients) was randomized. The etiology of neuropathy development was long healing burn wounds in the region of nerve trunk projection. Ozonetherahy was resend in all patients with neuropathies. The ground for its appointment was bacteriostatic and trophic effect of ozon. Ozon was used in form of local application for 15 – 20 minutes every day, 10 procedures for course.

Positive results improvement of sensitivity in region of autonomous innervations, decrease in manifestation of movement disorders. Were obtained in 17 patients with neuropathies, no improvement was observed in 3 patients.

The efficiency of ozonetherapy confirmed electroneuromyography.

The increase of conduction velocity in motor and sensor fibers was registrated. In compartment with control group acceleration of the burn wound healing after ozonetherapy was reached.

Introduction

Peripheral neuropathy which occurs in burn patients is not well recognized and hence is probably frequently missed. The incidence of peripheral neuropathy following bum injury has been quoted at between 15 per cent [1, 6] and 29 per cent [2, 3]. This may be a mononeuropathy due to local factors or a polyneuropathy due to general factors. Among recently noted clinical entity critically ill polyneuropathy is reported which observes usually in patients suffering severe sepsis from a variety of causes. It usually begins within I month of admission at the peak of the critical illness[7]. Movement in the head, facial, jaw and tongue muscles are relatively preserved. Sensory signs are milder, consisting of loss of all modalities in a symmetrical glove and stocking distribution, and problems may be encountered with painless pressure sores. All signs are most marked in the distal parts.

The nature and the pathogenesis of the peripheral neuropathy in burns are not well known. Anastakis et al. (1987) [4, 5] provide a review of the etiology of this condition.

Pathomorphologic changes in peripheral nerves and vasa nervorum in burn victims consist in vascular erythrostasis, sometimes fresh thrombi, plasmorrhagias and diapedesic hemorrhages, spread of necrosis from long-healing wounds onto peroneal and ulnar nerves, leading to anatomic break.

By the present moment burn treatment has achieved remarkable success, quite a number of new effective methods, agents, and drugs have been proposed. Still, all the problems have not been solved. New antibiotic-resistant microbial strains are constantly appearing, the number of allergic reactions to drugs is growing, antibiotics of the last generation are very expensive. Therefore, development of new preparations and methods of burn treatment is going on. One of the relatively new methods of treatment is ozone therapy.

Ozone renders a rather strong bacteriostatic, bactericidal, fungicidal, and virucidal effect, decreases microbial resistance to antibiotics, improves tissue trophism, does not induce allergic reactions; the method is simple and cheap enough.

In Russian Burns Center a great experience in using ozone for treatment of II-III degree burn wounds has been gained.

Aim of the study

To assess the effectiveness of ozonetherapy in burned patients with neuropathies.

Materials and methods

20 patients with thermal burns complicated with nerves impairment were included into the study (group I). The mean age of patients was 34.3±7.2 years with a range of 20 to 48 years; 2 were females and 18 were males. All patients had thermal burns, the total body surface area burned ranged from 5 to 60 per cent (31,6±13,3) with most of these burns included legs and arms. All patients were referred from the Institute of Traumatology and Ortopedics in Nizhny Novgorod, Russia, for evaluation during the period from January 1999 to January2001.

Each patient was submitted to the following examinations:

- Careful history and physical examination including type, duration, degree, surface area and site of burn.
- Full neurological examination. Patients with a known history of any predisposing cause of peripheral neuropathy (diabetes mellitus, collagen disease, uremia, alcohol abuse) were excluded from this study.
- Electrophysiological examination included electromyography and motor nerve conduction velocities (MNCV) of burn and non-burn limbs

Entrapment mononeuropathy was discovered in 14 patients, mononeuritis multiplex in 6. Control group 20 patients (group II) was randomized. All patients from control group were diagnosed with peripheral neuropathy by electromyography (entrapment mononeuropathy was discovered in 12 patients, mononeuritis multiplex in 8 cases). Ozonetherapy was used in all patients of group I and II. The ground for its appointment was bacteriostatic and trophic effect of ozon. Ozon was used in form of local application. The extremity was placed into a special plastic container, and ozone-oxygen mixture with concentrations ozone 2,0 – 4,0 mg/l was blown through container at 1 l/min speed for 15 – 25 minutes one other day, 10 procedures for course.

Statistical reliability of the results was estimated by Fisher accurate method.

Results

In 3 weeks interval after treatment beginning positive results improvement of sensitivity in region of autonomous innervations, decrease in manifestation of movement disorders. Were obtained in 17 patients of group I, no improvement was observed in 3 patients of this group.

The efficiency of ozonetherapy was confirmed by electroneuromyography. The in crease conduction velocity in impaired nerves was registrated before treatment and after treatment. The increase of M-response was registrated in 17 patients. The worst results (absence of improvement) were observed in 2 patients with direct thermal trauma of peroneal nerves and 1 patient with entrapment mononeuropathy of ulnar nerve. In group II in 3-week period positive changes were developed only in 4 patients with entrapment mononeuropathies of nerves medianus with absence of improvement in 16 patients In compartment with control group acceleration of the burn wound healing after ozonetherapy was also reached.

Table 1. Motor nerve conduction study median, ulnar and common peroneal nerves in 20 patients group I and 20 patients group II (mean ± SD)

Nerves	Amplitude (mV)	Distal latency (m/s)	motor nerve conduction velosity (m/s)
median group I			
before treatment	1,37 ± 0,98	2,52 ± 0,90	48,20 ± 5,70
after treatment	3,81 ± 1,23*	3,61 ± 0,50	56,40 ± 4,20*
median group II			
before treatment	1,40 ± 0,74	2,6 ± 0,70	49,34 ± 5,78
after treatment	1,8 ± 0,56	2,8 ± 0,60	53,65 ± 4,67
ulnar group I			
before treatment	1,77 ± 0,58	49,23 ± 6,11	2,52 ± 0,60
after treatment	2,93 ± 0,59*	52,12 ± 3,48	2,53 ± 0,30
ulnar group II			
Before treatment	1,67 ± 0,68	48,45 ± 5,98	2,36 ± 0,56
after treatment	2,21 ± 0,56	53,67 ± 7,45	2,65 ± 0,68
peroneal group I			
before treatment	0,92 ± 0,52	2,72 ± 0,90	38,20 ± 5,70
after treatment	0,96± 0,61	2,91 ± 0,50	42,40 ± 4,20
peroneal group II			
before treatment	1,40 ± 0,74	2,6 ± 0,51	38,34 ± 5,78
after treatment	1,8 ± 0,56	2,7 ± 0,63	44,65 ± 4,67

*p<0,005

Discussion

It is known that in autoplastyc of extensive burn wounds it is a priority to cover them above the superficial nerve trunks: in long-healing wounds the risk of necrotic spreading onto large nerve trunks is great, what leads to their anatomic break.

One of the new methods aimed at accelerating wound healing is regional ozone therapy. Gassing with ozone-oxygen mixture in a plastic bag allows local improvement of blood rheologic properties and microcirculation, increase of blood oxygenation, and with it reduction of terms of wound preparation for autodermplastyc. Regional ozone therapy promotes not only accelerated burn wound healing, due to bactericidal effect, but also improved trophism of nerve trunks. We have demonstrated reliable effectiveness of regional ozone therapy in treatment of burn victims with ulnar, median, and peroneal nerve injuries. Positive results in treatment of ulnar and median nerve injuries were obtained, in our opinion, due to acceleration of wound healing, reduction of extremity edema, and improvement of tissue trophism in the burn wound.

Low effectiveness of ozone therapy in treatment of peroneal nerve injuries can be explained by several evident factors. Firstly, peroneal nerve is superficial, what often leads to its deep injury, and there is no reliance on ozone therapy effectiveness in total anatomic break of the nerve trunk. Secondly, this nerve belongs to highly myelinized nerve trunks and has lowered resistance to hypoxia, often leading to irreversible demyelinization.

Conclusion

Ozonetherapy seems to be new promising method of treatment burns complicated with nerve impairment.

Thus, ozone therapy is a perspective method of treatment of peripheral nerve wounds and injuries in burned patients. However, not all aspects of therapeutic effect have been studied well enough, possibilities of combined application of ozone and other drugs have been poorly investigated, dosage and timing of exposure sessions remain disputable. These problems deserve further careful study.

References

1. Marquez, S., Ttuley, J. J., Peters, W. J. "Neuropathy in burn patients", J. Brain. 116: 471-483 (1993).
2. Helm, P.A., Johnson, E.R., Carlton, A.M. "Peripheral neurological problems in the acute burn patient", J. Burns, 3 (2): 123-125 (1977).
3. Khedr, E. M., Khedr, T, el-Oteify, M. A., Hassan, H. A., "Peripheral neuropathy in burn patients", J. Burns, 23(7-8): 579-83 (1997).
4. Anastakis, D.J., Peters, W.J, Lee, K.C., "Severe peripheral burn polyneuropathy: a case report", J. Burns, 13(3): 232-235 (1987).
5. Haberal, M. A., Gurer, S., Akman, N., Basgoze, O. J. "Carpal and Guyon tunnel syndrome in burns at the wrist", J. Hand Surg. 6(1):13-15 (1981).
6. Henderson, B., Koepke, G. H., Feller, I. J. "Persistent peripheral nerve pathologies in patients with electric burns", J. Burn Care Rehabil, 17(2):147-149 (1996).
7. Isner-Horobeti, M.E., Lecocq, J., Vautravers, P., Kummerlen, C. "Polyneuropathy and neuromyopathy in intensive care", J. Rev. Neurol. (Paris),154 (3):767-770 (1998).