

Beneficial effect of gaseous nitric oxide on the healing of skin wounds.

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Abstract

Intermittent daily exposures (60 s) to NO-containing gas flow (NO dose of 500 ppm) generated by air-plasma unit "Plason" improves healing of skin wounds in rats. The gas flow treatment shortened the recovery time of both aseptic and purulent wounds (300 mm² area) by nearly a third. The treatment allows to achieve a marked improvement in the histological, histochemical, and electron-microscopic characteristics of the affected tissue. The mechanism of this phenomenon was studied by spin trapping method. The NO status of the wound tissue was investigated with EPR by following the formation of paramagnetic mononitrosyl complexes with iron-diethylthiocarbamate, or with the heme groups in hemoglobin or myoglobin. For the first 5 min after a gas treatment with the exposure of 60s, detectable NO levels in the affected tissue were slightly lowered with respect to untreated controls. At subsequent times, treated tissues showed the formation of large quantities of nitroso-iron complexes: At 30-40 min after gas exposure, their levels were nearly two orders of magnitude higher than soon after (15 s-5 min) the exposure. The data demonstrate that the accumulation of nitrosyl-iron complexes reflects a sharp rise in endogenous NO production inside the affected tissue. Paradoxically, the beneficial effect of gaseous NO treatment can be mediated by the formation of limited quantities of peroxynitrite due to the reaction between exogenous NO and superoxide anions generated in high amount in wound tissue. This peroxynitrite has a strong prooxidant effect and can activate various antioxidant systems which diminish the amount of superoxide anions in wound tissue. The reduced superoxide levels allow to increase the contents of endogenous NO in gas-treated tissues. Therefore, the beneficial action of the treatment is attributed to enhanced NO bioavailability.

Citation

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An experimental substantiation of nitric-oxide containing gas flow in the treatment of eye traumas

N B Chesnokova, R A Gundorova, O I Kvasha, V P Bakov, N G Davydov, O V Beznos, E P Stoliarova, S M Kasakian, O A Gorbacheva, A B Shekhter, A V Pekshev

Abstract

The hypothesis on the biostimulating effect of exogenous nitric oxide (NO) was made use of to develop a new method to stimulate the healing of wounds through treating them by a NO saturated gas flow. The above gas flow is generated by air-plasma unit "Plazon". The experimental and clinical studies confirmed that the NO-therapy is a highly effective treatment method for different lesions of the skin and soft tissues. We tried to use the above method in ophthalmology. A comprehensive experimental study was carried out to assess the impact of the NO-containing gas flow on the eyeball structures. An optimal mode was designed, which does not exert any influence on the intraocular pressure, Ph of the lachrymal fluid, antioxidative activity and on the proteinase-inhibitor balance in tears; no morphological changes occurred in the ocular tissue structures. The mentioned morphological and biochemical studies confirmed that the application of the NO-containing gas flow speeds up the healing, process of both an experimental cornea erosion and penetrating corneal wounds. Optimal modes of NO-therapy were defined for both types of lesions.

Citation

N B Chesnokova, R A Gundorova, O I Kvasha, V P Bakov, N G Davydova, O V Beznos, E P Stoliarova, S M Kasakian, O A Gorbacheva, A B Shekhter, A V Pekshev. An experimental substantiation of nitric-oxide containing gas flow in the treatment of eye traumas *Vestnik Rossijskoj akademii meditsinskikh nauk / Rossijskaia akademiia meditsinskikh nauk*. 2003(5): 40-4

Effects of gaseous flow containing nitric oxide on the eyeball structures (an experimental study)

R A Gundarova, N B Chesnokova, A B Shekhter, N G Davydova, A V Pekshev, O I Kvasha, O V Beznos, O A Gorbacheva

Abstract

Nitric oxide is one of the main factors of intra- and intercellular regulation in the organism. Its vasodilating, antiaggregant, antithrombogenic, antibacterial, anticarcinogenic, and immunogenic effects are well known. It stimulates the reparative processes in soft tissue injuries. We failed to find reports about the role of NO in the wound process in the eyes. The source of NO in our experiments was medical air-plasma device Plason. Exposure of the eye to NO-containing gaseous flow did not cause changes in the lacrimal pH; NO penetrated through the cornea and sclera, exerted no appreciable cytotoxic effect on the surface epithelium of the eye, did not change the intraocular pressure, and caused no morphological changes in ocular tissues. On the other hand, NO-containing gaseous flow had an appreciable lasting effect on the diameter of the conjunctival vessels, this effect being dose-dependent. The doses of NO-containing gaseous flow which can be used in the treatment of eye wounds were determined.

Citation

R A Gundarova, N B Chesnokova, A B Shekhter, N G Davydova, A V Pekshev, O I Kvasha, O V Beznos, O A Gorbacheva. Effects of gaseous flow containing nitric oxide on the eyeball structures (an experimental study) *Vestnik oftalmologii*. 2001 Jul-Aug ;117(4): 29-32

Local application of low-energy aerial and argon plasma in the treatment of suppurative wounds and trophic ulcers

V I Khрупkin, A V Zudilin, L V Pisarenko, A V Pekshev, A B Vagapov, Iu N Nastich, M S Pokrovskaja

Abstract

The authors describe experimental and clinical (113 patients) data demonstrating the antimicrobial, hemostatic and stimulating the regenerating processes property of the low energy plasma in local treatment of purulent and long-standing wounds and trophic ulcers.

Citation

V I Khрупkin, A V Zudilin, L V Pisarenko, A V Pekshev, A B Vagapov, Iu N Nastich, M S Pokrovskaja. Local application of low-energy aerial and argon plasma in the treatment of suppurative wounds and trophic ulcers *Vestnik khirurgii imeni I. I. Grekova*. 2001;160(2): 39-45

Use of a new biological factor--exogenous nitric oxide--during surgical treatment of periodontitis

A S Grigor'ian, A I Grudianov, O A Frolova, Z P Antipova, A I Erokhin, A B Shekhter, A V Pekshev

Abstract

In order to improve the efficiency of surgical treatment of periodontitis, the operative wound was exposed to nitrogen oxide (NO) during osteogingivoplasty and on days 3, 5, and 6 after it. Clinical and laboratory data making use of the cytomorphometrical method indicate that NO exposure decreased and maybe prevented secondary injury to the operation wound in up to 46.6% patients, which was confirmed by decrease and even normalization of destruction index and inflammatory destructive index on days 7 and 14, which was not observed in the reference group patients not exposed to NO.

Citation

A S Grigor'ian, A I Grudianov, O A Frolova, Z P Antipova, A I Erokhin, A B Shekhter, A V Pekshev. Use of a new biological factor--exogenous nitric oxide--during surgical treatment of periodontitis *Stomatologiia*. 2001;80(1): 80-3

The use of air-plasma flows in military field surgery and disaster medicine

E G Zhiliaev, V I Khрупkin, L A Marakhonich, B P Kudriavtsev, L V Pisarenko, A V Pekshev, N A Sleptsov

Abstract

Plasma currents of high energy are considered to be very promising in the surgical treatment of modern pathology. The scientists of this country have constructed a portable field surgery apparatus in which a heated atmospheric air assumes a form of a high-temperature thin jet used like a surgeon's scalpel. Experiments and clinical tests proved the efficacy of this microplasmotron that can destroy and coagulate body tissue when treating it with plasma. This new method has, besides hemostatic action, some noticeable antimicrobial effect that leads to acceleration of tissue granulation and wound healing. In specialized and skilled medicare this progressive and priority method should be applied for initial surgical wound treatment, secondary hemorrhage arrests and surgical interventions when a high risk of infection spreading is involved.

Citation

E G Zhiliaev, V I Khрупkin, L A Marakhonich, B P Kudriavtsev, L V Pisarenko, A V Pekshev, N A Sleptsov. The use of air-plasma flows in military field surgery and disaster medicine *Voенно-meditsinskiĭ zhurnal*. 1998 Jul;319(7): 55-62, 95

Use of physical plasma in surgery of wounds and wound complications

V I Khrupkin, L V Pisarenko, S M Slostin, A V Pekshev, L N Bakunova, V A Piatenko

Abstract

The article is devoted to the local application of high energy plasma flows in the complex treatment of wounds and wound complications. The new technology of physical action upon the biological tissues allows performing dissections, evaporation and carrying on local hemostasis and sterilization of the wound surface simultaneously. The shortening of the first phase of the wound healing process and earlier development of the second phase are due to the "biophysical isolation" of the wound surface by the thermal necrosis layer from unfavorable effects of the external medium. The healing goes on by the type of productive inflammation. The use of plasma flows during surgical treatment of purulent wounds reduces pains during the postoperative period and considerably improves results of the treatment.

Citation

V I Khrupkin, L V Pisarenko, S M Slostin, A V Pekshev, L N Bakunova, V A Piatenko. Use of physical plasma in surgery of wounds and wound complications *Vestnik khirurgii imeni I. I. Grekova*. 1998;157(2): 43-7

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