Nasal Injury

Subjects: Pathology

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In this entry, the current knowledge in terms of the mechanism underlying nasal wound healing was initially discussed. The currently available treatment options for enhancement of wound healing following sinus surgery were discussed and these had included intravenous antibiotics or steroids, various nasal sprays, and nasal packing. In addition, emerging alternative therapies in nasal mucosa wound healing such as herbal medicine and the advancement of regenerative medicine therapies such as stem cells and their byproducts were also discussed. Despite the various available treatment options for wound healing in nasal mucosa, rigorous strong evidence of their efficacy is gravely warranted in order to recommend them as part of the treatment modality.

Keywords: Nasal injury ; alternative therapy ; stem cell

1. Introduction

Nasal mucosa injury can be caused by trauma, radiotherapy, chronic infection such as sinusitis, and post sinus surgery. The rate of healing and its treatment are important in the recovery of patients especially in post sinus surgery, which introduces new injuries.

2. Complementary and Alternative Management

Management of nasal injury has been described in many cultural and religious records in the past. Due to the intimate relationship between the nasal mucosa and the external environment through the air that is breathed in, herbal medicine plays a large role in the management of the many nasal injury occurrences within different cultures[1].

2.1. Nasal Irrigation

The ancient Hindu practice of Ayurveda provides the earliest record of nasal irrigation[2]. The Ayurvedic scriptures list out a number of personal hygiene practices termed soucha. Among the Soucha, there is *jala neti*, also known as the practice of nasal irrigation[3]. According to the scripture, a higher state of meditation can be achieved by purifying the nose as clear breathing can lead to clear thinking. The simplest method of nasal cleansing was to sniff water from cupped hands and blow it out, which is also a step in the Muslim ablutions practice[2]. In modern science, data from RCT has demonstrated the importance of nasal irrigation in enhancing the wound healing of the nasal mucosa[4].

The precise mechanisms are still unknown but most experts think that it is due to the direct cleansing of the nasal mucosa, independent of the solution composition used[3]. This causes the mucus lining to be soft and dislodge. Furthermore, antigen and inflammatory mediators such as leukotrienes and prostaglandins that cause allergic reactions and can be removed by nasal irrigation. The composition of salt solutions can affect the effectiveness of nasal irrigation where the use of a lower concentration of salt and isotonic solutions will immediately reduce the microbial antigens significantly. On the other hand, it is shown that hypertonic solutions that are used can minimally influence the concentration of the microbial antigens.

Nasal irrigation with the addition of ions such as sodium and chloride can promote the integrity and function of epithelial cells. Moreover, the addition of magnesium will reduce eicosanoid metabolism by directly inhibiting the 5-lipoxygenase enzyme, encouraging cell repair, and limiting inflammation[4]. Magnesium also inhibits exocytosis of permeabilized eosinophils and reduces respiratory cells apoptosis in association with zinc[4].

2.2. Chinese Medicine

In Chinese medicine, herbal formulations are created to balance the “Yin-Yang”, which is based on traditional Chinese medicine (TCM) theory. The occurrence of diseases is thought to be the result of imbalance within the theory. In Asian countries such as China, nasal steroids and oral antibiotics are used along with herbs as an adjuvant treatment for post-

ESS care. A study was done to investigate the safety and effectiveness of Zhu-Yuan decoction (ZYD) in the postoperative care of patients for FESS. In TCM theory, ZYD is used to treat Chinese medicine symptoms (phlegm and heat obstructing the sinus). The study has shown that ZYD administration has produced significant results that have similar safety and efficacy as intranasal cortisone. However, the study was short-term (lasting 12 weeks) and required the study of long-term effects and further study to elucidate the underlying mechanisms of ZYD[5].

2.3. Bee Propolis

Propolis is the material used by bees to build their hives. Synthesized by bees from plant resin, it has been demonstrated to have anti-inflammatory activity[6]. A study with rat models and nasal injury have revealed the reduction of inflammation and enhancement of healing of wounds of the nasal mucosa[7]. It has also been shown in a study that propolis reduces the severity of the inflammation and preserve both goblet cells and ciliary in nasal mucosa[7]. The exact mechanisms of nasal mucosa wound healing by propolis requires further study but its healing properties have been suggested to be due to its immune-stimulating effect where cytokine secretion capacity increases significantly during the treatment period in a time-dependent manner. Furthermore, propolis can stimulate a significant increase in ECM components during the initial phase of wound repair. Another study that looks into caffeic acid phenyl ester, a bioactive compound of propolis, has also revealed enhancement of wound healing in the nasal mucosa[8].

2.4. Curcumin

Among the spices, the medicinal properties of turmeric have been reported substantially[9]. In cutaneous wounds, curcumin has demonstrated anti-inflammatory and wound enhancement properties[10]. Utilizing the nasal injury rat model, curcumin has also been reported to reduce inflammation and enhance wound healing in the nasal mucosa[11]. This is due to a reduction of the inflammatory response in the nasal mucosa by inhibiting the cytokines production for the activation of macrophages and monocytes[11]. On the other hand, curcumin enhances the granulation tissue organization, which contains a higher number of smaller capillaries and myofibroblasts in a diabetic rat model[11].

2.5. Stem Cell Therapy and Tissue Engineering

Stem cells have been the subject of interest in regenerative medicine since the dawn of the 20th century. In terms of wound healing, there were reports on its efficacy with skin[12] and corneal epithelium[13] wound healing. Utilizing the nasal injury rabbit model, Kavuzlu et al. implanted adipose-derived mesenchymal stem cell sheet onto the nasal mucosa to enhance its healing[14]. The implant resulted in better morphology, abundance, and density of the ciliated nasal epithelial cells. The mechanisms regarding the healing process have been suggested to be due to increased re-epithelization and stimulation of wound angiogenesis through the secretion of growth factors, cytokines, and collagen tissue as well as antioxidant effect through neutralization of reactive oxygen species[14].

Another study has attempted to utilize the aerosol delivery technique to deliver regenerative cells onto the injured tissue such as the works of Kardia and colleagues[15]. They successfully demonstrated an improvement of regeneration and repair in the respiratory tract of a rabbit upon delivery of aerosolized allogenic airway epithelial cells[15]. The regeneration and repair process involved rapid re-epithelialization of the denuded region where cell dedifferentiation, migration, proliferation, and re-differentiation occur for the repopulation of the tracheal epithelium. Furthermore, it has been suggested that the repair process is mediated by secretions of compounds such as growth factors, cytokines, and chemokines to induce tracheal epithelium repair[16].

In many surgical interventions, autologous tissue graft is considered as the gold standard. This can be observed in burn wounds[17], ligament injury[18], and osteoarthritis[19]. The use of autologous nasal mucosa grafts on rabbit has shown to improve re-epithelization. Utilizing light and scanning electron microscopy, Topdag et al. had demonstrated that the ciliary epithelium covered greater area, had more mature and sophisticated cilia, and had less hypertrophied epithelium in grafted tissue compared to the non-grafted tissue[20].

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