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Research Paper

The Contribution of Apiphytotherapy in the Management of Open Fracture of the Right Leg – Case Report

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ABSTRACT
The work presents the application of a combination of honey, propolis and thyme volatile oil in a patient with right leg open fracture, operated, with skin and soft parts defects. The previous surgical treatment comprised open reduction of the comminuted leg fracture and osteosynthesis with plate and screws, with subsequent bony exposure due to skin and soft parts necrosis. After plate removal, repeated debridements and application of apiphytotherapic mixture, the fracture evolution was gradually favorable, with progressive closure of the wound. The combinations of honey, propolis and volatile oils could be indicated in severe wounds, due to the multiple actions on wound healing provided by honey bee products, along with the antiseptic action of volatile oils. These effects can be very useful in problem wounds with bone exposure or open fractures, especially infected with multiresistant germs, with difficult healing, poor local defense and limited surgical loco-regional resources. Combinations of honey, propolis and volatile oils are promising compounds with wound healing and antiinfectious effects, which can be applied especially in these difficult cases.
KEYWORDS: *honey, propolis, thyme volatile oil, open fracture, wound healing*

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I. INTRODUCTION

Acute and chronic wounds are important public health issues, due to the spread in the population, functional impairment, social and economic implications. Currently, there are a variety of products, most of which being obtained by chemical synthesis and with varying degrees of biocompatibility, as well as a lot of research and studies that aim to highlight the most appropriate solutions. In general, the therapeutic methods for wounds and burns are examined in the direction of two major lines of action that can be interconnected, the anti-infectious action and the wound healing action. In this regard, given the financial implications, the effectiveness and the availability of product, it is useful to consider honey, a remedy used since ancient times to treat various wounds and whose remarkable properties have recently been proven by scientific research and clinical studies, along with other natural products very useful for wound healing, such as propolis and volatile oils. Scientific studies have shown multiple properties and effects of honey which are favorable for wound healing, such as anti-infectious, anti-inflammatory, antioxidant, wound debriding, increasing the rate of healing, without development of bacterial resistance [1-10]. These actions can be very useful in cases of open fractures, especially infected with multiresistant germs, when the local defense of the organism is deficient and other surgical resources are limited.

II. MATERIALS AND METHODS

A 64-year-old male patient was treated in the Plastic Surgery Department, for traumatic open fracture of the right leg, comminuted, previously operated by the orthopedic surgeon, infected with multiresistant germs, with skin necrosis and soft tissue defects (Fig. 1).

Fig. 1. Left leg open fracture, osteosynthesis with plate and screws, with skin and soft parts necrosis

The plate was removed, to no longer maintain the infection with multiresistant germs and to allow the wound to close (Fig. 2). Due to limited loco-regional surgical resources, the treatment consisted in multiple debridements and application of a combination of medical grade honey, propolis extract (1-2% v/v) and thyme volatile oil (0.5 -1% v/v).

Fig. 2. The complex wound with bone exposure, upon removal of the plate

III. RESULTS

The evolution was progressively favorable after applying a mixture of honey, propolis and thyme volatile oil (Fig. 3-5), which led to:

- gradual decrease of inflammatory phenomena
- removal of debris and reduction of wound secretions
- gradual coverage of bone fragments with granulation tissue
- progressive closure of soft tissue defects
- final epithelialization of wound.

Fig. 3. Progressive wound closure, after applications of honey with propolis extract and thyme volatile oil

Fig. 4. Almost complete epithelialization of the wound, after api-phyto mixture

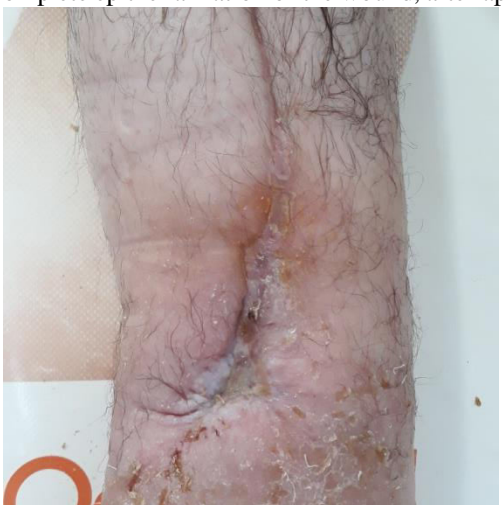

Fig. 5. Final epithelialization of the wound

IV. DISCUSSIONS

The presented case report falls within the spectrum of the most appropriate clinical recommendations for the treatment with medical grade honey-based products, as highlighted in the literature [11]: infected wounds and partial thickness burns. In burned wounds, honey-based products can be used as topical therapy in conservative (nonsurgical) approach or they can be applied as complementary (adjuvant) therapy, preparing the burned wound for skin grafting or completing the results obtained after surgery.

As in the reported case, the therapeutic options may become limited in some severe injuries, with bone or tendon exposure and risk of aggravation. Problem wounds can be found in patients with deep, infected wounds, exposed bone tissue or open fractures, previously treated surgically and with limited remaining loco-regional surgical resources.

Besides the multiple wound healing and antiinfectious properties, scientifically proven, honey can exert a skeletal-beneficial effect in animal models of osteoporosis. Honey is a potential functional food for bone health and can protect the bone tissue through the antioxidant and anti-inflammatory properties, due primarily to its polyphenol content that acts upon several signaling pathways, leading to bone anabolic and antiresorptive activities [12].

This case highlights the effectiveness of the combination of surgical treatment and topical applications of honey, combined with volatile oils and propolis, natural potent agents with wound healing and anti-infectious effects. This type of mixtures could be especially indicated in such difficult wounds, with:

- exposure of osteo-articular structures
- poor local defense
- infection with multi-resistant germs
- limited possibilities or failure of reconstructive surgery to close the skin and soft parts defects.

After application of medical grade honey, we have noted no side effects, except transient pain in some sensitive patients, which was easily managed by simple measures, such as:

- decreasing the quantity of product
- cleansing or dilution with sterile saline solution
- slightly wet subsequent dressing
- administration of a common analgesic.

Propolis is another bee product used and studied in wound management, which exhibit broad spectrum of therapeutic properties, useful for wound healing [13-15]:

- antiseptic, antibiotic (action on bacteria, viruses, fungi and protozoa)
- astringent, anti-inflammatory, local anesthetic
- antioxidant and free radical removal (due to the high content of flavonoids)
- wound healing and tissue regeneration
- accelerates the healing of burned wounds, by stimulating tissue accumulation of glycosaminoglycans, which are required for granulation, tissue growth and wound closure.
- stimulates the modification of chondroitin and dermatan sulphates structure, responsible for the binding of growth factors.
- accelerates tissue repair, decreases local inflammation in the initial period, and stimulates collagen production.

The application of propolis does not cause any side effects, except for a small percentage of susceptible persons (sensitive), where the application of propolis can lead to dermatitis, which however disappears when the skin no longer remains in contact with the product [16].

A clinical study comparing a propolis cream to silver sulfadiazine, in the treatment of grade IIA burns, showed a significant decrease in inflammation and faster healing of propolis-treated lesions, without any difference in microbial colonization between similar wounds treated with the two products [17].

Moreover, in vivo research studies have shown that aqueous propolis extract could be used as a new reinforcement material in improving bone healing and has great potential in augmentation of autologous bone grafting. The percutaneous injection of diluted aqueous propolis extract in the bone defect (25 mg/defect) can improve bone formation in the critical sized, nonunion, radial bone defect model in rat. The woven bone and the hyaline cartilage were the main constituents of the newly formed tissues in the propolis group, while the defect site in the chitosan and untreated groups were mainly restored by fibrous connective tissue,and the lesions in the autograft group were mostly filled by cartilage and a lesser amount of woven bone [18].

Propolis is able to protect bone health by inhibiting osteoclastogenesis and promoting osteoblastogenesis, partly due to its antioxidant and anti-inflammatory activities [19].

Furthermore, in vivo experimental studies have shown beneficial effects of propolis on accelerating fracture healing: increased bone mineral density, improved radiological and histological assessment scores and decreased superoxide dismutase, total glutathione and myeloperoxidase levels in rats treated with oral propolis

(200 mg/kg/day) compared to controls. In addition, bone mineral density and histological assessment scores have shown time-dependent improvement in the propolis groups [20, 21].

The volatile (essential) oils have been also studied for wound management, due to their various chemical constituents, of which 90% are terpenes, that exhibit a wide variety of structural features and manifest multiple actions [22], such as:

- antibacterial
- anti-inflammatory
- antioxidant
- wound healing stimulation.

Among the biological properties of volatile oils, scientific research has particularly highlighted the broad spectrum anti-infectious activity: antibacterial (Gram positive and Gram negative, including MRSA), antiviral, antifungal and antiparasitic [23-27].

Experimental studies on *Thymus vulgaris* essential oil have highlighted significant antimicrobial activity, as well as strong antioxidant properties. The thyme volatile oil represents a very promising natural product and can be regarded as a new source of natural antiseptics, with future applications in the pharmaceutical and food industry [28-30].

In vivo research studies with thyme essential oil applied orally and topically to wounds have shown outstanding wound healing activity, without any degeneration, necrosis or infiltration of inflammatory cells in the skeletal muscle of the wound [31], through:

- remarkable contraction of the wound
- improvement of histopathological alteration
- rejuvenation of hair follicles
- protection of injury site from infections
- inhibition of inflammatory cells
- increasing connective tissue formation in repaired tissues

Api-phyto combinations are an alternative source of natural wound healing compounds, due to multiple properties and favorable effects for wound healing exerted by honey and propolis, along with the representative antiseptic action of **volatile oils**. These actions can be extremely useful especially in **problematic cases of wounds** with bone exposure or open fractures, especially infected with multiresistant germs, with difficult healing, poor local defense and limited loco-regional surgical resources.

In order to be considered and used externally as medical grade, honey must be organic, harvested and processed properly, and sufficiently free of microorganisms.

We used certified bacteriological tests to check the quality of fresh polyfloral honey. Our results fall within the strict microbiological criteria that have been proposed for bacteria at a maximal limit of 10 CFU/g honey, and for fungi at a maximal limit of 10 CFU/g honey [32].

V. CONCLUSIONS

Laboratory research and clinical studies have highlighted a broad and complex range of activities provided by honey: anti-infectious, anti-inflammatory, antiexudative, antioxidant, wound healing, wound debriding, wound drainage, nutritional and deodorizing properties. Honey can be applied externally on wounds or used internally for immune stimulation, anti-infectious, anti-inflammatory, antioxidant, nutritive, energizing effects and overall health improvement. Besides promoting holistic medicine and sustainable agriculture, the use of honey for wound healing is an integrative form of therapy, with a biologic product with complex range of properties. Moreover, honey can be associated with other bee products (like propolis, beeswax, bee pollen, royal jelly), with medicinal plants and essential oils (api-phyto-aromatherapy).

The combination of honey, propolis and thyme volatile oil is a useful compound with wound healing and antiinfectious effects, and can be applied especially in these problem wounds, with bone or articular exposure, poor local defense, tissue defects, infection with multi-resistant germs and limited surgical possibilities. Concomitant oral intake of bee products, such honey and propolis, may sustain bone anabolism and promote bone and overall health.

However, further clinical studies are needed to establish the best indications, methods and forms of administration of medical grade honey, in combination with other natural products, such as propolis and volatile oils, as well as selection over other forms of treatment in wound management, of course, depending on the preference and experience of the people involved.

Future lines of research and development could be given by new standardized alternative products for wound management, with scientifically proven efficiency, based on medical grade honey and other complex natural ingredients.

Disclosure statements

The author declares no potential conflict of interest and no financial interest in honey or honey-based wound care products. This article's writing was unfunded.

REFERENCES

[1]. Molan, P.C., The evidence supporting the use of honey as a wound dressing. Int J Low Extrem Wounds, 2006, 5(1): p. 40-54.
[2]. Molan, P.C., The evidence and the rationale for the use of honey as a wound dressing. Wound Practice and Research, 2011. 19(4): p. 204-220.
[3]. Subrahmanyam, M., A prospective randomised clinical and histopathological study of superficial burn wound healing with honey and silver sulfadiazine. Burns, 1998. 24(2): p. 157-161.
[4]. Subrahmanyam, M., et al., Antibacterial activity of honey on bacteria isolated from wounds. Ann Burns Fire Disasters, 2001. 14(1), 100.
[5]. Cooper, R.A., et al., Absence of bacterial resistance to medical-grade manuka honey. Eur J Microbiol Infect Dis, 2010. 29(10): p. 1237–1241.
[6]. Merckoll, P., et al., Bacteria, biofilm and honey: A study of the effects of honey on „planktonic" and biofilm-embedded chronic wound bacteria. Scand J Infect Dis, 2009. 41(5): p. 341–347.
[7]. Okhiria, O.A., et al., Honey modulates biofilms of Pseudomonas aeruginosa in a time and dose dependent manner. J ApiProductApiMed Sci, 2009. 1(1): p. 6–10.
[8]. Alandejani, T., et al., Effectiveness of honey on Staphylococcus aureus and Pseudomonas aeruginosa biofilms. Otolaryngol Head Neck Surg, 2009. 141(1): p. 114–118.
[9]. Hill, K.E., et al., An in vitro model of chronic wound biofilms to test wound dressings and assess antimicrobial susceptibilities. J Antimicrob Chemother, 2010. 65(6): p. 1195–1206.
[10]. Nagane, N.S., et al., Efficacy of topical honey therapy against silver sulphadiazine treatment in burns: a biochemical study. Indian J Clin Biochem, 2004. 19(2): p. 173–176.
[11]. Jull, A.B., et al., Honey as a topical treatment for wounds. Cochrane Database of Systematic Reviews, 2015. Issue 3. Art. No.: CD005083.
[12]. Kamaruzzaman, M.A., et al., A review of potential beneficial effects of honey on bone health. Evid Based Complement Alternat Med. 2019; 2019: 8543618.
[13]. Olczyk, P., et al., Propolis induces chondroitin/dermatan sulphate and hyaluronic acid accumulation in the skin of burned wound. Evid Based Complement Alternat Med. 2013; 2013: 290675.
[14]. Olczyk, P., et al., Propolis modifies collagen types I and III accumulation in the matrix of burnt tissue. Evid Based Complement Alternat Med. 2013; 2013: 423809.
[15]. Pessolato, A.G., et al., Propolis and amnion reepithelialise second-degree burns in rats. Burns. 2011; 37(7): p. 1192-1201.
[16]. Burdock, G.A., Review of the biological properties and toxicity of bee propolis (propolis). Food Chem Toxicol. 1998; 36(4): p. 347–363.
[17]. Gregory, S.R., et al., Comparison of propolis skin cream to silver sulfadiazine: a naturopathic alternative to antibiotics in treatment of minor burns. J Altern Complement Med. 2002; 8(1): p. 77-83.
[18]. Meimandi-Parizi, A., et al., Propolis extract a new reinforcement material in improving bone healing: An in vivo study. Int J Surg. 2018;56: p. 94-101.
[19]. Ekeuku, S.O., et al., Application of propolis in protecting skeletal and periodontal health—A systematic review. Molecules. 2021; 26: 3156.
[20]. Guney, A., et al., Effects of propolis on fracture healing: an experimental study. Phytoter Res, 2011. 25: 1648-1652.
[21]. Sahin, A., et al., A comparison of the effects of Grayanotoxin-containing honey (Mad honey), normal honey, and propolis on fracture healing. Med Princ Pract. 2018; 27: p. 99-106.
[22]. Barreto, R.S.et al., A systematic review of the wound-healing effects of monoterpenes and iridoid derivatives. Molecules. 2014;19(1): p. 846-862.
[23]. Edwards-Jones, V., et al., The effect of essential oils on methicillin-resistant Staphylococcus aureus using a dressing model. Burns. 2004; 30(8): p. 772-777.
[24]. Lodhia, M.H., et al., Antibacterial activity of essential oils from palmarosa, evening primrose, lavender and tuberose. Indian J Pharm Sci. 2009; 71(2): p. 134-136.
[25]. Larrondo, J.V., et al., Antimicrobial activity of essences from labiates. Microbios. 1995; 82(332): p. 171-172.
[26]. Koch, C., et al., Inhibitory effect of essential oils against herpes simplex virus type 2. Phytomedicine. 2008; 15(1-2): p. 71-78.
[27]. Moon, T., et al., Antiparasitic activity of two Lavandula essential oils against Giardia duodenalis, Trichomonas vaginalis and Hexamita inflate. Parasitol Res. 2006; 99(6): p. 722-728.
[28]. Borugă, O., et al., Thymus vulgaris essential oil: chemical composition and antimicrobial activity. Journal of medicine and life, 7 Spec No. 3 (Spec Iss 3), 2014. 56–60.
[29]. Grigore, A., et al., Chemical composition and antioxidant activity of Thymus vulgaris L. volatile oil obtained by two different methods. Romanian Biotechnological Letters, 2010. 15(4): p. 5436–5443.
[30]. Sacchetti, G., et al., Comparative evaluation of 11 essential oils of different origin as functional antioxidants, antiradicals and antimicrobials in foods. Food Chemistry, 2005. 91(4): p. 621–632.
[31]. Barakat, H., et al., Synergistic effect of Thymus vulgaris essential oil oral administration on topically treated wound with chitosan, thyme essential oil and their combination in rats. J Nutr Food Sci. 2018; 8: 695.
[32]. Hermanns, R., et al., Defining the standards for medical grade honey. Journal of Apicultural Research, 2019. 59(2): p. 125-135.