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Honey Dressing of Cutaneous Wounds on Limbs in the Traumatology Orthopaedics Department of Bouaké University Hospital

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Abstract

The study evaluated the effectiveness of honey dressings in healing recent skin wounds with soft tissue loss on limbs. Conducted over a year with 60 patients, results showed a significant reduction in wound size and early healing, with complete recovery on average within 29 days. The study supports honey as a viable wound treatment.

Keywords

Healing, Honey, Limbs, Loss of Substances

1. Introduction

Honey is a viscous, supersaturated sugar solution derived from nectar harvested and modified by the honeybee, Apis mellifera [1]. The virtues of honey in the treatment of wounds have been recognised since ancient times [1]-[3]. It is known, in particular, for its antibacterial, pro-healing and immunomodulating properties [1]-[9]. Although the mechanisms and bioactive compounds behind these properties are still poorly understood, honey is emerging as a therapeutic agent in the treatment of a wide variety of wounds [10]. Due to its high sugar concentration and acidic pH, honey is undeniably a hyperosmotic medium that inhibits the growth of pathogens. It acts by reducing hyperhaemia and stimulating granulation tissue [4]-[8]. Its recognised healing power is currently the subject of

much interest, with honey-based ointments now available on the pharmaceutical market [9]. In Europe, as in Africa, the therapeutic virtues of honey are increasingly recognised in the treatment of infected and non-infected wounds [1] [4]. In Côte d'Ivoire, there has been renewed interest in the use of honey, thanks to its budding properties, in the treatment of loss of cutaneous substances [4] [11] [12]. However, there is no protocol for dressing wounds with honey. This study was prompted by the indiscriminate use of honey in the Orthopaedic and Traumatological Surgery Department, with no therapeutic protocol, and the absence of documentation on the effectiveness of honey. The hypothesis was that the use of honey to dress cutaneous wounds with loss of soft tissue substances would allow early budding. The aim of this study was to evaluate the healing of soft tissue wounds using honey dressings in the short and medium term in order to propose a dressing protocol.

2. Methods

This was a prospective, cross-sectional, analytical study conducted over a 12-month period (1st April 2022 to 31st April 2023). This was a simple random sample of patients with no allergy or contraindication to honey. It included all patients aged over 15 years treated for a recent cutaneous limb wound with loss of soft tissue substance without bone exposure, whatever the aetiology. Skin wounds previously treated in another department were not included. The skin wounds were dressed with market honey from the Poro region (Korhogo), purchased from the same vendor in large quantities for the study. In this study, it was offered to the patient and cost 500 CFA francs (0.76 euros) for a 500 ml jar. The average duration of use of a jar of honey was 35 days. The dressing was occlusive and began by cleaning the wound with antiseptic soap or saline. This was followed by the application of honey to the wound, which was then covered with sterile compresses. Occasionally, skin necroses were trimmed or excised locally to speed up healing. Swabs were taken for cytobacteriological examination if there were any signs of infection. A quantity of 10 - 30 ml of honey was applied to the wound, corresponding to approximately 25 - 50 mg of honey. The amount of honey used depended on the size of the wound (surface area, depth). It was dispensed using a graduated measure. Dressings were applied every two days. Photographs were taken with each dressing to monitor progress (detersion, budding, complications). The variables studied were epidemiological (sex, age, occupation, aetiology and comorbidities), anatomo-clinical (nature, site and size of the wound, germs isolated before dressing), therapeutic (frequency, number and duration of dressings) and evolutionary (wound size, healing, complications, germs isolated after dressing). Descriptive statistics were performed for quantitative variables (mean, standard deviation, minimum and maximum) and qualitative variables (frequency). Comparison of the means of wound area and depth using the t-Student test was performed at the 5% significance level. A binary logistic regression test was performed to identify factors that might influence budding.

3. Results

A total of 60 patients were enrolled. The mean age was 36 ± 31.4 years (17 - 61). There were 46 men (77%) and 14 women (23%), with a sex ratio of 3.3. Other epidemiological characteristics are listed in Table 1.

Table 1. Epidemiological characteristics of patients.

Characteristics	Number (n = 60)	Percentage (%)
Patients activities		
Direct services to individuals, shopkeepers and sales staff	15	25
Students	14	23.3
Farmers and skilled agricultural workers	10	16.7
Teaching specialities	9	15
Health professionals	7	11.7
Elementary occupations (bricklayers, labourers)	5	8.3
Etiologies		
Traumatic	48	80
Road traffic accident	34	56.6
Ballistic accidents	14	23.4
Accidents at work	4	6.7
Infectious	8	13.3
Other (vascular, ulcerative)	4	6.7
Comorbidities		
No	46	76.7
Yes	14	23.3
-Hypertension	6	10
-Type 2 diabetes	5	8.3
-Hypertension +diabetes	3	5

The nature of the wounds was decaying (n = 37; 61.6%), necrotic (n = 13; 21.7%), suppurated (n = 6; 10%) and tumorous (n = 4; 6.7%) (Figure 1). The distribution of wounds according to site is summarised in Table 2.

Table 2. Breakdown of patients by skin wound site.

Site of wound	Number (n = 60)	Percentage (%)
Thoracic limb	17	28.3
Arm	3	5
Hand	14	23.3

Continued

Pelvic limb	43	71.6
Thigh	13	21.6
Leg	21	35
Foot	9	15

The mean surface area of the wounds before the honey dressing was 49 ± 34.6 cm^2 (15 - 102). The mean wound depth before honey dressing was 2.8 ± 1.3 cm (1 - 4).

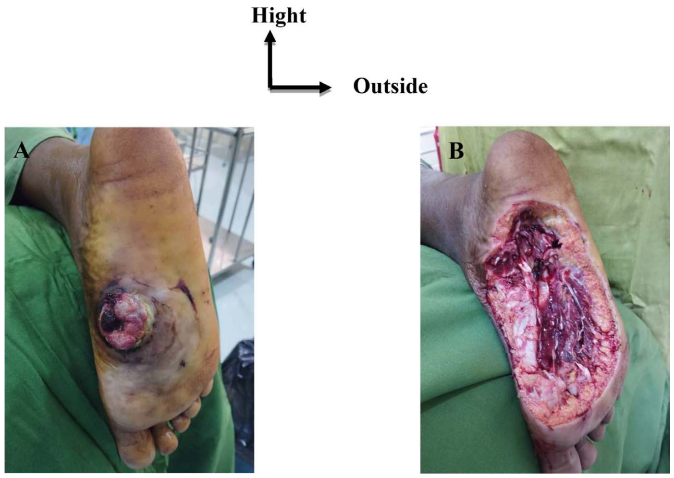

Figure 1. Loss of substance over an area of 96 cm^2 (B) after tumour resection of an ulcerating plantar mass (A).

There were 17 patients with wounds showing signs of infection. Staphylococcus sp (n = 7; 11.6%) followed by Staphylococcus aureus (n = 5; 8.3%) were isolated after cytobacteriological examination.

The quantity of honey applied to the wounds was 10 ml (n = 49; 81.7%), 30 ml (n = 8; 13.3%) and 50 ml (n = 3; 5%) respectively. The mean number of dressings to achieve detersion and budding was 4.5± 3.9 (3 - 8) and 13.8 ± 10.3 (5 - 12) respectively. The mean total dressing time was 41 ± 32.4 days (10 - 65). Budding occurred on average at 9.6 ± 6.9 days (5 - 17). The mean surface area and depth of wounds after honey dressing at a mean of 32 days were 17 ± 12.9 cm^2 (6 - 28) and 0.7 ± 0.3 cm (0.5 - 1.5), respectively (**Figure 2**). Healing was complete in all patients with a mean delay of 29 ± 20.4 days (17 - 38). Healing was spontaneous in 34 (56.7%) patients. In 26 (43.3%) patients, a thin skin graft was used for epidermalization. Complications included keloid scarring in two patients and dischromic scarring in three others. A reduction in the number of bacteria was noted after honey dressing of the initial infected wounds without the appearance of new infections: Staphylococcus sp (n = 1; 1.6%) followed by Staphylococcus aureus (n = 2; 3.2%)

The statistical analysis is summarised in **Table 3** and **Table 4**.

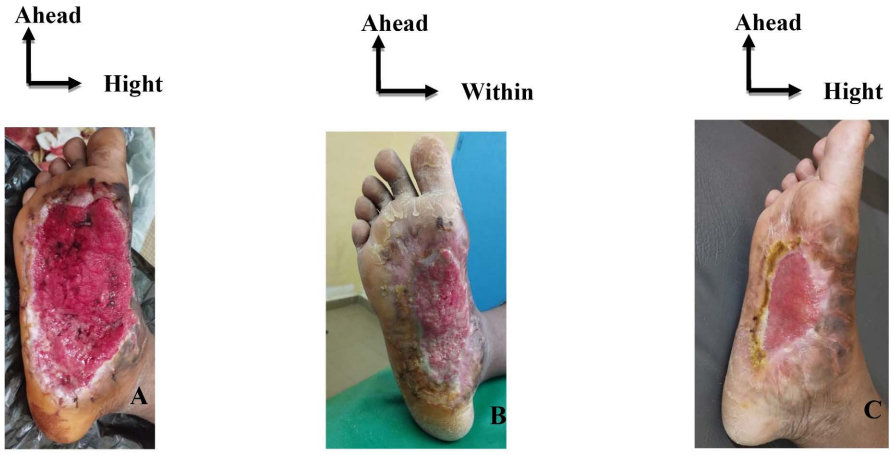

Figure 2. Evolution of budding during honey dressing after surgery on d-7 (A), d-17 (B) and d-28 (C).

Table 3. Comparison of the mean surface areas of skin wounds before and after dressing with honey.

Variables	Before dressing	After dressing	p (*t-Student*)
Average surface (cm^2)	49	17	0.03
Average depth (cm)	2.8	0.7	

There was a statistically significant regression in wound dimensions (surface area and depth) after honey dressing ($p < 0.05$) at an average of 10 days.

Table 4. Results of the logistic regression determine the factors that may influence the early budding of skin wounds after honey dressing.

Indépendent variables	IC à 95%	p
Age (>50 ans)	[0.490 - 11.649]	0.08
Wound site (pelvic limb)	[0.290 - 14.649]	0.00
Comorbidities (absent)	[1.260 - 95.643]	0.04
Quantity of honey (>10 ml)	[4.280 - 90.475]	0.97
Type of wound (not infected)	[3.463 - 68.977]	0.01
Surface of wound (< 50 cm^2)	[2.210 - 87.781]	0.07

CI: Confidence interval; p: probability.

The location of the skin wound on the pelvic limb, the absence of comorbidities and non-infected skin wounds were good factors for early budding.

4. Discussion

The aim of this study was to evaluate the healing of recent cutaneous wounds of the limbs with loss of soft tissue substances using honey dressings. The wounds were decaying in 61.6% of cases and occurred in young subjects. The size of the

wounds decreased after the honey dressing, with budding occurring at an average of 10 days. The hypothesis of this study was confirmed with total healing achieved at an average of 29 days.

The young male subjects, with an average age of 36 years, were mostly victims of road traffic accidents (63.3%). In their series, Yao *et al.* [13] observed a predominance of traumatic wounds in young adults. This increase in the number of accidents can be explained by the growing number of two-wheeled vehicles and the failure to comply with the Highway Code. Motorbikes are one of the main means of transport in Bouaké.

In the present study, the majority of skin wounds treated with honey were decaying wounds (61.6%), followed by necrotic wounds (21.7%). These wounds were located on the pelvic limb (71.6%) and especially on the leg (35%). The necrotic and often septic nature of these traumatic wounds could be explained by the delay in consulting the doctor, and sometimes by poorly conducted treatment, or by the inadequacy or absence of initial wound trimming. Several series in the literature have observed a predominance of traumatic skin wounds of limbs in the pelvic limb [13]-[15]. In a number of series in the literature [4] [5], honey has proved its worth in the treatment of septic wounds (infected traumatic wounds, necrotising fasciitis) and bedsores. The average wound dimensions (surface area and depth) were smaller than those observed by Attipou *et al.* [4] and Descottes [14], who observed larger dimensions. This may be related to the type of wound treated and the size of the sample. The germs isolated before the honey dressing were essentially Staphylococcus sp. These are micro-organisms belonging to the transient flora of the skin surface.

Hey come either from another site on the body, or from exogenous contamination occurring during care, with the main vector being the hands of carers [5].

There are several advantages to using honey in the treatment of skin wounds with loss of soft tissue substances. Firstly, honey is a natural product, making it safe and well-tolerated by most patients. It is also easy to apply and remove, simplifying the wound care procedure. In addition, honey has been shown to promote faster and better wound healing than other treatment options [15]-[24]. Its use in dressings has resulted in early detersion, early budding, a significant reduction in wound size and early healing. The hypothesis of early budding in the short and medium term when honey is used to dress skin wounds with recent soft tissue loss without bone exposure has been confirmed, as in some other series [4] [5] [15]-[25].

Budding occurred at an average of 10 days. This delay in granulation tissue formation has been reported by several authors [26]-[29]. Since it prevents dressings from adhering and protects the granulation lining, honey thus potentiates budding. It is also thanks to hydrogen peroxide that honey stimulates cell multiplication, the growth of fibroblasts and the development of neovascularisation favourable to good healing [14] [29]. The healing power of honey can be explained by its physical, chemical and enzymatic properties. In fact, because it is saturated with

sucrose, honey maintains an osmotic pressure that is too low to encourage the growth of germs. Another property of honey is the secondary increase in collagen-producing fibroblasts, which is thought to promote good quality budding and scarring [4] [5] [15]-[24]. The location of the wound on the pelvic limb, the absence of co-morbidities and non-infected wounds were factors in early budding in this study. This result was consistent with those of Attipou *et al.* [4].

Honey dressings have been shown to reduce the carriage of germs in skin wounds. Honey has antibacterial and antifungal properties [14] [25] [30]-[34]. This result is consistent with the literature [4] [5] [15] [21]-[23] [35]. However, the use of standard or specific antibiotics after antibiotic susceptibility testing could also explain the reduction in the number of germs. When honey is applied to a wound, several mechanisms of action come into play to prevent and treat infections. Micro-organisms need water to grow, and honey has an osmotic property that extracts water from bacterial and fungal cells, drying them out and limiting their growth [14] [31]-[33]. There is a complex bioactivity of honey's antibacterial properties in the variability of wound healing. Its bioactive components, such as peroxidases, bacterial enzyme inhibitors, phenolic compounds, and organic acids, act synergistically to inhibit bacterial growth and promote healing. However, the variability in honey's therapeutic properties highlights the importance of choosing high-quality honey and continuing research to better understand the mechanisms underlying its beneficial effects [31]-[33].

The healing time (29 days) observed was in line with that observed in the literature [4] [5] [11] [14]-[23] [26]-[29]. Furthermore, there is inter-individual variability in healing that should be considered when using this treatment. The chemical composition of honey, wound characteristics, the immune status of the individual, and environmental factors can all influence the effectiveness of this treatment. A personalized approach, taking these factors into account, is therefore essential to maximize the healing results of honey. With proper use and careful evaluation, honey can be a valuable tool in the field of wound healing [26]-[29] [33]. This study has its limitations. It is monocentric and non-comparative. Based on the results of this study, the following honey dressing protocol can be proposed for recent cutaneous wounds of the limbs with loss of soft tissue without bone exposure. For non-septic wounds, mechanical or non-mechanical detersion of the wound + a honey dressing should be applied every two days until the wound buds and heals; for a wound surface area of < 50 cm^2 and a depth of < 1 cm (10 ml of honey); for a surface area of > 50 cm^2 and a depth of > 1 cm (at least 30 ml of honey). For septic wounds, a bacteriological sample of the wound must be taken before using honey; mechanical or non-mechanical detersion of the wound + dressing with honey every two days until the wound has budded and healed; for a wound surface area of < 50 cm^2 and a depth of < 1 cm (10 ml of honey); if surface area > 50 cm^2 and depth > 1 cm (at least 30 ml of honey).

5. Conclusion

This study has enabled us to describe the results of our experience in the use of

honey in cutaneous wounds of the limbs. Complex wounds were frequent and predominantly in young males. They were sometimes infected and located on the pelvic limb. The healing power of honey was demonstrated in this study using our method. Early budding (at 10 days) was obtained, and healing was observed within the required time (29 days). Honey thus appears to be a good alternative in our conditions of practice because of its bearable cost for the income of our populations and because of the less restrictive methods of use. This honey dressing protocol could be evaluated through a multicentre study or a comparative study with fatty dressings to assess the healing time.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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