

Role of Hemoglobin Spray in Wound Bed Preparation

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Received Date: February 05, 2020; **Accepted Date:** February 29, 2020; **Published Date:** March 11, 2020.

Citation: Imran Pathan, Ravi Kumar Chittoria, Saurabh Gupta, Chirra Likhitha Reddy and Padmalakshmi Bharathi Mohan, Role of Hemoglobin Spray in Wound Bed Preparation, J. Clinical Research Notes. Doi: [10.31579/crn.2020/011](https://doi.org/10.31579/crn.2020/011).

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Abstract

Wound is a common problem following burn, trauma or infection. There are various methods to limit the infection and to cover the raw area. Before definitive cover, the wound bed must be ready to accept the reconstructive procedure. Various methods help in wound bed preparation. Recently hemoglobin spray has been advocated to hasten the wound bed preparation. In this article, we share our experience of using innovative hemoglobin spray in wound bed preparation.

Keywords: hemoglobin spray; wound; management

Introduction

Wound is a common problem encountered by plastic surgeons. The wound that fails to heal in three weeks is considered as a chronic wound. Various factors may lead to chronic or non-healing wounds. Diabetes mellitus is among the most important cause that may result in a non-healing ulcer, especially in lower limbs. Many methods do exist which are claimed to hasten the healing with varying success. Poor oxygenation of tissue is a factor that leads to poor wound healing. Recently hemoglobin spray has been claimed to accelerate wound healing by delivering oxygen to wound bed. In the review of the literature, we have seen very few Indian studies on hemoglobin spray in wound management. We share our experience of using innovative hemoglobin spray in wound management.

Methodology

This is a case report of the use of innovative hemoglobin spray in a diabetic wound. This study was conducted in a tertiary care hospital in 2019. Informed written consent was taken from the patient. The patient was a 70 year male with known case of hypertension, diabetes mellitus, and dyslipidemia. The patient had a non-healing ulcer at the first web space of the left foot for three months. (Figure-1) The patient was

thoroughly investigated. Wound tissue culture was sent and appropriate antibiotic therapy was given. Regular cleaning and dressings were done for two weeks but the wound failed to show any healthy granulation tissue. To promote the healing, decision was made to give trial therapy of innovative hemoglobin spray therapy.



Figure-1 – Wound at presentation

Under all aseptic precautions, 2.7ml of blood was harvested from the antecubital vein. It was mixed with 0.3ml of 3.8% sodium citrate solution (Na-citrate to blood ratio=1:9) to prevent coagulation. The blood was transferred to a glass vial and a cap with the spray and nozzle mechanism was placed on it (figure-2 and 3). The blood was sprayed uniformly (Figure-4) on the wound and a sterile dressing was applied. The spray was given every time the dressing was changed (twice a week). The wound was assessed weekly by clinical examination. Six such sprays were given over three weeks period.



Figure-2- Glass bottle and a cap having spray mechanism



Figure-3- Bottle containing anticoagulant mixed blood



Figure-4 Spray being done

Result

With regular application of hemoglobin spray, the wound starts granulating and size also decreased. The wound area was measured using digital planimetry. Before the application of hemoglobin spray, it was 15.7 cm². After three weeks, it reduced to 7.5 cm² (Figure-5). The wound also developed red healthy granulation tissue.



Figure-5 Wound after three weeks

Discussion

Oxygen is vital to wound healing. Temporary hypoxia stimulates wound healing while chronic hypoxia leads to a non-healing wound. The rate, at which all normal wounds heal, is shown to be oxygen-dependent. Fibroblast replication, collagen deposition, angiogenesis, resistance to infection, and intracellular leukocyte bacterial killing are oxygen-sensitive responses essential to normal wound healing.^{1,2} Evidence suggests that intermittent oxygenation of wound bed starts a cascade of events that leads to wound healing. Increased tissue oxygen level leads to an increase in reactive oxygen and nitrogen species. This leads to enhanced neovascularization by increased levels of VEGF, TGF-beta, angiopoietin, etc. There is increased ECM formation due to raised FGF expression and increase rate of collagen synthesis. It also reduces inflammation by decreasing edema, decreasing pro-inflammatory cytokines etc.^{3,4}

The most widely utilized modality to increase the local tissue oxygen level is hyperbaric oxygen (HBO) therapy. Hyperbaric oxygen therapy was first used in the field of wound care in the 1960s following the discovery that patients with burns who received treatment for carbon monoxide poisoning healed more quickly. More recently the role of topical oxygen therapy, without the need for full-body hyperbaric chambers, has come into existence. However, not all patients can tolerate or have access to the HBO chamber.

Granulox™ is a commercially available product from InFirst Ltd, UK, which is designed to be more straightforward to deliver oxygen to tissue than HBO. The product, Granulox™, contains porcine haemoglobin contained in a spray canister. It is applied twice weekly to a DFU wound during redressing, and can be used in a clinic or patient's home setting.⁵

When Granulox is sprayed, haemoglobin binds to atmospheric oxygen. Once saturated with oxygen, the haemoglobin becomes oxy-haemoglobin (HbO₂), which diffuses to the base of the wound, and increases the oxygen supply to the cells by diffusion. We have used our innovative way of using the patient's blood for spraying oxygen by using a simple glass vial and a cap with a nozzle and spray mechanism.

Conclusion

In this study, we found that hemoglobin spray has a role in wound bed preparation. The wound shows granulation at a faster rate. But since it is a single case study, a definite conclusion cannot be made. Large randomized control trials are required to confirm the efficacy of hemoglobin spray in wound bed preparation.

Conflicts of interest

None.

Declarations

Authors' contributions

All authors made contributions to the article

Availability of data and materials

Not applicable.

Financial support and sponsorship

None.

Consent for publication

Not applicable.

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DOI: [10.31579/crn.2020/011](https://doi.org/10.31579/crn.2020/011)

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