

Innovative cost effective bone marrow spray device for wound management

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Abstract

Topical application and infiltration of bone marrow is used in the treatment of various types of chronic/non-healing wounds. Currently available methods for application of bone marrow include injectable or irrigation by syringe but have the limitation of inadequate coverage of surface area requiring large amount of bone marrow. To improve the application over large surface of wound area with minimum amount of bone marrow we have designed indigenously made spray device. This article highlights the application of this device in one of the patient in plastic surgery. This is an easily prepared cost effective device.

Keywords: Bone marrow Spray, Stem cell spray, Chronic wounds

Introduction

Topical application of bone marrow derived mesenchymal stem cells is a proven method to accelerate the wound healing and the wound bed preparation.^(1,2) Bone marrow contain mesenchymal and multipotent stem cells that can differentiate into variety of cells including endothelial cells, fibroblasts, osteoblasts, chondrocytes, epithelial cells etc., and hence it can form variety of tissues including skin, muscle, bone etc., and aids in wound healing.^(3,4) It also contains inflammatory progenitor cells and hematopoietic hormones which participate in wound healing.^(5,6) Modes of application of bone marrow include local infiltration, irrigation by syringe methods. But these methods have the limitation of coverage of large area with the available limited amount of bone marrow. Some method or device is required to cover large area with minimum amount of bone marrow with uniformity. This article discusses the new method of application of bone marrow using indigenously prepared spray device.

Case detail and Methodology

A twenty twoyear old male patient presented to plastic surgery department with black colored unhealthy skin on bilateral trochanteric region of six months duration. Patient was a known case of post traumatic C5 cervical spine fracture with quadriplegia, bowel and bladder incontinence of nine months duration. On examination patient's nutritional status was found to be poor, bilateral upper limb weakness present and absent sensation below the level of nipple region, with absent bowel and bladder continence and paraplegia. Bilateral trochanteric grade IV pressure ulcers of size 9x8 cms (right side), 10x9 cm on left side found. Wound bed preparation and attempts to improve patient's nutritional status started simultaneously. One of the methods utilized for wound bed preparation is bone marrow topical spray, which was applied through an

indigenously designed spray device. The spray device consists of sterile 50 ml glass container with threading cap at the neck, a hand pump spray system mounted on an air tight cap with adequate pore size, silicone inner tubing for connecting the sprayer system and the bottle (Fig. 1).

Usually large amount of bone marrow (10 - 30 ml) is required to infiltrate or irrigate donor area for early epithelialization. But in this case we used only 3 ml of bone marrow that was sprayed uniformly over the wound with the surface area of 80 cms² Bone marrow was harvested from the iliac crest by standard technique. Bone marrow was transferred in the heparinized spray container under all aseptic precaution after spray device sterilized by ETO Gas sterilization (Fig. 2). Bone marrow was sprayed immediately over the wound after harvesting and collagen dressing was done (Fig. 3).



Fig. 1: Components of bone marrow spray device



Fig. 2: Bone marrow in the spray device



Fig. 3: Bone marrow being sprayed over the wound, spray stream can be seen

2. Badiavas EV, Falanga V. Treatment of chronic wounds with bone marrow-derived cells. *Arch Dermatol.* 2003;139(4):510–516.
3. Watt FM, Hogan BL. Out of Eden: stem cells and their niches. *Science.* 2000;287(5457):1427-30.
4. Ratajczak MZ, Kucia M, Reza R, Majka M, Janowska-Wieczorek A, Ratajczak J. Stem cell plasticity revisited: CXCR4-positive cells expressing mRNA for early muscle, liver and neural cells 'hide out' in the bone marrow. *Leukemia.* 2004;18(1):29-40.
5. Lingen MW. Role of leukocytes and endothelial cells in the development of angiogenesis in inflammation and wound healing. *Archives of pathology & laboratory medicine.* 2001;125(1):67-71.
6. Chittoria RK, Nandhagopal V, Mohapatra DP, Thiruvoth FM, Sivakumar DK, Asokan A. Autologous Bone Marrow Aspirate Therapy in Wound Healing. 2016:102-105.

Discussion

Topical application of bone marrow for large ulcers may not provide uniformity in the coverage of large area, for which large amount of bone marrow is required. To overcome these problems we indigenously designed bone marrow spray device as described in methodology, through which the bone marrow can be sprayed uniformly over the entire raw surface with the available minimal quantity. Since the application is more uniform, large area of wound tends to heal better. This sprayer device can be prepared by assembling various components easily available. It is cost effective (INR 40/-) that is costing less than 1 US Dollars and it saves the quantity of bone marrow and covers large surface area of application. This study has limitation that it was tested only in one case.

Conclusion

Spray method provides uniform topical application of bone marrow with the available minimal amount to cover the large surface area of wound. This innovative cost effective device needs to be tested in large sample size with controlled study.

References

1. Jain P, Perakath B, Ranjan Jesudason M, Nayak S. The effect of autologous bone marrow-derived cells on healing chronic lower extremity wounds: results of a randomized controlled study. *Ostomy-Wound Management.* 2011;57(7):38.