Use of Combination of Vitamin D Powder with Gentamycin Injection in Management of Non-healing Wounds: A Case Report

INTRODUCTION

Non-healing wounds are wounds that fail to heal without external or internal intervention and which fail to show signs of healing progress beyond a particular stage of healing[1]. It has been observed in studies that these types of wounds become arrested in the inflammatory stage of healing[2.9] and fail to progress beyond this stage on their own. In recent times, the incidences of these types of wounds have increased due to various circumstances, one of which is ignorance due to the high cost of medicine and treatment of the same[3,4]. The causative factor for these wounds needs to be identified so as to effectively manage these in the best possible manner and at the least possible time with the least cost of treatment to the patient.

Various guidelines have been issued and implemented on the management of chronic non-healing wounds that range from basic wound care to the most advanced wound dressings under hyperbaric oxygen therapy. Chronic non-healing wounds are the ones that are commonly associated with co-morbid conditions like diabetes mellitus coronary artery disease or dyslipidemias or may be associated with as simple as micro-nutrient deficiency, especially vitamin D[4-6]. Vitamin D is an essential micro-nutrient pro-hormone that plays a major role in the cellular differentiation, growth and its proliferation[5,6]. It aids in localized cutaneous immune response and hence promotes healing. Gentamycin injection is an effective antibiotic that kills the bacteria by inhibiting the protein synthesis at the 30S ribosomal sub-unit. It is a bactericidal drug and is most effective against gram-negative bacteria and some gram-positive bacteria[7].

To our knowledge, there has not been a case study where vitamin D sachet and Gentamycin Injection are used in combination as a local wound therapy to cure acute as well as chronic non-healing wounds that fail to heal on their own. This paper is first of the kind of the study using a combination of vitamin D powder and Gentamycin injection.

1. Case Report 1

A 50-year-old lady presented to our hospital with a history of severe pain in the lower abdomen for the past 15 days. She had undergone a lower segment cesarean section at an institute one month back. She came with a discharging non-healing infected surgical site wound that had failed to respond to oral antibiotics(figure 1). Local examination of the scar revealed tenderness around the scar line, induration of the edges and wound opening over the left lateral aspect of the scar. Induration and warmth was present over the wound site. A foul-smelling discharge was seen from the wound. There is no fresh epithelial tissue seen. Underlying subcutaneous tissue was seen and there was no fistula seen. She was admitted to the hospital for management of the same. Under aseptic precautions, dressing was done using one vitamin D sachet and one ampule of Gentamycin injection mixed to form a paste-like consistency in a sterile bowl. The paste was gently applied over the infected wound site, and the site was covered with a sterile gauze and a sterile gauze pad, and a sticking tape was applied. It was particularly kept in a note to not let the dressing wet. The dressing was evaluated every five days and repeat dressing was done in the same manner as described. It was seen that after the second dressing, the wound started to show active granulation tissue, and healthy status was seen. After the fourth dressing, the wound was seen to have shrunk in size by around 50 percent(figure 2). She was discharged after the seventh dressing where the wound was found to be healed with no exposed underlying soft tissue and no discharge from the surgical site(figure 3). The patient during her stay in the hospital was not administered any oral or intravenous antibiotics. She was discharged with oral analgesics, calcium and was advised to review after one week. It was found that the wound was completely healed and there was no signs of non-healing or infection at the wound site.

2. Case 2

A 30-year-old gentleman presented to our hospital after having suffered a road traffic accident around two months back with a history of non-healing, foul-smelling infected wound over the groin area that had failed to respond to oral or intravenous antibiotics. The wound was seen to be pale in color at the base with foul-smelling discharge with exposed underlying soft tissue and upon further examination was found to be in the inflammatory phase of the healing cycle(figure 4 and 5). Local examination of the wound revealed - tenderness around the wound, induration of the edges and warmth was present over the wound site. A foul-smelling discharge was seen from the wound. Wound was seen to be contaminated. There was no fresh epithelial tissue seen. Underlying subcutaneous tissue was seen and there was no fistula seen. He was admitted to the hospital for management of the same. Under aseptic precautions in the operation theatre a debridement was performed where the edges of the wound were freshened up, the base of the wound was scraped and fresh bleeding was ensured. The wound was packed with three sachets of vitamin D powder mixed with three ampules of Gentamycin antibiotic to form a paste-like consistency and was covered with a sterile gauze and dressing was done. The first dressing was opened after three days as the usual protocol and it was found that there was no foul smell in the wound and the granulation tissue started to show signs of healing and was found to be healthy and red. Consecutive dressings were done according to the protocol and it was found that the wound had started to heal rapidly with the dressings. The patient was discharged after the tenth dressing following which he was advised to follow up in OPD for further dressings(figure 6). On OPD visit after five days the wound was found to be healed with no exposed underlying soft tissue and no active foul smelling discharge from the surgical site.

DISCUSSION -

Chronic wounds are defined as wounds that fail to heal normally within six weeks by themselves without any intervention, due to health issues. The most common examples of such wounds are diabetic ulcers which are most common on the foot due to neuropathy and poor circulation, venous ulcers, bedsores, arterial ulcers, etc[(4)]. Acute wounds on the other hand are the wounds that are caused by sudden injury and a normal healing is expected by four to six weeks[(1)]. The most common types of wounds are surgical sharp wounds, traumatic wounds, burns, and blisters. Non-healing or infective wounds often get stuck in the inflammatory stage of wound healing due to the inability of neutrophils and macrophages to clear off the debris and let the immune cells enter the wound. This disbalance state creates a state of arrest where there is an exhaustion of immune cells to heal the wound and the wound is arrested in the inflammatory stage. One of the reasons for a non-healing wound is the formation of biofilm by the bacteria which makes the wound resistant to antibiotics and hence halts the process of healing. Chronic debilitating conditions like diabetes, peripheral artery disease, or venous insufficiency impair the circulation hence impairing the blood supply and hence the normal healing process of the wound. Chronic inflammation also prevents the repair by damaging healthy tissue. Wound healing is a complex multifaceted process influenced by myriad factors including infection, tissue perfusion, and systemic health.Despite significant advancements, chronic and non-healing wounds continue to pose substantial clinical challenges, impacting patient quality of life and healthcare resources worldwide. This paper is first of its kind in integrating the usage of Vitamin D and Gentamycin antibiotic as synergistic in wound healing and tissue regeneration and highlights the critical need of innovative approaches that can effectively accelerate healing of wounds and prevent complications.

Effective wound management is crucial for all chronic wounds, regardless of their underlying cause. Timely intervention is essential for improving the prognosis, as it helps to prevent further complications and reduce morbidity. Treatment strategies must be individualized, considering the patient's specific

needs, including the management of any comorbid conditions, patient education on lifestyle factors, psychological support, and ensuring nutritional adequacy.

Gentamycin is an aminoglycoside antibiotic and its role in wound healing is primarily antimicrobial. It helps in controlling and preventing tissue infection which is essential for the optimum healing of wounds[7]. Due to the bactericidal nature of gentamycin, it kills the bacteria, mostly gram-negative and some gram-positive, at the 30S ribosomal subunit by inhibiting its protein synthesis. Thus, it helps in reducing the bacterial load in the wounds, especially in contaminated and infected wounds. Gentamycin has been used in orthopedic and surgical wounds for a long in the form of antibiotic beads as it provides a high local concentration of antibiotics with minimal systemic side effects. It indirectly helps in wound healing by reducing inflammation and necrosis and prevents biofilm formation. Gentamycin acts locally by enhancing the body's self-healing mechanism to progress without bacterial interference.

Vitamin D sachets contain cholecalciferol (vitamin D3) which plays a supportive role in the wound healing process. Vitamin D is known to regulate innate and adaptive immunity which in turn is essential for reducing the inflammation at the wound site and enhancing the macrophage and neutrophilic activity in clearing the infections[5,6]. Vitamin D3 also boosts the production of cathelicidin and defensins which are natural antimicrobial peptides that prevent wound infections, and speed up healing in chronic wounds. Vitamin D helps in the formation of new blood vessels (angiogenesis) that are essential for the delivery of oxygen and nutrients to the healing tissues and the removal of waste products from the wound site. Apart from this, vitamin D also influences keratinocyte proliferation and differentiation which is important for re-epithelialization; and fibroblastic activity enhancement which helps in extracellular matrix production and collagen production[5,9,10]. It also helps indirectly in the production of collagen which helps in the maintenance of the structural integrity of healing tissue.

Combining vitamin D powder and Gentamycin antibiotic for infective wounds is an emerging strategy that brings together antimicrobial action and immuno-modulatory and tissue-supportive effects, potentially offering synergetic benefits in wound healing, especially for chronic or infected wounds[7]. Gentamycin possesses a bactericidal property that directly kills the bacteria which when combined with vitamin D enhances the production of antimicrobial peptides (like cathelicidin), and boosts innate immunity, thus acting synergistically[5,9,10]. Vitamin D modulates the immune response to resolve inflammation faster, helping the translation to the proliferative phase of healing of the arrested infected wounds. Vitamin D promotes keratinocyte and fibroblast activity, supports re-epithelization and collagen remodeling, and hence enhances cellular repair while gentamycin controls bacterial interference. Vitamin D'simmune immune-enhancing properties reduce the bacterial load, potentially lowering the required dose of gentamycin and limiting the development of resistance[5,9]. The combination therapy is cost-effective and is easily available to the patient. There is no particular brand name as to which this combination has to be made and used over the wound.

CONCLUSION

The novel technique presented herein offers a promising advancement in wound management by addressing the key barriers that traditionally hinder the healing trajectory. Through its local and unique mechanism of action, our method enhances local tissue regeneration, modulates inflammation, and improves anti-microbial defence thereby fostering an optimal environment for wound healing[1,2,9]. Our results indicate superior healing rates, reduced infection, reduced cost, and improved patient outcomes. Integrating such innovative strategies into clinical practice has the potential to revolutionize wound care[5,10]. Future large scale studies and long term evaluations will further elucidate its efficacy and safety profile. This approach represents a vital step towards more personalised, effective and holistic wound management offering renewed hope for patients suffering from chronic wounds.

LIMITATION -

More large-scale randomized control trials are needed to confirm the efficacy and safety of the local therapy combination of the two drugs and establish a definitive role in wound healing.

REFERENCES -

1. Guo S, DiPietro LA. Factors affecting wound healing. J Dent Res. 2010;89(3):219-29.
2. Broughton G, Janis JE, Attinger CE. The basic science of wound healing. Plast Reconstr Surg. 2006;117(7 Suppl):12S-34S.
3. Ghatnekar O, Willis M, Persson U. Cost effectiveness of treating deep diabetic foot ulcers with becaplermin: economic analysis of a randomized, placebo-controlled trial. Pharmacoeconomics. 2001;19(8):767-78.
4. Shankhdhar KL, Shankhdhar U, Shankhdhar S. Diabetic foot problems and prevention. J Assoc Physicians India. 2008;56:75-9.
5. Schwalfenberg GK. A review of the critical role of vitamin D in the functioning of the immune system and the clinical implications of vitamin D deficiency. Mol Nutr Food Res. 2011;55(1):96-108.
6. Gunton JE, Girgis CM, Baldock PA, Lips P. Bone muscle interactions and vitamin D. Bone. 2015;80:89-94.
7. Nelson CL, Hickmon SG, Harrison BH. Elution characteristics of gentamicin-PMMA beads after implantation in humans. Orthopedics. 1994;17(5):415-8.
8. Enoch S, Harding KG. Wound bed preparation: the science behind the removal of barriers to healing. Wounds. 2003;15(7):213-29.