Editorial

Wound Healing – A Surgical Fundamental Revisited

Col BM Nagpal VSM ^{*}, Lt Col R Katoch ⁺, Lt Col S Rajagopalan[#]

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The treatment of wounds is an age-old problem. A small Sumerian clay tablet lists three gestures for wound treatment namely: washing, making plasters and bandaging. Ancient surgeons had devised many methods appropriate to their time as reported in the Edwin Smith papyrus, Sushrut Samhita and so on. Greek and Roman physicians cleansed wounds, applied animal fat, ash, oils and herbs. Following the failure of aggressive methods like boiling oils, Ambrose Pare used gentler methods like rose oil and ligation of bleeders. In the latter half of twentieth century, both topical and systemic antibiotics were in vogue in addition to local wound care. The recent trend is early wound closure with skin or skin substitutes and emphasis on nutritional support and anabolic steroids. The future appears to be towards cellular and molecular biological manipulative techniques of wounds.

Acute wounds may be clean as an incised wound or potentially contaminated as a war wound. Chronic wounds, by commonly accepted definition, are those that fail to improve at four weeks or close within eight weeks (like a traumatic wound) or often complicated by circulatory disturbances, metabolic disorders like diabetes and so on.

Healing of wounds is a complex interplay of multiple physiochemical reactions in which epithelial and collagen tissue are laid down, fibroblasts and macrophages playing a dominant role. In acute wounds, re-epithelialisation in as little as three to five days and a peak collagen synthesis between two to four weeks is noticed. Chronic wounds respond differently [1] and the repair process being staged I to IV – particularly unique are wounds around the ischium, sacrum and heel [2].

Wound healing, for ease of comprehension, may be explained in three phases, namely; inflammatory, proliferative and maturation. The initiation and transition of these phases are ill defined and are a continuation of events. Inflammatory phase involves transient vasoconstriction of local arterioles and capillaries followed

by increased blood flow and oxygen with an influx of inflammatory cells to mediate the process. Several growth factors like platelet derived growth factor, basic fibroblast growth factor, vascular endothelial growth factor are involved. The proliferative phase is characterized by angiogenesis and rapid fibroblastic activity. The final maturational phase involving collagen synthesis and breakdown may last up to two years, though the resultant scar only regains up to eighty percent of its original tensile strength [3]. Any shift between collagen synthesis and degradation disrupts healing.

Failure of wound healing is multifactorial. Local factors impeding wound healing include, inadequate nutrients, tissue hypoxia, tissue desiccation, wound exudate and infection. Systemic factors include inadequate blood, oxygen, systemic infection, stress and loss of body proteins.

Acute wounds heal by primary or first intention after immediate closure. War wounds heal after debridement and delayed primary suturing. Recently, primary wound closure is being tried after thorough wound debridement, in some selected cases of war wounds. Chronic wounds heal by spontaneous intention or secondary closure.

Effective use of dressings is essential for optimal wound management. Dressings once served only a protective function, but many of them are now used for interactive functions. The ideal dressing maintains a moist environment, is not cytotoxic, minimizes discomfort, protects the wound, absorbs exudation, allows gas exchange, is impermeable to micro-organisms, is cheap and is acceptable to the patient. Such dressings include alginates, foams, hydrocolloids, hydro gels, povidone iodine dressings and transparent films.

A variety of procedures are used to close chronic wounds, the most common involve skin grafts of varying thickness and flaps. The role of nutrition in wound management cannot be overemphasized [2]. Caloric intake should increase to about 50% beyond daily

^{*} Professor & Head, ^{**} Reader, Department of Surgery, Armed Forces Medical College, Pune - 411 040.

needs and proteins up to 1.5gm per kg per day. Micro-nutrients like vitamins and inorganic compounds like trace elements along with water intake of about 25 to 50ml per kg body weight is essential. Tube feeding or hyper alimentation whenever necessary is resorted to.

Accelerated wound healing is an area of active research. Sub atmospheric pressure dressings have been used in recent years for closure of large wounds. The vacuum assisted closure system uses a polyvinyl foam sponge applied directly over the wound. It is then tightly sealed in a polyurethane drape. A tube embedded in the foam exits to a vacuum pump suction machine, providing a sub atmospheric pressure environment on the wound bed. These forces are believed to enhance local blood flow, assist debridement, reduce oedema and bacterial count to coapt the wound edges [4].

Living skin equivalent is a biological skin substitute commercially produced from neo-natal fibroblasts and keratinocytes using tissue engineering technology. These are available for epidermal, dermal and composite wounds. The disadvantage is a biopsy, and a two to three week delay for cultivation. Dermal grafts consist of neonatal dermal fibroblasts cultured in vitro on a bio-absorbable polyglactin mesh. Composite grafts are bi-layered which look and feel like human skin. It does not contain blood vessels, hair follicles or sweat glands. It acts like human skin, produces all cytokines and growth factors. It is non-invasive, does not require anaesthesia, avoids donor site complications and has a shelf life of five days. It is an effective but expensive technology.

The pharmacological manipulation with growth hormone, insulin-like growth factors and anabolic agents are topics for future review and discussion. Recombinant DNA technology has provided widespread research in growth factors. Platelet derived

growth factor is already in use as it is commercially available [6]. Transforming growth factor B and granulocyte macrophage colony stimulating factors are not yet approved for clinical studies.

Additional technologies and modalities like transfection of IGF-1 gene into dermal cells of small animals is a new approach to wound healing. The issue of angiogenesis is another possible research tool. Aloe Vera, a herbal product, is increasingly being used for wound healing. Chronic topical and systemic hyperbaric oxygen, hydrotherapy, low intensity laser, ultra sound, ultra violet light and intermittent pneumatic compression have all been reported of value [7].

In conclusion, focussed assessment, an interdisciplinary team approach using clinical pathways incorporating new technological advances will help in improving problematic wounds.

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