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Review

Autologous epidermal cell suspension: A promising treatment for chronic wounds

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Abstract *Background:* Chronic wounds have become an increasing medical and economic problem of aging societies because they are difficult to manage. Skin grafting is an important treatment method for chronic wounds, which are refractory to conservative therapy. The technique involving epidermal cell suspensions was invented to enable the possibility of treating larger wounds with only a small piece of donor skin. Both uncultured and cultured autologous epidermal cell suspensions can be prepared and survive permanently on the wound bed.
Methods: A systematic search was conducted of EMBASE, Cochrane Library, PubMed and web of science by using Boolean search terms, from the establishment of the database until May 31, 2014. The bibliographies of all retrieved articles in English were searched. The search terms were: (epithelial cell suspension OR keratinocyte suspension) and chronic and wound.
Results: From the included, 6 studies are descriptive interventions and discussed the use of autologous keratinocyte suspension to treat 61 patients' chronic wound. The various methods of preparation of epidermal cell suspension are described. The advantages and shortcomings of different carriers for epidermal cell suspensions are also summarised. Both uncultured and cultured autologous epidermal cell suspensions have been used to treat chronic wounds.

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Conclusion: Although the limitations of these studies include the small number of patient populations with chronic wounds and many important problems that remain to be solved, autologous epidermal cell suspension is a promising treatment for chronic wounds.

1. Background

Chronic wounds have become an increasing medical and economic problem of aging societies, not only in Italy and China, but also in other parts of the world [1,2]. The aetiologies of chronic wounds include local and systemic factors. Local factors include ischaemia, necrosis, foreign bodies, abnormality of extracellular matrix remodelling, dysfunction of fibroblasts, infection, lack of response to growth factors, inflammation, oedema or ionising radiation [1,2]. Systemic factors include poor nutrition, anaemia, autoimmune pathologies, peripheral vascular disease, diabetes, immunosuppressant, and anti-inflammatory therapy. Chronic wounds can be a result of a delay in each or all phases of the healing process, which is divided into 3 phases: the elimination of the necrotic base, the formation of granulation tissue, and epithelialisation. Clinical outcome is largely affected by 2 factors, proper wound management and adjustment of the general condition of the individual. Wound management strategies include debridement, advanced dressings, hyperbaric, vacuum-assisted closure therapy, and reconstructive surgery [1—3]. Importantly, for patients with significant systemic diseases, optimising their individual medical condition can markedly improve the healing potential of their wounds. With the currently available treatments, the healing of these chronic wounds represents a challenge.

Skin grafting, using full and split thickness techniques, is a routine method for burn wound management. However, the donor sites are limited in massively burned patients, which hampers the treatment of skin wounds and compelled scientists to look for new methods to treat such wounds. The technique utilising autologous epidermal cell suspensions has been introduced and developed quickly [4—8]. The major advantage of this technique is the possibility to treat larger wound areas with only a small piece of donor skin. At present, the treatment of cutaneous wounds, such as burn wounds, post-burn leucoderma, congenital melanocytic nevus and vitiligo with autologous epidermal cell suspensions had yielded satisfactory results [9—12].

Skin grafts are a common treatment method for chronic wounds that are refractory to conservative therapy [13—15]. To spare donor skin, alternative grafting strategies have been based on cultured epidermal cells applied as multilayered stratified epidermal sheets. However, the epidermal sheets are expensive and have not yielded satisfactory results, owing to poor graft-take and epidermal fragility [16,17]. Allogeneic epidermal cell suspensions seem to act as a potent stimulus for chronic wounds, and allogeneic keratinocyte and fibroblast-based products have been used to treat chronic leg ulcers [18—20]. However, these do not survive permanently on the wound bed. However, the autologous epidermal cell is the most important cell for the reepithelialisation of cutaneous wounds, and it can be used to not only make tissue engineer skin, but also to repair wounds. Recently, a few articles have reported that autologous epidermal cell suspensions can be used to treat chronic wounds effectively [21—26]. Many methods to prepare epidermal cell suspensions exist, and the application methods for each epidermal cell suspension are also different from one another. As such, knowing the shortcomings or advantages of each method is helpful when treating patients with chronic wounds. Here, we reviewed the preparation methods, delivery systems, clinical effect and current problems related to the use of autologous epidermal cell suspensions.

2. Method

2.1. Databases chosen

A systematic search was conducted of EMBASE, Cochrane Library, PubMed and web of science by using Boolean search terms, from the establishment of the database until May 31, 2014. The bibliographies of all retrieved articles in English were searched. The search terms were: (epithelial cell suspension or keratinocyte suspension) and chronic and wound.

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