P-0703 – THE USE OF BIOMEDICAL TECHNOLOGIES IN SURGICAL MANAGEMENT OF DIABETIC FOOT

K. Koreyba¹, E. Silina², R. Gabitov², A. Komarov³, V. Stupin⁴.

¹Kazan State Medical University, Kazan, Russia.

²I.M. Sechenov First Moscow State Medical University, Moscow, Russia.

³FSBI Clinical Hospital, Moscow, Russia.

⁴N.I. Pirogov Russian National Research Medical University, Moscow, Russia.

Background

In accordance with data of International Diabetes Federation (IDF) there were 12.1 million people with diabetes mellitus (DM) on 01 Jan 2016. Diabetic foot syndrome (DFS) develops in 15-25% of diabetic patients, 85% of trophic ulcers in patients with DFS lead to lower limb amputations. Diabetic foot ulcer (DFU) is the chronic wound. Sequence of healing processes ranging from cell migration and restructuring of the extracellular matrix to the remodeling of the tissues are disturbed. Collagen formation slows down. Thus, the effective repair is impossible.

Aim

To study the implementation of treatment method for repair of soft tissue defects in patients with DFU (Russian Patent No. 2549459, 30 March 2015).

Method

The clinical data were obtained from 70 DFS patients. Ulcer defects had different anatomical locations over the lower extremities, namely, on the plantar and dorsal surfaces of the foot, the plantar surface of the fingers, inner or outer surface of the lower third of the tibia and in the area of postoperative wounds of the foot. According to Wagner Ulcer Grade Classification the ulcers were found to be in grade W1, W2 or W3.

Stages of the treatment methodology include: 1 - debridement; 2 - implantation of modern biomaterials on the base of type I collagen Collost (Russia) / Salvecoll (Europe); 3 - creation favorable conditions for reparative-proliferative processes with application of interactive dressings, immobilization by the Total Contact Cast (TCC). The 1st stage is the wound bed preparation by ultrasonic cavitation with hydrosurgical debridement at the day of hospitalization. The 2nd stage is the implantation of bioplastic material based on native collagen type I – injections of gel in paravulnar and vulnar tissues intraoperatively after wound cleansing. The biomaterial derived from bovine skin, through special processing by removal of epidermis, adipose tissue, and all dermal cells without disruption of the native collagen matrix. It has no antigenic structures. We used this material in the form of 7% or 15% gel.

The use of type I collagen biomaterial is caused by understanding of pathological processes in chronic wounds in patients with DM. In neuroischemic form of DFS the relationship of protein fractions is broken that leads to collagen desorganization in wound.

But collagen has the main role of reparative-proliferative phase of wound healing.

Physiological course of wound healing is violated, chronic ulcer is formed and wound cachexia develops, that leads to disruption of metabolic processes in wound, delay healing, reduce reactivity, and lack of epithelialization. The implantation of biomaterial is technically performed on the "clean wound field" at the exit of the needle. Thus, a tunnel is filled by the collagen material. 3d stage - wound closing by interactive hydrocolloid dressings (for "humid environment"). To prevent secondary infection we applied atraumatic dressings with Ag contained dressings since 5-7 days after implantation. Dressings after implantation were performing once every 3-5 days. Hospital stay depends on the amount, specificity of wound fluid and reaction of the interactive dressing. Transfer of patients to outpatient monitoring was carried out on 5-7 day after implantation of the biomaterial.

The measurement of wound area is complicated due to the fact that epithelialization was indicating in the areas of biomaterial implantation, i.e. epithelialization was going not only from the periphery to center as in physiological course of wound healing, but also from the center to periphery. This fact determined increasing the relative speed of healing (RSH). $RSH = (1 - S1/S0) \times 100\%$, S1 - the area of ulcer on one of the days after implantation, S0 - the initial area of ulcer.

Results

Epithelialization of the wound defect was started on 10.3 ± 2.8 day. After 17.4 ± 3.2 days the were granulating wound without inflammation reactions or rejections of the biomaterial. There were no any cases of hypertrophic scarring.

Discussion

Necrectomy by ultrasonic hydrosurgical debridement is the most effective method for removing wound biofilms, purulent-fibrinous plaque and devitalized tissue. The use of bioplastic collagen material in patients with DFU stimulates tissue regeneration and epithelialization. And this fact can to reduce the inpatient stay and treatment period. This technique avoids to creating two wound surfaces (donor and recipient sites) vs autodermoplasty, and can be used for both inpatient and outpatient treatment.

Clinical cases – p. 2, 3.

P-0703 – THE USE OF BIOMEDICAL TECHNOLOGIES IN SURGICAL MANAGEMENT OF DIABETIC FOOT

Clinical case 1. Type 2 DM, insulin-dependent, severe course, decompensated. DFS, neuroischemic form, W5, diabetic gangrene of the left foot, diabetic angiopathy, CAI stage 4 of the left leg.

Photo 1. The 4th day after amputation of the first finger on the left foot with resection at the middle-third of the first metatarsal bone, excision of purulent-necrotic foci of the left foot compartments and necrectomy. The 3rd day after X-ray endovascular angioplasty of the left lower limb.

Photo 2. The intra-operative implantation of collagen gel following ultrasonic cavitation with hydrosurgical debridement of the wound surface and exarticulation of the second finger of the left foot.

Photo 3. Implantation of collagen membrane

Photo 4. Application of hydrocolloid dressings

Photo 5. The 35th day after admission. Wound epithelialization.

P-0703 – THE USE OF BIOMEDICAL TECHNOLOGIES IN SURGICAL MANAGEMENT OF DIABETIC FOOT

Clinical case 2. Type 2 DM, insulin-dependent, sub-compensated, severe course. DFS, W2. Trophic ulcers of the right foot. Diabetic angiopathy. CAI stage 3 of the right lower limb. Condition after amputation of the third finger of the right foot with resection of distal head of the third metatarsal bone. Diabetic neuropathy.

Photo 1. View upon admission.

Photo 2. Implantation of type I collagen in the form of 7% gel.

Photo 3. Application of hydrocolloid dressing.

Photo 4. The 27th day after complex treatment with collagen biomaterial.