

CORRECTION OF NEUROTROPHIC DISORDERS IN PATIENTS, SUFFERING CONSEQUENCES OF A SPINAL CORD AND PERIPHERAL NERVES TRAUMA

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Abstract

On clinical base of cathedra of the disasters medicine, military medicine, anesthesiology and reanimatology in 2010 — 2013 yrs 62 patients were treated for neurotrophic disorders, in 12 of them the method was applied, elaborated in the clinic. For neurotrophic ulcers in 5 patients autodermoplasty was performed, using splitted cutaneous flap, in 1 for the wound defect on a forearm — plasty, using rotational cutaneo—adipose flap, based on axial blood supply. In 44 patients after a spinal cord trauma a neurotrophic defects degree III — IV have formed. The kind of operative intervention was selected depending on size of the defect, the wound depth and functional peculiarities of the injured area. Introduction of a new method of treatment of neurotrophic ulcers of the lower extremities, using preparation of hyaluronic acid with sodium succinate, expands the perspectives of treatment in patients, suffering defects of cover tissues. Differentiated approach to choice of the wound closure method, caused by damage of central and peripheral neural system, have permitted to achieve positive results in 98.1% of patients.

Key words: neurotrophic defect; autodermoplasty; application of hyaluronic acid with sodium succinate.

Spinal cord injury accounts for up to 1 to 4 % among different types of injuries [1]. The most grave complications in these patients are neurotrophic disorders and vascular abnormalities in tissues covering the torso and limbs, with their frequency amounting up to 40-90% [2].

The formation of pressure ulcers is often complicated by abscesses, osteomyelitis, or sepsis, and may be fatal in 20-25 % of patients [3, 4].

After surgical intervention for neurotrophic ulcer lesion, up to 25 to 50% of patients suffer from complications that require secondary reconstruction or prolonged conservative treatment [5].

Study purpose: to improve treatment outcomes in neurotrophic lesions in covering tissues in patients after spinal cord injury.

MATERIALS AND METHODS

A total of 62 patients aged 23 to 65 years old (mean age 44 years) were treated for neurotrophic disorders from 2010 to 2013 at the clinical site of the Department of Disaster Medicine, Military Medicine, Anaesthesiology and Intensive Care. There were 4 (6.5 %) women and 58 (93.5 %) men. The method developed in the clinic was used to treat 12 patients.

Patients' examination included clinical evaluation, angiography and neurological exam, lab tests, wound microbiology monitoring, two-dimensional radiographs of feet and joints, electroneuromyography, laser Doppler flowmetry, and photographic documentation of wounds.

RESULTS AND DISCUSSION

In the presence of neurotrophic ulcers due to damaged peripheral nerve trunks in 6 patients, electroneuromyography and neurosurgeon examination were considered mandatory, and specific

treatment was prescribed. Five patients with trophic ulcers in the lower limbs underwent the split-skin autografting (shave therapy) and 1 patient who had a wound defect on the forearm underwent a dermoplasty using an adipocutaneous axial pattern rotation flap (having axial perfusion).

Stage III and IV pressure trophic lesions were found in 44 patients in the area of the spine (n=22) and greater trochanters (n=21). Type of surgery depended on the size of the skin defect.

Twelve patients had neurotrophic ulcers located in two different areas simultaneously, while 4 patients in three areas. If an ulcer was localized in the area of the spine, 7 patients underwent skin grafting using one or two V-shaped myocutaneous rotation flaps and 16 patients using pedicle adipocutaneous two-part flaps; while 9 patients with neurotrophic ulcers in the area of greater trochanters had dermoplasty using a pedicle adipocutaneous rotation two-part flap. The split-skin autografting (shave therapy) was used to cover wound defects in the rest of patients.

Active suction drains were introduced for 5-7 days to prevent the formation of a lymphocyst or a haematoma in the early postoperative period. Compulsory preoperative care included rational antibiotic therapy based on antibiotic susceptibility tests, and measures to eliminate electrolyte, fluid or protein balance disorders.

All patients achieved primary healing of wound defects. There were no cases of graft rejection or marginal necrosis of the flaps. Three patients developed a subflap lymphocyst (up to 5 cm in diameter), which was successfully removed. Long-term recurrences of neurotrophic ulcers were not reported.

Twelve patients suffering from a heel neurotrophic ulcer received a course of treatment using the hyaluronic acid-based preparation combined with sodium succinate (1.5% solution) for 2 to 6 weeks [6]. Positive outcomes (complete healing of the defect) were reported in all patients.

Clinical manifestations of neuropathy were its painless run, alterations in skin temperature and its normal colour, preserved pedal artery pulse, plantar hyperkeratosis, and specific toe, foot and joint deformities. Trophic ulcers were located in areas of excessive pressure on the sole, such as the heel, heads of metatarsal bones, and lateral foot. The diagnosis was confirmed in all patients by electroneuromyography results based on the absence of electrical conductivity in peripheral sensory nerve terminals of the lower leg.

A new method for treating trophic ulcers of the lower limbs is based on using the hyaluronic acid preparation combined with sodium succinate, which increases the treatment efficacy in patients suffering from decompensated chronic venous insufficiency and diabetic foot syndrome.

The hyaluronic acid-based preparation combined with sodium succinate as 1.5 % solution was administered in a dose of 1 mL intracutaneously around the ulcer area once in a week for 5 to 7 weeks. During the treatment, the dimensions of the trophic ulcer were regularly measured.

All patients treated with the proposed method were discharged with positive treatments results, i.e. complete healing of the trophic ulcer.

Due to administration of hyaluronic acid preparations into the extracellular matrix, the area of the operative intervention receives additional amounts of hyaluronic acid to optimize its biological functions in the skin, including improved tissue tension and flexibility, stimulation of elastic fiber production, collagen production and angiogenesis.

Sodium succinate (succinic acid sodium salt) has its effect on the mitochondria level, activates the processes of cellular respiration and synthesis of ATP and structural proteins of the skin.

This treatment method can be used not only in a clinical setting but also on an outpatient basis, which greatly reduces the overall duration of treatment and in-patient care.

Although the method calls for special personnel training, its further use requires no specific equipment, anaesthetic support or an operating room.

Weekly measurements of the trophic lesion dimensions allow estimating the results of treatment over the time and adjust the therapy, if necessary.

Therefore, the proposed method allowed increasing the treatment efficacy, hastening the recovery

of patients, and reducing the incidence of complications and duration of in-patient care.

Besides the fact that this method does not require special tools or professionals of another expertise, it can be used in an outpatient setting to treat chronic trophic ulcers of vascular etiology combined with surgical interventions. Our clinical case report is presented below.

Patient L., 28 years old, was admitted to the Department of thermal injury and plastic surgery and diagnosed with the following: severe spinal cord injury; mild brain contusion, closed wound of the head; comminuted vertebral compression fracture of T₆, complete anterior dislocation of T₅, fracture of the T₅-T₆ processes; severe spinal cord contusion; simultaneous bilateral complete dislocation of the heads of ribs V to VII; right-sided haemopneumothorax; right-sided hypostatic pneumonia; large neurotrophic ulcers in the back, buttocks, and both heels; lower paraplegia; and pelvic organ dysfunction.

At admission, the patient complained of wounds in his back, buttocks and both heels, as well as general weakness and fever up to 38°C.

The injury occurred in a traffic collision. In neurosurgical department, the patient received the multimodality therapy including the following complex surgery: a decompression laminectomy at T₅-T₆; an open surgical reduction of T₅ dislocation; and posterior spinal fusion using transpedicular fixation with the XIA[®] screw system at T₄ to T₈. After surgery, pressure ulcers were formed in the operational site on patient's back, buttocks, and heels. For further treatment, he was admitted to the Department of thermal injury.

In the area of spinal surgery (at T₅-T₆), a wound defect was detected. The lesion 10.0 cm in diameter had smooth edges and granulation tissue; the stabilizing construction elements and a rib fragment were seen in the top corner of the wound; a wound lesion 8.0 cm in diameter with granulation tissue was observed at sacrum; and areas of tissue necrosis were found on both heels.

Antibacterial treatment, infusion therapy, physical therapy, a series of massage, and debridement of wound lesions were introduced. An operative intervention was performed, which included the excision of necrotic lesions and subsequent autodermoplasty of wound defects on patient's back, buttocks and heels using split-skin autografts (shave therapy). Initial engraftment of autografts was observed on the back and buttocks, while heel lesions demonstrated skin graft lysis.

A course of injections of the 1.5 % hyaluronic acid-based solution combined with sodium succinate was initiated. In the dressing room, the wound lesions were treated with an antiseptic solution. Before treatment initiation, the skin lesion dimensions were determined using a measuring tape. A disposable prefilled glass syringe with Luer lock and additional needles were used to inject the solution of unstructured hyaluronic acid combined with sodium succinate (hyaluronic acid concentration: 15 mg/mL). Approx. 0.5 cm away from the ulcer edges, an intracutaneous injection of 0.1-0.2 mL of the solution was performed once, using a tunnelled method. The intervals between injections were 0.5 cm. A sterile gauze dressing was applied to the wound lesion. The treatment was repeated twice a week with mandatory measurements of the wound lesion dimensions and wound photographs. The treatment course was 2 weeks.

Complete epithelialisation over the wound areas on both heels was reported after the treatment.

CONCLUSIONS

1. Selecting the method for surgical correction and covering the skin defect was dependent on the wound size and depth as well as functional characteristics of the damaged area.

2. The new method for treating trophic ulcers of the lower limbs using the hyaluronic acid-based preparation combined with sodium succinate expands the perspectives for the treatment of patients suffering from defects of covering tissues.

3. A case-specific approach to select a method to cover wound surfaces appeared as a result of damage to central or peripheral nervous system allows to achieve positive treatment results in 98.1 % of patients.

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