



Case Analysis of moist Burn Regenerative Medical Technology Combined with Micro-Particle Skin Implantation in the Treatment of Wagner Grade 5 Type 2 Diabetic Foot Gangrene

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ABSTRACT

This article mainly analyzes and discusses the clinical effect of moist burn regenerative medical technology combined with micro-particle skin transplantation in the treatment of Wagner grade 5 type 2 diabetic foot gangrene. According to previous international treatment experience, diabetic foot gangrene of grade 5 often requires amputation treatment. This study mainly analyzes and explores the role of moist burn regenerative medical technology combined with micro-particle skin transplantation technology in promoting and shortening wound healing, reducing the risk of amputation, reducing the psychological burden of patients, and promoting social development. Harmonious development is of great significance.

Keywords: Type 2 diabetes; diabetic foot gangrene; moist burn regenerative medical technology; microskin transplantation; in situ regeneration; one life community; potential stem cells; keratin type 19 stem cells; osteonecrosis; calf wounds

Research Purpose

The aim is to study the clinical therapeutic effect of using moist burn regenerative medical technology combined with micro-particle skin implantation to treat Wagner grade 5 type 2 diabetic foot gangrene.

Research Significance

By using regenerative medical technology combined with micro-particle skin transplantation technology on the basis of systemic comprehensive treatment for patients with Wagner grade 5 type 2 diabetic foot gangrene, the treatment time for Wagner grade 2 type 2 diabetic foot gangrene can be reduced and limb salvage treatment can be performed.

Literature review

[Chronic complications of diabetes]. It mainly explains what the chronic complications of diabetes are, as well as the pathophysiology, treatment methods and prognosis of their occurrence and development. It focuses on diabetic foot gangrene as one of the chronic complications of diabetes. Treatment often requires amputation and the prognosis is poor.

[Encyclopedia of Burn Treatment]. Mainly researching Professor Xu Rongxiang's application of moist burn regeneration therapy to various burns and scalds, diabetic chronic difficult-to-heal wounds, cancerous wounds, etc. It provides an effective treatment method. It has important clinical research significance for shortening wound healing and reducing amputation of diabetic foot gangrene.

[Factors and countermeasures affecting the healing of diabetic foot gangrene]. The main content is to state the specific classification of diabetic foot gangrene according to Wagner classification, which is of guiding significance for the formulation of specific treatment strategies for the treatment of diabetic foot gangrene.

[Human body regeneration and restoration science: Somatic cells are induced into stem cells to regenerate and restore tissues and organs in situ]. This book is Human Regeneration and Restoration Science written by Professor Xu Rongxiang. It mainly tells that human epidermal cells can be activated into stem cells with regenerative potential. Under appropriate circumstances, keratin type 19 stem cells can be cultivated and then proliferate and differentiate into normal skin tissues and organs, providing a theoretical basis for microskin transplantation technology.

[Experience in treating diabetic foot gangrene with moist burn ointment]. It mainly explains that moist burn regenerative therapy mainly uses moist burn ointment as the culture medium, and the medicinal properties of the ointment have obvious effects on treating diabetic foot gangrene.

[Factors affecting the healing of diabetic foot gangrene and countermeasures]. It mainly studies the various factors and treatment strategies that affect the healing of diabetic foot gangrene, which has practical guiding significance for clinical treatment.

[Moist exposure therapy for burns]. This article mainly explains the main ingredients and pharmacological properties of moist burn ointment, which has theoretical guiding significance for the treatment of diabetic foot gangrene.

[Traditional Chinese Medicine]. The main content is to further study the pharmacological properties of moist burn ointment from the perspective of traditional Chinese medicine, and analyze the main efficacy of each drug, so that it has important clinical significance in the treatment of diabetic foot gangrene.

[Qualitative study of real-life perioperative experiences of patients with diabetic foot gangrene amputation]. It is explained that the treatment of diabetic foot gangrene often requires amputation, highlighting the important clinical research significance of the limb-sparing treatment described in this article.

[Explanation of wound treatment principles and mechanisms of burn regenerative medicine and therapy]. It mainly explains the specific treatment of wounds by burn regenerative medicine and therapy, and provides clinical treatment basis for the treatment of patients in this article.

[Experience in treating perianal acute necrotizing fasciitis with integrated traditional Chinese and Western medicine Experience meeting]. It mainly focuses on the experience of using burn regenerative medicine therapy to treat necrotizing fasciitis of the lower limbs. The therapy can regenerate all layers of tissue in the wound and heal the wound in situ. The discovery of this treatment has reference significance for this study.

[Moist burn ointment combined with autologous microskin transplantation A case report on healing chronic difficult-to-heal wounds of lower limbs]. It mainly shares the clinical treatment of chronic difficult-to-heal wounds with autologous microskin transplantation, and provides clinical technical theoretical guidance for this study.

[Scrotal necrotizing fasciitis with pus Experience in the diagnosis and treatment of toxemia]. Mainly the experience of treating severe wounds and necrotizing fasciitis with moist burn regenerative therapy. The wound treatment contraindications mentioned in the article that need to be paid attention to during the application of moist burn regenerative medicine and therapy are explained, and specific treatment reminders are provided for this clinical study.

Explanation of terminology and research mechanism

The WAGNER classification divides diabetic foot gangrene into: Grade 0: There is no ulcer on the foot, but risk factors are present. Grade 1: Superficial ulcer, skin rupture that does not penetrate deep into the subcutaneous fat layer and superficial infection, with or without cellulitis. Grade 2: Full-thickness ulcer that penetrates the subcutaneous tissue layer and extends deep into the ligaments, tendons, joint capsule, or deep fascia, but without abscess or osteomyelitis. Grade 3 deep ulcers penetrate the tendon and reach the foot bone and are accompanied by abscess osteomyelitis or sepsis, and may present with infection of the abscess, tendon, or tendon sheath. Level 4: Partial infection (toes, multiple toes, part of the foot, heel or forefoot) and other parts may be infected, but can be saved. Level 5: Most or all of the foot is gangrenous and irreversible, requiring amputation to save life. Moist burn regenerative medical technology was founded by Chinese Professor Xu Rongxiang in the early years. It aims to directly induce cells with regenerative potential in the body into stem cells by using a series of regenerative nutrients such as moist burn ointment with the cooperation of various technologies, and then convert them into stem cells. Stem cells are cultured into tissues and organs in situ, and the newly generated tissues or organs in situ gradually replace the tissues and organs that have lost their structure and function. Microskin transplantation technology uses moist burn cream as a culture medium, uses tissue cell culture technology to activate potential regenerative cells in the wound, and induces them into keratin 19 type stem cells (skin embryonic stem cells), through cell proliferation and differentiation into normal cells. Skin tissues and organs can regenerate various wounds, restore normal skin organs, and restore proper skin functions.

Research Background

Diabetic foot gangrene is a common chronic complication of diabetes, in which about 5% to 10% of patients require amputation [1]. The incidence of diabetic foot gangrene (DFG) in patients with long-term poor blood sugar control is significantly increased, seriously threatening the function of the affected limb and even life-threatening. Domestic and foreign literature reports that the incidence of DFG in European and American countries is more than 10%, and in Japan it is 2.37% [2] According to the Wagner classification of diabetic foot gangrene, grade 5 is gangrene in most or all of the foot. [3] This study mainly studies the comprehensive treatment of grade 5 diabetic foot gangrene that spreads to calf wounds using moist burn regenerative medical technology based on moist burn ointment.

The clinical manifestations of diabetic foot gangrene are local skin, fat, muscle and bone necrosis in the gangrene area. In severe cases, it can cause delayed healing, sepsis, septic shock, multiple organ failure, etc. and even death. In most cases, amputation is required to save life. Using regenerative nutrients and the cooperation of various technologies, cells with regenerative potential in the body can be directly induced into stem cells. Tissues and organs are then cultured in situ. The newly generated tissues or tissues and organs in situ, and the tissues and organs that replace the urban structure and function form the same life community with the original remaining tissues and organs.

[4] A large number of previous studies and clinical efficacy results have proven that with moist burn regenerative medical technology as the core, moist burn ointment as the wound tissue culture medium, covering the wound surface, and micro-particle skin transplantation technology as the clinical operation method to induce stem cell regeneration, can regenerate the wound skin in situ. This technology can actively and effectively improve the blood supply of the wound, inhibit wound infection, and shorten the healing time of the wound. After surgery, the patient has a high probability of retaining the affected limb and retaining some physiological functions of the affected limb. Therefore, it can actively participate in social production activities and enhance the patient's confidence in treatment. Significantly reduce the occurrence of mental illness in patients and promote the vigorous development of society and the country.

Given the many advantages of this technology. Therefore, this study applied this technology to the local treatment of type 2 diabetic foot gangrene, observed and recorded the treatment effect, and based on the result analysis, the clinical treatment of this patient achieved ideal results. Therefore, the author summarizes the detailed process, treatment effects, personal opinions and technology development prospects of this technology application as follows.

Clinical information

1. Case information

The patient is an Asian, male, 69 years old. He was admitted to a hospital in Beijing, China, mainly because of "burns on his left calf and foot that lasted for more than a month and worsened for half a month." "Debridement of the left lower limb and amputation of the necrotic toe" were performed. After the operation, vancomycin 500g/ivgtt/q12h, piperacillin-sulbactam 3g/ivgtt/q12h were given to fight infection, and iodophor was used for dressing treatment. No significant improvement was seen, so he came to our hospital for treatment. The patient was admitted to the hospital with "gangrene of the left calf and left foot with infection" since the onset of the disease. Since the onset of the disease, the patient's energy, diet, and sleep have been poor. His bowel movements are acceptable, and his weight has not been significantly reduced.

Specialist examination: Necrotic wounds with an area of approximately 40.0cm × 4.0cm were visible on the left foot and left calf, and a 15.0cm × 5.0cm wound was visible on the sole of the foot. During this period, a large amount of necrotic black scabs could be seen, and probe exploration revealed multiple subcutaneous cavities in the inner and lower parts. The longest subcutaneous cavities were 15.0cm × 3.0cm. Thin yellow-brown purulent fluid can be seen exuding from the wounds, accompanied by a foul odor; plantar exploration shows necrosis in the toes and a large amount of inflammatory exudation. The clinical diagnosis is diabetic foot gangrene (Wagner grade 5). Type 2 diabetes, anemia, hypoalbuminemia, and atherosclerotic obliterative disease of both lower extremities.

Auxiliary examination results showed that the patient was infected with *Proteus mirabilis* and *Klebsiella pneumoniae* subspecies, and was sensitive to piperacillin and sulbactam sodium, etimicin, and moxifloxacin. Complete relevant examinations after the patient is admitted to hospital. On the basis of symptomatic and supportive treatment such as piperacillin and sulbactam sodium for anti-infection, insulin for blood sugar regulation, and lipid emulsion amino acid glucose injection for nutritional supplementation, local wounds were treated with moist burn ointment after dressing expansion..

Standard moist burn regenerative medicine therapy is applied to the wound surface, and the wound is expanded in batches to remove necrotic tissue. External use of chitosan excipient hydrocolloid prevents wound adhesion, and nanosilver medical antibacterial dressing strengthens anti-infection. The patient's wound had a lot of necrotic tissue, so Gudu Shengji Powder was added to assist the shedding of necrotic tissue, promote the growth of new tissue, and use red light irradiation to improve local circulation and anti-inflammatory response. After 30 days of treatment, the granulation tissue of the wound grew well, and the wound was treated with microskin transplantation. After 86 days of treatment, the wound healed completely and the patient was discharged. Follow-up for half a year after discharge showed no recurrence of the wound after recovery.





-The picture above shows the first day after admission-

2. Treatment methods

2.1 Systemic treatment

Complete preoperative preparation after the patient is admitted to the hospital. Vancomycin 500g/ivgtt/q12h, piperacillin sodium and sulbactam sodium 3g/ivgtt/q12h were all given. After the results of bacterial culture and drug sensitivity test of wound secretions came out, they were changed to sensitive antibiotic anti-infective treatment. Insulin and other drugs are administered in a timely manner to regulate blood sugar, and diseases such as hypertension, type 2 diabetes, moderate anemia, and hypoalbuminemia are actively treated. Albumin or blood products are injected intravenously in a timely manner according to the patient's nutritional status to correct the patient's water and electrolyte imbalance. When necessary, calm the patient's emotions and ensure a soothing treatment environment for the patient.

2.2 Local treatment

After the local wound is cleared of necrotic tissue and the sinus tract is incised and expanded (pay attention to protecting important nerves, blood vessels and ecological tissues during the debridement process). Apply moist burn ointment (approximately 2.0mm thick) evenly. And cover it with 2 to 4 layers of moist burn plaster gauze and sterile cotton pads. Change the dressing once a day. After the granulation tissue has grown well, the micrograin skin is transplanted. The micro-grain skins are planted one by one in the granulation tissue of the wound, with a planting depth of 1.5 to 2.0 mm and a planting spacing of 0.5 to 1.0 mm. After the implantation, the wound will continue to be treated with moist burn ointment and dressing until the wound is completely healed. Microskin preparation: routine disinfection of the donor area and local infiltration anesthesia. After you are satisfied, use a skin test needle bent into a small hook at 45° to gently hook up the epidermis of the donor area. Cut the epidermal skin slices with scissors at an interval of 2.0mm, a depth of 0.2-0.3mm, and a diameter of 1.0-2.0mm. And cut into particles with a diameter of 0.5-1.0mm, and store them in physiological saline for later use.

3. Result

3.1 Treatment results

The patient's wound healed completely, and the healing time was (86.11 ± 10.12) days. There were no ulcers, edema, or scabs after the wound healed. The limbs retain most of their normal physiological functions, there are no adhesions in tendons and muscles, and the ankle joints are not restricted. During the follow-up visit six months after the treatment, the patient's wound healed without ulceration, edema, or scabbing.





-Typical pictures of the treatment process are shown in the picture-

4. Discussion

Research shows that the delay in healing of diabetic foot gangrene is caused by multiple factors. Mainstream theory believes that insufficient blood supply to local tissues caused by microvascular disease is the key factor in the disease. Infection is an important trigger.[5]

The main risk factors include:

1.Age: Nature and extent of DFG: Patients with severe DFG have a poor prognosis. 2. Lower limb blood flow, dorsalis pedis artery pulsation and nail fold microcirculation status: These three factors reflect the degree of limb vascular disease. Those with poorer status of these three factors will have more difficulty in DFG healing. 3.Bone destruction: DFG local If there is dead bone or the bone destruction is severe. This nonviable or infected bone can serve as a source of foreign bodies or purulent lesions, prolonging the healing time of the DFG. [6]

Moist burn ointment is scientifically processed from *Scutellaria baicalensis*, *Coptis chinensis*, *Cortex Phellodendri* and other traditional Chinese medicines. It has the functions of clearing heat and detoxifying, activating blood circulation and removing blood stasis, removing putrefactive tissue, promoting muscle growth, and relieving pain [7].

Pharmacology has proven that the main ingredients baicalin, wogonin, berberine, berberine, etc. have broad-spectrum antibacterial effects, dilate blood vessels, improve microcirculation, lower blood sugar, and protect platelets. [8]

According to the current international traditional medical treatment methods, amputation is currently an important measure to save the lives of patients with diabetic foot gangrene and severe infections. [9]

Patients with diabetic foot gangrene are under tremendous psychological pressure before and after undergoing amputation, and are prone to many physical, psychological and social problems. [10] Therefore, how to solve the problem of delayed healing of diabetic foot gangrene and preserve the affected limb to the greatest extent has become a research hotspot.

5. Conclusion

The patients in this study were treated with moist burn regenerative medical technology and dressing change. After the granulation tissue on the wound surface grew well, microskin transplantation was performed. The results showed that the patient's wound was completely healed, saving the patient from amputation, and there was no recurrence of the wound six months after the treatment. It can be seen that the use of moist burn regenerative medical technology combined with micro-particle skin transplantation after early debridement can effectively promote the healing of diabetic foot gangrene wounds.

The reason may be that moist burn regenerative medical technology can undergo a series of biochemical reactions such as hydrolysis, enzymatic hydrolysis, rancidity, saponification, lipidation and esterification with necrotic wound tissue, promoting its liquefaction and elimination and inhibiting wound infection [11]. Its active ingredients can activate the potential regenerative cells of the wound and convert them into stem cells to regenerate all layers of tissue in the wound in situ and promote wound healing [12].

Microskin contains full-thickness skin structures such as subcutaneous tissue, dermis and epidermis. When it is planted in the granulation tissue of the wound, each layer of tissue can expand and extend rapidly. Moreover, moist burn ointment, the core drug of wound regeneration medical technology, can also provide rich nutrients for the rapid growth of micro-skin and the regeneration and repair of wounds, thereby accelerating wound healing [13].

However, it should be noted that during the treatment of moist burn regenerative medical technology, the use of aqueous agents (normal saline), disinfectants, desiccants, astringents, etc. should be avoided as much as possible, and wound exudates, necrotic tissues and Change dressing. In addition, the principle of "de-escalation treatment" should be actively adopted for broad-spectrum antibiotic anti-infective treatment to quickly control the infection and reduce further damage to subcutaneous tissue [14]. It has important guiding significance for diabetic foot gangrene.

Summary:

1. For patients with severe diabetic foot gangrene, the use of moist burn regenerative medical technology combined with microskin transplantation technology can effectively promote wound healing and greatly reduce the risk of amputation; however, according to international traditional treatment, amputation is often required to save life.
2. The patient is very satisfied with the psychological expectations of this treatment.
3. Preserve the patient's limbs to the greatest extent and retain the basic physiological functions of the affected limb. After recovery, the patient can participate in normal social activities and promote the harmonious and stable development of society.
4. This study shows that moist burn regenerative medical technology combined with micro-particle skin transplantation technology can activate potential regenerative cells in wounds and transform them into stem cells. Regenerate all layers of tissue in the wound in situ, promote wound healing, and regenerate the patient's skin. Therefore, this technology has clinical significance for the treatment of patients with more severe diabetic foot gangrene and large-area skin defects all over the body due to various reasons.

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References

- [1] Shen Zhizhou, Wu Songhua. Chronic complications of diabetes [M]. Shanghai: Shanghai Medical University Press, 1999: 288.
- [2] Xu Rongxiang. Encyclopedia of Burn Treatment [M]. China Science and Technology Press, 2008.
- [3] Guan Xiaohong, Liu Dehui, Zhu Xi'e. Factors and countermeasures affecting the healing of diabetic foot gangrene [J]. Air Force Medical Journal, 1998, 000(002):110. DOI:10.3321/j.issn:1006-6187.2000.02.021.
- [4] Xu Rongxiang. Human body regeneration and restoration science: Somatic cells are induced into stem cells to regenerate and restore tissues and organs in situ [M]. China Social Sciences Press, 2009.
- [5] Song Quanchao, Sun Zhenyan. Experience in treating diabetic foot gangrene with moist burn ointment [J]. Journal of Modern Integrated Traditional Chinese and Western Medicine, 2005, 014(007):924-925. DOI:10.3969/j.issn.1008-8849.2005.07.082.
- [6] Guan Xiaohong, Liu Dehui, Zhu Xi'e. Factors affecting the healing of diabetic foot gangrene and countermeasures [J]. Air Force Medical Journal, 1998, 000(002):110. DOI:10.3321/j.issn:1006-6187.2000.02.021.
- [7] Xu Rongxiang. Moist exposure therapy for burns [A] // Technology transfer training materials [M]. Beijing: Guangming Institute of Traditional Chinese Medicine Burns, Wounds and Ulcers, 1989: 78-79.
- [8] He Zhiguang. Traditional Chinese Medicine [M]. Beijing: People's Medical Publishing House, 1996: 111-112.
- [9] Zheng Qing, Wang Jing, Yang Hongmei. Qualitative study of real-life perioperative experiences of patients with diabetic foot gangrene amputation [J]. Journal of Nursing Education, 2011, 26(11):2. DOI:10.3969/j.issn.1002-6975.2011.11.015.
- [10] Zheng Qing, Wang Jing, Yang Hongmei. Qualitative study of real-life perioperative experiences of patients with diabetic foot gangrene amputation [J]. Journal of Nursing Education, 2011, 26(11):2. DOI:10.3969/j.issn.1002-6975.2011.11.015.
- [11] Chen Yongchong, Li Qing, Zhang Tai'an. Explanation of wound treatment principles and mechanisms of burn regenerative medicine and therapy [J]. Chinese Journal of Burns, Wounds and Ulcers, 2014, 26(1): 1-14.
- [12] Chen Ruichao, Liu Chang. Experience in treating perianal acute necrotizing fasciitis with integrated traditional Chinese and Western medicine Experience meeting [J]. Chinese Community Physician, 2014, 30(33): 103-104, 106.
- [13] Li Linlin, Luo Xiaojun, Huang Xiaolin. Moist burn ointment combined with autologous microskin transplantation: A case report on healing chronic difficult-to-heal wounds of lower limbs [J]. Chinese burn wounds and ulcers Journal, 2021, 33(2): 103-105.
- [14] Yang Long, Yuhe, Jiang Zhuanxin, Qiu Xuede, et al. Scrotal necrotizing fasciitis with pus: Experience in the diagnosis and treatment of toxemia (with 15 case reports) [J]. Chinese Journal of Andrology, 2020, 26(12): 1149-1151.