EURASIAN JOURNAL OF ACADEMIC RESEARCH
Innovative Academy Research Support Center
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CREATION OF A NEW MODEL OF BURNS IN RATS WITH THE DETERMINATION OF THEIR DEGREE AND THE USE OF CARBOXYMETHYLCHITOSAN APIS MELLIFERA

Khojiev Dilmurod Yakhshiyevich[1]
Candidate of Medical Sciences, Associate Professor of the Department of Anatomy, Clinical Anatomy (OSTA) of the
Kurbonova Feruza Nurulloyevna[2]
Doctoral student of the Department of Organic and Physical Colloid Chemistry,
[1]Bukhara State medical institute
[2]Bukhara State University
https://doi.org/10.5281/zenodo.6778484

ARTICLE INFO

Received: 28th May 2022
Accepted: 02nd June 2022
Online: 25th June 2022

KEY WORDS

chitosan, carboxymethylchitosan, modeling, burn injury, epithelialization.

ABSTRACT

The article provides information about thermal skin burns and emerging pathophysiological changes in integumentary tissues. The aim of studying and treat these severe processes, burn the skin of animals. A new model of thermal skin injury in rats has been created. For the occurrence of a skin burn, a soldering gun with a flat rod PP REXANT ZD-715 12-0188 with a tip heating temperature of up to 400 0C was used. The degree of the burn was determined by histological examination of skin tissues under a microscope, which was grade IIIA and IIIB. Positive results of using an ointment based on carboxymethylchitosan (CMHZ) have been recorded.

Burn injury is known as the most traumatic wound. In clinical practice, most burn patients experience severe pain during wound dressing; which necessitates the promptest effective treatment and the use of advanced drugs. In evaluating a burn wound care model, the use of animals is considered appropriate in studying the pathophysiology of burns, as well as in studying the effectiveness of treatment strategies due to the complexity and heterogeneous nature of burns [1].

Burn injury is a polypathophysiological phenomenon in which destructive injuries cause structural and functional disorders in many systems and organs of the human body. The use of animal models is considered to be an appropriate tool to study the pathophysiology of burns instead of an in vitro experiment. This is due to the heterogeneous nature of burns and the similarity of animal skin with the characteristics of human skin. Over the past two decades, a number of models of thermal damage to the skin of animals have been developed to reproduce various degrees of burn injury, elucidate pathophysiological changes and study effective therapeutic therapy [2].

The skin is the largest organ of the body and its destruction, especially caused by burns, can be life-threatening. Skin burns are responsible for pathophysiological changes in the body, leading to severe forms of burn disease, in which a number of complications are manifested, such as escalation of infection and high mortality, as well as prolonged hospitalization of the patient [3]. With a large area of damage, burns can turn into a systemic problem affecting various organs [4].

The use of animal models of burns is critical for burn research, especially for studying the medicinal properties of new drugs, since it is known that new treatment strategies should be initially tested at an experimental level before clinical application [5]. An experimental model is essential when studying burns and their underlying mechanisms. Many animal models of burn injuries have been reported using mice, rats, rabbits, dogs, and pigs. They are widely used to study the pathology of a burn wound, the effect of systemic drug use, local therapy, and the effect of a burn injury on the entire body [6–8].

The use of animals as experimental models in various biological studies for transfer to human physiology was originally provoked by Bernard in 1865 [9]. Over time, the marked similarities in anatomy and physiology between humans and animals have further motivated many researchers to explore a wide range of mechanisms and treatments in animal models before translating their findings to the treatment of thermal injury in humans. In burn research, there are several common methods of producing burn injuries in animal models, including hot water, hot metal instruments, electricity, and heated paraffin [10]. In these methods, the animal's back is shaved and heated material is applied to the skin to induce the desired surface area of the burn. Specific parameters such as heat and exposure are used differently in each burn model [11]. In addition, the integral design of an animal burn model experiment is also critical for the assessment of tissue burn.

Motamed and others demonstrated a rat model of third-degree burn to investigate the effectiveness of the amniotic membrane in combination with adipose-derived stem cell treatment. A burn wound has been formed by extinguishing a hot rod (boiled in water) in the dorsal area for 30 seconds [12]. The authors of the literature [13] developed a similar model using a brass block heated to 190°C on the back of rats parallel to the midline for 20 seconds. This model is used to assess the treatment of severe burns with a medical dressing applied to the wound, as well as its inflammatory responses and healing mechanisms.

Discussion

A known method of modeling a burn in an experiment in animals (mice, rats) is carried out by immersing the back of the animal in water heated to a temperature of 65-100°C [14].

However, the known method provides heating of not only the skin, but also the skeletal muscles of the animal (this is due to the fact that mice and rats have a weakly expressed layer of subcutaneous tissue) and causes early death of animals already in the first 2-3 days with a lesion area of 15-20% of the surface body. In addition, burns obtained in this way are accompanied by the development of wet skin necrosis, which also increases the severity of the injury. To reduce the severity of the injury and prolong the life of the animal, to monitor the course of reparative processes, they resort to thermal insulation of deep tissues by subcutaneous injection of 150-200 ml of air at the time of the burn, followed by its removal, which does not allow to transfer

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this model to the situation fully enough burns in humans [15].

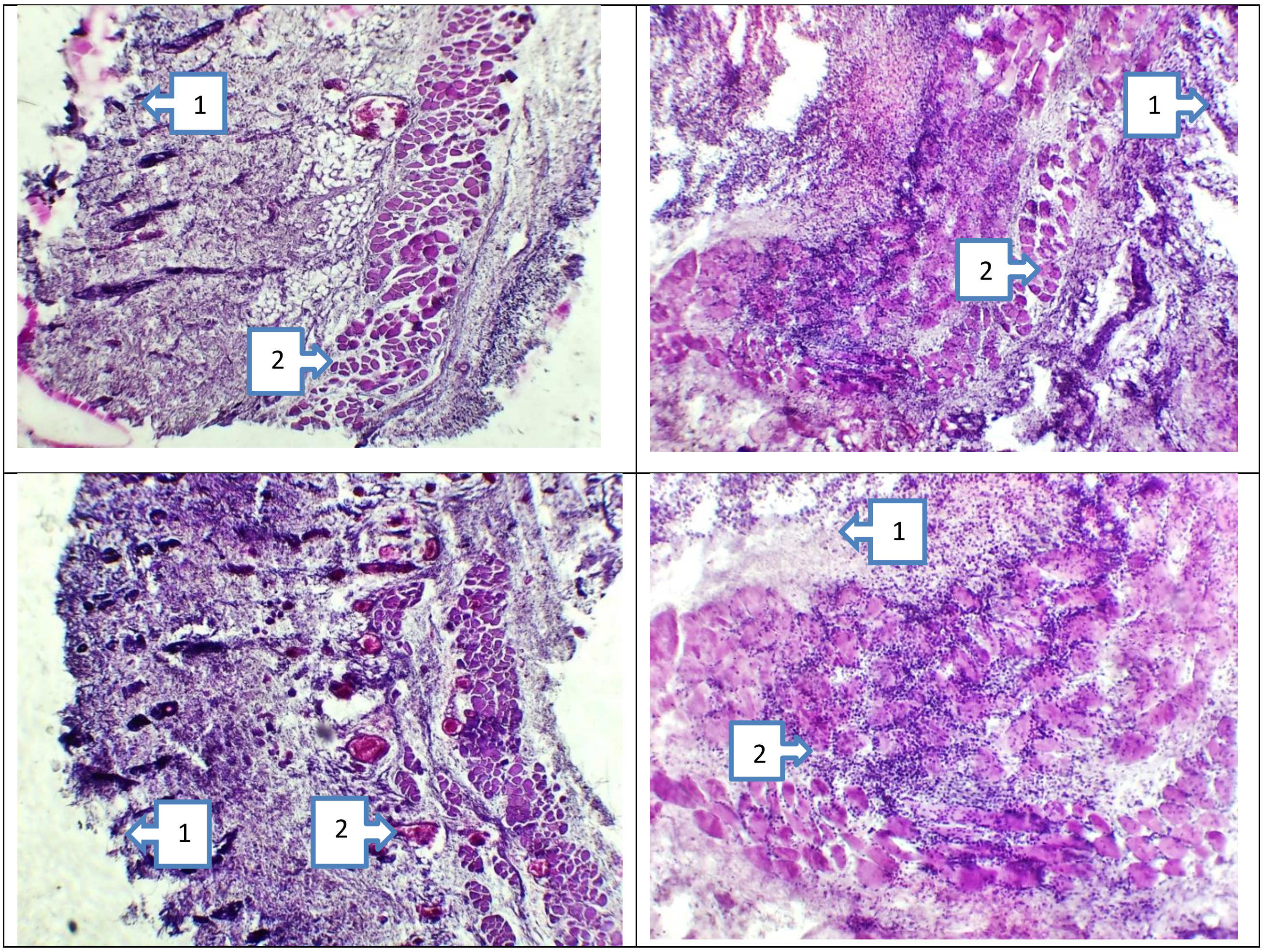
In our study, we developed the following model for the development of a burn on the skin of a test animal. Were selected white outbred inbreeding experimental rats, whose body weight is relatively the same. They were measured and divided into three groups. Group I - control rats, weighing 190-210 g. Group II - rats 180 - 205 g, treated with an ointment drug applied to the surface of a burn wound. The basis of the ointment preparation prepared by us was levomekol, to which powdered micro-dispersed CMHZ was added. CMHZ has been synthesized by us from the dead bee Apis mellifera [16-17] and used to treat burn wounds. Group III, rats weighing 180 - 210g. have been treated with monotherapy using levomekol ointment. In all groups, 10 individuals of rats of different sexes have been selected. Only six rats from the first (control) group and all rats of the other groups have been prepared for the process of inflicting burn injuries. The fur on the posterior dorsal part of the rats was sheared with medical scissors to obtain identical skin burns in all groups. Rats located in a specialized box were anesthetized (by intramuscular injection of 0.1 ml of ketamine) with the injection of medical ether vapors. Animals are fixed in the machine for four limbs. Subcutaneously, at the site of the alleged thermal injury, 20-30 ml of air has been injected. The reason for introducing air under the skin is to save the lives of rats in order to protect the internal organs and underlying tissues from burns, for further morphological study of the burn wound and to study the effect of our drug.

Picture 1. Rats with IIIA and IIIB degree burns on the 2nd day.

For thermal damage to the skin, a soldering gun with a flat rod PP REXANT ZD-715 12-0188 manufactured in Russia with a tip heating temperature of up to 400^0 C has been used. The exposure time of the heated tip on the rat skin was for 10 seconds. The contact of the flat tip of the soldering iron with the skin was set at 30 degrees relative to the plane of the skin of the animal. The burn diameter has been made in an area of 4,0x2,0 cm. When the burn process was over, within 15 minutes the rats began to recover from anesthesia and ointments were applied to the wound surface in the previously prescribed order. The next day after thermal trauma, that is, on the second day, four rats from all groups were killed and given for histological examination (Fig. 1).

The degree of burn damage was determined by histological examination of skin tissue under a microscope. Pathological damage to the skin during histological examination of tissues under a microscope showed that the rats had burns of IIIA and IIIB degrees with blackening and necrosis of the skin (Fig. 2.).

Daily toilet of the wound was carried out according to the prescribed pattern 1 time per day with the application of medicinal ointments with a layer of 0.5-3 mm on the burn surface without bandaging[18-19].



Picture 2. IIIA degree burns. Partial death of the skin (1), preservation of the deep layers of the dermis and its derivatives (2).

Conclusion

Application of medicinal ointments and nutrition of rats (bread, cereal seeds, sunflower seeds) was carried out once a day at the same time interval. The wound therapy has been carried out for 22 days until complete healing, epithelialization of the burn wound in the 2nd group occurred on the 3rd week after the skin burn. In the group where monotherapy with levomecol has been used (group 3), the epithelium of the wound closed within 24 days, and in the control group, the restoration of the skin occurred on the 30th day after thermal damage. The advantage of our simulation was the 100% viability of the rats. The rats remaining after sampling for histological examination survived until the burn process has been completely cured.

Thanks to the proposed animal model, a better understanding of the morphological changes in thermally affected tissues during burns, the mechanism of formation of burns of varying degrees, and future research will be constantly improved with new treatment strategies that improve the quality of life of patients with burns.

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