

# Kidneys condition in multiorgan inefficiency resulting from burn disease

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## ABSTRACT

In severe burn disease, inflammatory processes in kidneys often result in lethal outcome. The present study shows the material of 46 autopsies of died patients (29 males and 17 females), being treated at Burn Department of Samarkand branch of RSCUMA during year 2006 to 2012. Electronic microscope study of kidneys made it possible to verify morphological substrate and pathogenesis of renal insufficiency in burn disease. From the study we can distinguish typical features of morphological changes in kidneys in burn disease; damage to microvessels and cellular elements.

**Key words:** Burns, autopsies, microscope study of kidneys, Sepsis.

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## INTRODUCTION

Thermal trauma remains one of the real problems of modern medicine, because of its heavy clinical course, the difficulties of treating the victims, the high mortality rate and sometimes unacceptable results of treatment. However, according to the World Health Organization (WHO) data, more than 95% of fatal fire-related burns in 2002, for example, occurred in low and middle income countries (WHO Report, 2002). In Uzbekistan 8,500 patients with burns are treated every year.

Sepsis, including burn sepsis, is one of the most complex problems of practical and theoretical medicine. It must first of all be considered as generalized infectious complication, developed on the background of burn trauma. With this, almost in all cases bacteriemia is revealed. In spite of significant success achieved during recent years in treatment of patients with severe burns, lethal outcome from infectious complications of burn disease is still high (Alexeev, 1993; Bone et al., 1992; Herndon, 2001).

Moist burnt tissues with constantly adding reserve of nutrients, diffusing from plasma and heated surface, present favourable medium for rapid multiplication of

microbes (Sarkisov and Teplakov, 1996; Kramer et al., 2007; Dancey et al., 1999).

Spectrum of microorganisms, causing infection of burn injuries, gradually changes depending on hospital infection. Taking into account significance of staphylococcus aureus being one of the main agents of hospital infection it is necessary however to emphasize that proportion of conventionally pathogenic gram-negative microorganisms (Krutikov, 2005) has greatly increased among nosocomial flora in recent years. Among them pseudomonas aeruginosa becomes most significant. Thus, *Staphylococcus aureus* and *Pseudomonas aeruginosa* strains are discharged from burn injuries in 70 to 80% of patients (Padman et al., 2005; Dellinger, 1999). In pathogenesis of burn disease and particularly in its first phase of burn sepsis, disturbance of filterable reabsorptive and secretory function of kidneys is of particular significance. Renal dysfunction is one of multiorgan inefficiency (MOI) manifestations. The aim of this research was to study morphological changes of micro vessels, structural and functional diversion in renal cells in burn disease.

## MATERIAL AND METHODS

The present study shows the material of 46 autopsies of died patients (29 males and 17 females), being treated at Burn Department of Samarkand branch of RSCUMA from year 2006 to 2012. All patients in the clinic suffered from multiorgan insufficiency including renal insufficiency. In 38 patients the course of the disease was complicated by pieces of renal tissue 1.0 x 1.0 x 0.5cm, were fixed in 10% solution of neutral formalin. Histological study was performed on paraffin section of 5 mkm thickness, stained by hematoxylin and eosin. Kidney samples for electronmicroscopic study were fixed in 2.5% solution of glutaraldehyd. Ultrathin sections were contrasted with Plumb citras and studied in electronic microscope of Philips.

## RESULTS

The research showed that distinctive changes of kidneys in burn sepsis revealed in histological preparations were caused by disturbances of microcirculations of various degree, manifested by sharp dilatation of blood capillaries lumen, aggregation of erythrocytes, micro thrombus and plasma segmentation. The observed impairments and nephrocytes necrosis are the main morphological signs of renal insufficiency. Marked destructive changes are noted both in cortical and medullary substance of kidneys. In electronic microscope study of cortical substance of kidneys in patients died of burn sepsis, first of all changes in the endothelium of blood capillaries are noted. Clots are often revealed in the lumen of these capillaries.

The process of endothelial cells becomes thin and partly destroyed. In places of basal membrane impairment there are lumens in the capillary wall. In basal part of endothelial cell of nephron proximal section there is destruction of cellular organelle. Mitochondria are swelled, with luminal matrix and destroyed crystals, they have uneven contour and are freely located in luminal cytoplasm. Membrane epithelial cells in the basal part, composing its banding, are completely lysed and remnants are attached to loosened basal layer. Collagenous fibres and fibroblast processes as well as changed capillaries are localized in intercellular space. Sharp decrease of ribosome number, lysis of endoplasmatic net membranes contribute to laminar effect of cytoplasm in which swelled mitochondria, changed nuclei and vacuoles are located most microvilli of brush border of cellular apical part are destroyed and moved away with its fragments into the nephron cavity. Thus cell wholeness is destroyed and openings are formed through which cellular contents is pouring out into the canaliculus cavity.

In addition removing of microvilli and performing of erosion areas take place as a result of the process of normal filtration and microcirculation in kidneys is impaired. In the process of research, typical features of morphological changes in kidneys in burn disease are

damage to microvessels and cellular elements were distinguished. Systemic damage to micro vessels is manifested by impairment of vascular wall wholeness, resulting in its necrosis, plasmatic impregnation and erythrocytic diapedesis. Similar changes prove the disturbance of permeability and functions of capillary endothelium. In its turn disturbance of transendothelial transport and growing hypoxia cause reversible and irreversible damage to renal cells.

Thus, electronic microscope study of kidneys made it possible to verify morphological substrate and pathogenesis of renal insufficiency in burn disease. The observed destructive changes in kidneys, developing under the effect of bacteria, result in development of slagphenomenon, stasis, microvessels trombosis and hypoxia in future. Changes in cells of proximal and distal nepkron sections of renal cortical layer in the conditions of hypoxia are marked irregularly and are more often of irreversible character. Almost complete basal banding and lysis of microvilli of brush border of cellular apical part of proximal canaliculi prevent normal reabsorption. With this the degree of impairment of the main renal functions due to burn severity is an important prognostic sign of burn disease. As a result of blood flow impairment and development of hypoxia, reversible and irreversible cellular impairment and development of necrosis areas in places of bacteria localization take place that makes the basis of renal insufficiency in burn disease complicated by sepsis.

## DISCUSSION

Burn trauma remains one of the real problems of modern medicine, because of its long clinical course, the high mortality rate and sometimes the unacceptable results of treatment. According to the World Health Organization (WHO) data for the year, 2002, more than 95% of fatal fire related burns occurred in low and middle class.

Depression of renal excretory function makes it difficult to maintain the normal level of hydrogen ion concentration in blood. In patients with clinical picture of shock and acute toxemia, oliguria and even anuria are often observed. Subsequently in accordance with disappearance of toxemia signs, restoration of diuresis is noted.

It should be noted that there is not a single view to the mechanism of renal impairments in all periods of burn disease (Spies, 1996; Vertrees et al., 2004). Insufficiency of peripheric blood flow being the component of burn shock, hemo-concentration due to plasmorrhagia and Grown Kids Syndrome (DIV syndrome) (Krilov et al., 2006; Alexeev and Krutikov 2004) are important in etiopathogenesis of acute renal insufficiency of the first period. All these changes are strictly connected with extension and depth of burn and as a rule they accompany severe burn shock.

According to the data of Pittet and Rangel-Frausto (1995) renal insufficiency, complicating the course of burn

disease is the direct cause of death in more than 30% of patients with burns.

## CONCLUSION

In severe burn disease inflammatory processes in kidneys often result in lethal outcome. Their development may be caused by marked and extended disturbance of nonspecific barrier mechanisms function taking place in severe burn trauma damages, this being an important pathogenetic factor of early bacterial intoxication and sepsis development. One of the leading roles in the development of this process belongs to direct effect of bacteria and product of their vital activity to cellular structure.

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