

# Analysis of burn patients and the isolated pathogens

## Nudegusių ligonių ir jų žaizdų patogenų analizė

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### Background / objective

The major challenge for a burn team is infection, which is known to cause over 50% of burn deaths. Burns become infected, because the environment at the site of the wound is ideal for the proliferation of infecting organisms. This study, approved by the regional Ethics Committee, analyzes the features of burned patients and the rates of pathogens isolated from burn wounds.

### Patients and methods

We studied 2246 burn patients (mean age 27 years) admitted to the tertiary academic hospital in 1997–2002. The differentiation of the severity of burn injury was based on the scheme of the American Burn Association (ABA). 2462 surface swabs for microbiological analysis were taken from all 2246 patients. The wound area was swabbed with an alginate swab and cultured in 5% blood and MacConkey agar.

### Results

There were 1447 (74%) men and 799 (26%) women ( $p < 0.001$ ), age range 2–47 years. There were 1261 patients (56%,  $p < 0.05$ ) with minor, 522 with moderate and 463 with major burn injuries. 2130 swabs (86.5%) out of 2462 burn wound surface swabs were positive. Out of 2130 isolates positive for pathogenic bacterial culture, there were 1110 (52.1%) isolates positive for *Staphylococcus aureus* infection. The rate of MRSA was 23.4% (498 isolates).

### Conclusions

Young male patients mostly have a minor burn injury. Burn wounds are most commonly infected with *S. aureus*. MRSA is still the main hospital pathogen in burns.

**Keywords:** severity of the burn injury, burn swabs, isolated pathogens

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### Įvadas / tikslas

Didžiausia nudegimų chirurgijos problema yra infekcija, nuo kurios miršta daugiau kaip 50% visų nudegusių pacientų. Nudegimų žaizda greitai infekuojasi, kadangi žaizdos aplinka yra ideali mikroorganizmams atsirasti ir daugintis.

Studijoje, patvirtintoje Universiteto etikos komiteto, analizuojami nudegę pacientai ir iš nudegimo žaizdų išskirti patogenai.

### Pacientai ir metodai

Mes analizavome 2246 nudegusius pacientus (amžiaus vidurkis – 27 metai), gydytus KMU Chirurgijos klinikose 1997–2002 metais. Nudegimo sunkumas buvo vertintas pagal Amerikos nudegimų asociacijos (ABA) schemą. 2462 nudegimo žaizdos pasėliai (2246 pacientų) buvo paimti steriliu tamponu ir pasėti 5% kraujo ir MacConkey terpėse.

### Rezultatai

Iš nudegusių pacientų 1447 (74%) buvo vyrai ir 799 (26%) – moterys ( $p < 0,001$ ). Pacientų amžius – nuo 2 iki 47 metų. 1261 (56%,  $p < 0,05$ ) pacientai patyrė lengvą, 522 – vidutinį ir 463 – sunkų kūno nudegimą. 2130 pasėliai (86,5%), paimti iš 2462 nudegimo žaizdų, buvo teigiami. Iš 2130 teigiamų pasėlių *Staphylococcus aureus* išskirtas 1110 (52,1%) pasėliuose, iš jų MRSA – 498 (23,4%).

### Išvados

Jauni vyrai dažniausiai patiria lengvus kūno nudegimus. Nudegimo žaizda dažniausiai infekuoja *S. aureus* mikroorganizmais. MRSA yra pagrindinis ligoninės patogenas, infekuojantis nudegimo žaizdą.

**Reikšminiai žodžiai:** nudegimo sunkumas, nudegimo žaizdos patogenai, išskirti sukėlėjai

## Introduction

Burn wound infections are serious complications of thermal injury. Burn patients are at the risk for acquiring infection because of their destroyed skin barrier and suppressed immune system, compounded by prolonged hospitalization and invasive therapeutical and diagnostic procedures [1, 2].

Currently, the common pathogens isolated from burn wounds are *Staphylococcus aureus* (75%) *Pseudomonas aeruginosa* (25%), *Streptococcus pyogenes* (20%) and various coliform bacilli (5%). Other streptococci, anaerobic organisms and fungi (*Candida albicans* and *Aspergillus fumigatis*) can also cause infection [4].

Microorganisms are still transmitted to the burn wound surfaces of recently admitted patients by the hands of personnel, by fomites, and perhaps, to some extent, by hydrotherapy. The gastrointestinal tract continues to be a potential reservoir for microorganisms that colonize the burn wound surface. It is likely that endogenous microorganisms continue to be transmitted to burn wound surfaces by feces [7].

This study analyzes burned patients and the incidence of pathogens isolated from burn wound in the Division of Plastic Surgery and Burns of Kaunas Medical University Hospital.

## Patients and methods

We studied 2246 patients admitted to the Division of Plastic Surgery and Burns (DPSB) of our hospital from January 1997 till December 2002. The evaluation of patients' age, sex, severity of burn injury, hospital stay, and surgical interventions was performed on the basis of the data of case histories. According to the severity of the burn injury, the patients were differentiated into those with minor, moderate, and major, or critical, burns. The differentiation was based on the scheme of the American Burn Association (ABA) [13].

Data about pathogens were obtained by microbiological analysis of swabs taken from burn patients. 2462 surface swabs were taken from 2246 burn patients. Swabs were taken when wound infection was clinically diagnosed. Repeated pathogens for the same patient were not involved into the study.

An area was swabbed using alginate swabs and cultured in 5% blood and MacConkey agar. The growth of microorganisms was rated by semi-quantitative methods. The identification of microorganisms was done according to their biochemical and fermentative activity.

The study has been approved by the regional Ethics Committee. The analysis of the data was performed using the Statistica software package. The difference was considered statistically significant at  $p < 0.05$ .

**Results**

Mean age of all 2246 patients was 27 years (quartile range: from 2 to 47 years). There were 1447 (74%) men and 799 (26%) women ( $p < 0.001$ ). There were 1261 patients with minor, 522 with moderate and 463 with major burn injuries. The rate of patients with minor burns (56%) was statistically significant ( $p < 0.05$ ) (Fig. 1). Necrectomy and autodermoplasty was done to 1199 (53%) burn patients. The mean hospital stay was 17.14 days. The number of patients varied from 356 per year in 2000 to 397 in 1999.

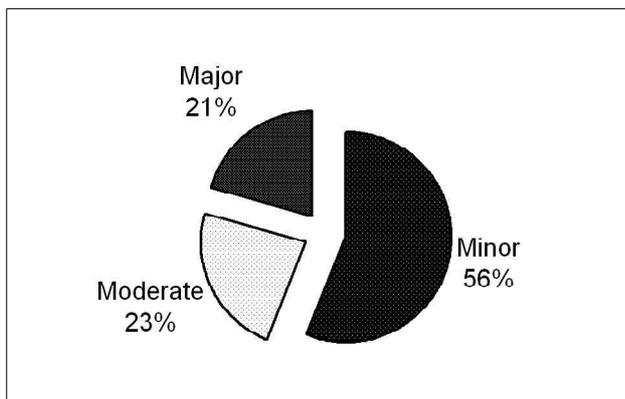
2462 surface swabs were taken from burn wounds and 2130 swabs (86.5%) were positive. The number of positive swabs varied from 249 in 2002 to 405 in 1999 (Table 1). Out of 2130 isolates positive for pathogenic bacterial culture, there were 1110 (52.1%) isolates positive for *Staphylococcus aureus* infection. The rate of methicillin-resistant *Staphylococcus aureus* (MRSA) infection (23.4%, 498 isolates) was marginally higher than that of *Pseudomonas* spp. (17.6%, 375 isolates),  $\beta$ -hemolytic streptococci (1.7%, 250 iso-

lates), *Enterobacteriaceae* (11.5%, 244 isolates) and *Acinetobacter* (7.1%, 152 isolates) (Fig. 2).

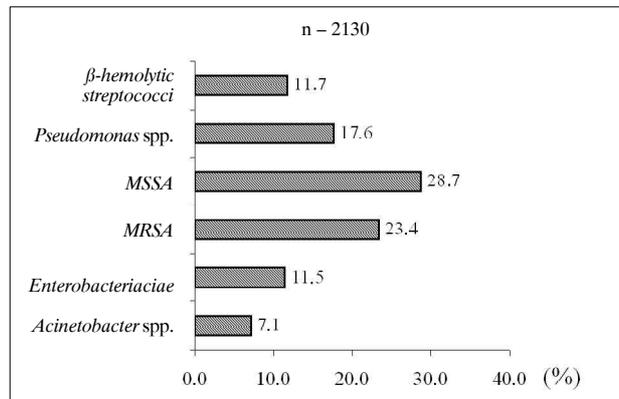
**Discussion**

Burns become infected because the environment at the site of the wound is ideal for the multiplication of infecting organisms. The immune-suppressive status of the patient and the immediate lack of antibodies allow the microorganisms to multiply freely. There is a plentiful supply of moisture and nutrients in the physical environment; the temperature, gaseous requirements, etc. are ideal for growth. Bacteria will proliferate rapidly; the mean cell generation time in optimum conditions is approximately 20 min. Therefore, a single bacterium cell can increase in numbers within a 24 h period to over 10 billion cells [3].

The goal of burn wound management is to reduce the onset and density of bacterial contamination, which usually occurs by the second week after injury, and thereby to prevent invasive wound infection [4]. This has been achieved to a large extent by



**Fig. 1.** Patient distribution according to the severity of burn injury in the Division of Plastic Surgery and Burns (1997–2002)



**Fig. 2.** Isolated pathogens from burn wound swabs in the Division of Plastic Surgery and Burns (1997–2002)

**Table 1.** Distribution of patients, swabs and positive swabs in the Division of Plastic Surgery and Burns (1997–2002)

Years	1997	1998	1999	2000	2001	2002	Total
Number of patients	361	391	397	356	370	371	2246
Number of swabs	415	473	522	375	396	281	2462
Number of positive swabs	369	405	437	333	337	249	2130

the management of burn patients in specialised burn centres utilising isolation and reverse isolation techniques, early wound closure and the use of various topical anti-microbial agents [5, 6].

The potential for infectious disease transmission from the environment is further demonstrated by clinical and laboratory studies showing the transmission of microorganisms from person to person and via inanimate surfaces, water, hand, food and household surfaces [8].

Effective handwashing is recognized as one of the best means for preventing the spread of infection in hospitals. The aim of the procedure is to minimize the potential for infection to patients, directly or indirectly, by hand contact to prevent hand care personnel from becoming vectors of nosocomial pathogens. Barrier practice including patient isolation and the use of gloves, gowns, or masks, are widely recommended for the control of endemic antimicrobial resistance [9, 10, 12].

Optimal infection control programs in health care facilities decrease the frequency of nosocomial infections, are effective in controlling some outbreaks of

colonization and infection with antimicrobial – resistant organisms in health care facilities [12].

Our study showed that the main problem in our department was MRSA infection (23.4%). This pathogen has been a common cause of nosocomial infections in Europe for over 10 years. For the period 1999–2001, the European antimicrobial surveillance system showed a prevalence of <3% MRSA in northern European countries (Iceland, Sweden, Denmark, the Netherlands). By contrast, in southern and middle Europe, the proportions of MRSA were alarmingly high (United Kingdom: 46.1%, Greece: 36.8%). A Belgian national survey (1994–1998) reported an MRSA frequency of 14.3% [11, 12]. Optimal infection control programmes could influence solving MRSA problems as well. The frequency of MRSA infection still remains high and this problem is open for future researches.

## Conclusions

Young male patients mostly have minor burn injury. Burn wounds are most commonly infected with *S. aureus*. MRSA is still the main hospital pathogen in burns.

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