The epidemiology and treatment of adult patients with hand burns in Kaunas University of Medicine Hospital in 1985, 1995, 2001 and 2002

Kęstutis Maslauskas, Rytis Rimdeika, Žilvinas Saladžinskas, Tadas Ramanauskas
Division of Plastic and Reconstructive Surgery, Clinic of Surgery, 1Clinic of Surgery, Kaunas University of Medicine Hospital, 2Kaunas University of Medicine, Lithuania

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Summary. This study reviews the epidemiology of adult patients with hand burns admitted to Kaunas University of Medicine Hospital in Lithuania during selected four years (1985, 1995, 2001 and 2002). Two hundred and forty six cases were reviewed retrospectively with 74.4% of males and 25.6% of females among them. Median of age was 40 years (38 males, 45 females). Fire (71.9%) was the most common cause of injury; scalds (15.4%) were the second most common reason. The median of burned total body surface area was 12%. Analyzing the burns, 58.9% of them occurred in urban area (57.1% full-thickness burns), and 41.1% in rural (42.9% full-thickness burns). The study revealed that 17.1% (42) males and 3.7% (9) females were affected by alcohol at the time of injury. Early skin grafting was performed in 29.4% cases (mostly in 2001, 2002), delayed – 70.6% (mostly in 1985, 1995) of all skin grafting operations. Early grafting was found to give better results in the length of hospital stay. Overall, the median of hospital stay significantly decreased and was 24 days (35 days in 1985, 19 days in 2002).

Introduction

The hand is used for manipulatory and exploratory functions, and the upper extremity is thus the most often burned part of the human body (1). A study of product-related injuries estimated that 36% of these involved the hand and the upper extremity, and that 39% of burn wounds involved some portion of the hand and arm (1). During a two-year study at the US Army Institute of Surgical Research, 89% of 568 burn patients had burns involving one or both arms (2). Hands comprise 5% of the total body surface area (TBSA) and a burn can represent a serious short- or long-term disability (3). Even small surface area burns may adversely affect hand function. The treatment of such injuries is properly relegated to a multidisciplinary team.

Hand burns occur mostly when adults have contact with fire (often due to smoking in bed under the influence of alcohol) followed by the accidents such as careless usage of boiling hot water or explosions.

Three periods are observable in treatment of hand burns in Kaunas University of Medicine Hospital. The first period covers 1972–1995, the second period covers 1996–2000, and the last period has started since 2001. During the first period hand burns were treated conservatively or delayed skin graftings were performed as a standard. During the second transitive period early skin graftings were performed as well as delayed one. Starting with 2001 early necrectomy and grafting persist as a standard. We performed a prospective study of patients with hand burns in the period of 2001–2002, and compared with the data from randomly selected years from the period of conservative treatment. According to some authors early skin graftings can be performed as well as delayed ones because they have not got any relation with postburn hand function (4). The purpose of this research is to study the epidemiology, variation of burns and relationship between early postburn surgery and hospital stay comparing the data of four year 1985, 1995, 2001 and 2002.

Material and methods

There is no comprehensive registry collecting the
data of burned patients in Lithuania, as well as in the other Western European countries. Burns are placed in the same group with other serious injuries and the real number of burned patients is unknown. Hand burns are referred to serious injuries therefore all the patients with hand burns were transferred directly to special centers with the priority to Kaunas University of Medicine Hospital. We analyzed 246 cases of patients with hand burns admitted to the Center of Burns of Kaunas University of Medicine Hospital over the four years (1985, 1995, 2001 and 2002). Burn injuries involved one or both hands. In most cases other parts of the body were also involved. Data were collected including patient's age, sex, place of residence (urban/rural), socioeconomic status (working, non-working, students, disabled, pensioners, and registered jobless), burn etiology (fire, scalds, electricity, chemical, and contact burns), relation to alcohol abuse, percentage of TBSA burn, depth of burn (partial-thickness, full-thickness), length of hospital stay, and time of surgical procedure (early/delayed).

The Z test was used to check the hypotheses. P of less than 0.05 was considered significant. The coefficient Cramer’s V was used to verify the relation strength (0≤Cramer’s V≤1). The calculation was made using the program STATISTICA, version 5.5.

**Results**

**Age and sex**

We found 65 patients in 1985, 34 – 1995, 60 – 2001, 87 – 2002. There were 183 (74.4%) males and 63 (25.6%) females. The median of age was 40 years (38 years of males, 45 years of females). Maximum age of female was 89 years (of male – 75).

**Place of residence**

Comparing the place of residence 58.9% (145) urban and 41.1% (101) rural residents were found. During the analysis we tried to realize the place where injury occurred. In most cases we achieved this information and provided analysis on this base.

**Anatomical site**

Analysis of the anatomical area burned is shown in Table 1. The hands entirely were burned in 35 (14.2%) cases. The study revealed that 40 (16.3%) patients were admitted with burned left hand only, 69 (28.0%) – with right, and 137 (55.7%) with burned both hands. There were no significant differences comparing the patients’ hand burns by left, right or both burned hands (P=0.05). In most cases hand burns were also accompanied by other burns of the body. The areas with a higher incidence of burns were the arm(s) (63.4% of the admissions), followed by burns group of the face, head, neck (56.5%) and trunk (50.8%). Burns of rump and genital organs were observed in 13.4%. The median TBSA burned was 12% (in 1985 – 12; in 1995 – 13; in 2001 – 13; and in 2002 – 11).

**Etiology of burns**

Fire (71.9%) was the most common cause of injury; scalds were the second most common one (15.4%) (Table 2). There were no significant differences comparing the etiology factors by the year (P>0.05) and sex (P>0.05).

**Depth of burn**

Analyzing the depth of burn, 11% (27) partial-thickness and 89% (219) full-thickness hand burns were found. We found that mostly fire, scalds and contact with hot surface caused full-thickness hand burns. There were no significant differences analyzing the depth of burn and etiology factors such as fire, scalds and contact burns by the year (P>0.05, Cramer’s V=0.18). Fig. 1 shows distribution of patients according to the depth of burn, the place of residence and the year. Comparing the depth of burn and the place of residence, the urban patients had less full-thickness hand burns in 2001/2002-year group (P<0.05 compared to 1985/1995-year group).

**Table 1. Analysis of the anatomical burn area of patients (P<0.05 compared to 1985)**

<table>
<thead>
<tr>
<th>Hand burns (with)</th>
<th>1985</th>
<th></th>
<th>1995</th>
<th></th>
<th>2001</th>
<th></th>
<th>2002</th>
<th></th>
<th>Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Wrist(s) and hand(s) only</td>
<td>11</td>
<td>16.9</td>
<td>6</td>
<td>17.6</td>
<td>5</td>
<td>8.3*</td>
<td>13</td>
<td>14.9</td>
<td>35</td>
<td>14.2</td>
</tr>
<tr>
<td>Upper limb(s)</td>
<td>16</td>
<td>24.6</td>
<td>5</td>
<td>14.7</td>
<td>17</td>
<td>28.3</td>
<td>23</td>
<td>26.5</td>
<td>61</td>
<td>24.8</td>
</tr>
<tr>
<td>Face, head and neck</td>
<td>12</td>
<td>18.5</td>
<td>8</td>
<td>23.5</td>
<td>15</td>
<td>25.0</td>
<td>21</td>
<td>24.1</td>
<td>56</td>
<td>22.8</td>
</tr>
<tr>
<td>Trunk</td>
<td>13</td>
<td>20.0</td>
<td>7</td>
<td>20.7</td>
<td>13</td>
<td>21.8</td>
<td>15</td>
<td>17.3</td>
<td>48</td>
<td>19.5</td>
</tr>
<tr>
<td>Rump and genital organs</td>
<td>4</td>
<td>6.2</td>
<td>2</td>
<td>5.9</td>
<td>2</td>
<td>3.3</td>
<td>2</td>
<td>2.3</td>
<td>10</td>
<td>4.0</td>
</tr>
<tr>
<td>Lower limb(s)</td>
<td>9</td>
<td>13.8</td>
<td>6</td>
<td>17.6</td>
<td>8</td>
<td>13.3</td>
<td>13</td>
<td>14.9</td>
<td>36</td>
<td>14.7</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>100</td>
<td>34</td>
<td>100</td>
<td>60</td>
<td>100</td>
<td>87</td>
<td>100</td>
<td>246</td>
<td>100</td>
</tr>
</tbody>
</table>

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Socioeconomic status
The patients were divided into six groups in order to describe the socioeconomic status. The groups were: working, non-working, registered jobless, disabled, students and pensioners. Table 3 shows the distribution of patients according to the socioeconomic status and the year. Analysis of the period showed significant difference in working group each year. During 1985 working patients had more hand injuries than in 1995, 2001, or 2002 ($P<0.05$). Comparing the depth of burn and socioeconomic status working and non-working patients had more full-thickness burns than other groups each year ($P<0.05$, Cramer’s $V=0.72$).

Length of hospital stay and time of surgical procedures
The median of hospital stay was 24 days (in 1985 – 35; in 1995 – 41; in 2001 – 21.5; and in 2002 – 19); the average was 28.6 days (in 1985 – 36.4; in 1995 – 34.8; in 2001 – 24.9; and in 2002 – 23). Analyzing the patients by skin grafting, early skin grafting appeared in 43 (29.4% of all operated) cases, delayed – in 103 (70.6%) ones. Fig. 2 shows distribution of patients according to skin grafting and the year. Comparing the skin grafting by the year, delayed skin grafting was performed less in 2002 ($P<0.05$ compared to 1985) and much less in 2001/2002-year group ($P<0.005$ compared to 1985/1995). Early skin grafting

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**Table 2. Distribution of patients by the etiology factors and the year of burns**

(P>0.05 compared to 1985)

<table>
<thead>
<tr>
<th>Etiology factors</th>
<th>1985</th>
<th>1995</th>
<th>2001</th>
<th>2002</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Fire</td>
<td>42</td>
<td>64.6</td>
<td>26</td>
<td>76.4*</td>
<td>43</td>
</tr>
<tr>
<td>Scalds</td>
<td>15</td>
<td>23.0</td>
<td>2</td>
<td>5.8</td>
<td>11</td>
</tr>
<tr>
<td>Electricity</td>
<td>4</td>
<td>6.1</td>
<td>2</td>
<td>5.8</td>
<td>0</td>
</tr>
<tr>
<td>Chemical</td>
<td>1</td>
<td>1.5</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Contact</td>
<td>3</td>
<td>4.6</td>
<td>4</td>
<td>11.7</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>100</td>
<td>34</td>
<td>100</td>
<td>60</td>
</tr>
</tbody>
</table>

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**Fig. 1. Distribution of patients by the depth of burn, the place of residence and the year**

*P<0.05 compared to 1985/1995 year group.

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was performed in 2001 and 2002 years mostly and gave better results in terms of shortened hospital stay ($P<0.05$). Some patients with early or delayed skin grafting have also had an amputation. The ablation was provided for fingers (17 cases), hand (1 case), forearm (2 cases) or even arm (1 case) (5). The most common causes of injury in these cases were fire, electricity and contact burns.

**Relation to alcohol abuse**

The study revealed that 17.1% (42) of males and 3.7% (9) of females were drunk at the time of the injury. Comparing the depth of burn and relation to alcohol abuse non-drunk patients had more full-thickness burns than the drunk ones (Cramer’s $V=0.70$). During 2002 non-drunk patients had less full-thickness burns than in 1985 ($P<0.05$) (Fig. 3).

**Discussion**

Thermal hand injuries, as the other burns, are characterized by varying degrees of skin and underlying structures damage, depending on the temperature, type of the heat source and the duration of exposure (1). The retrospective study examines how these and other factors such as patient’s age, sex, place of residence, socioeconomic status, relation to alcohol abuse, depth of burn, hospital stay and time of surgical procedure variate over the randomly selected four years.

According to sex analysis, hand burns, as other hand injuries, were more common in males (74.4%).

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Similar trends have been also reported in other countries (6, 7). Usually males are more involved in the situations where hand burns can occur. It is hard to provide the explanation why median age of females is higher than of males. We suppose that it could depend on longer females’ lifetime and socioeconomic environment. In 2002 significant rise of burned disabled and pensioner age patients was found. The tendency of elderly patients’ burns was observed. Comparing the etiology of burns the fire was the most common injury followed by scalds every year (8). In the reports of other authors scalds occur more frequently in younger patients and fire burns in the older ones (9). This analysis was carried out with regard to adult patients and confirmed the trend. Females had more contact and scald burns. Males sustained electrical injuries more often than females (10). However males predominate in all kinds of burns each year.

Analyzing the reports of other authors we did not find any data about relation to alcohol abuse at the time of injury. In our study we observed that sober patients have had more full-thickness burns than the drunken ones. We think that this result needs a correction. Most of the patients were admitted to local hospitals first and transferred to our Center of Burns later on. The average of lost hours was 67.4 (max 83.5 in 1995). From this point it is hard to obtain reliable information if patients were affected by alcohol or not, especially if there is no record. We suspect the percent of patients affected by alcohol during the time of injury to be much higher. The number of partial-thickness burns is low in our study due to limited number of beds available for such patients (they are mostly treated in local hospitals). This affected comparison of the depth of burn throughout the years. No reports about partial-thickness burns were received in 1995, because most patients with partial-thickness burns were treated in local hospitals. Full-thickness burns were usually caused by fire, scalds and contact with hot surface (11). No significant differences in the depth of burn and etiology factors such as fire, scalds and contact burns were found. Also we expected rural residents to sustain more full-thickness burns because of poor socioeconomic conditions and low background. Comparing the depth of burns and the place of residence, the urban patients had more full-thickness hand burns in 1985 and 1995. It shows the decreasing tendency of full-thickness hand burns in the urban area. The average TBSA had no statistical significant difference comparing the years. In this study the median of TBSA burned was 12% with the average of 15.5%. Similar trends have been reported by other authors (5, 11). Most patients with high TBSA burned had labile vital functions. Therefore the patients could obtain only delayed skin grafting and surgical treatment. The hand comprises 5% of TBSA.

Fig. 3. Distribution of patients by the relation to alcohol abuse, the depth of burn and the year

*P<0.05 compared to 1985.
Meshed split-thickness dermal auto-grafts are used to cover burned hand areas. Using these auto-grafts additional burns area could be covered and survival chances increased (12, 13). Some authors found no differences in postburn surgery time. Analyzing early and delayed skin grafting significant difference in the length of hospital stay was found (14). Our study confirmed the advantage of early skin grafting in deep hand burns treatment that was reported by other authors. In 2001 and 2002, an early skin grafting was performed until the 7th postburn day, the length of hospital stay was reduced and it was found to be more cost-effective (4, 15). Usually the hands are not the only burned part of the body (11). During the injury the hands are used to avoid the burns of other body parts and are also burned. As we realized during the study the areas with a higher incidence of burns are the face, head, neck and trunk.

Using the data of our department we tried to prognose how many patients will sustain deep and superficial hand burns during the next year. For this purpose we invoked the method of linear regression. We found that deep hand burns have tendency to increase as well as superficial ones. Number of superficial hand burns would increase by function $y=-962.45+0.486*\text{year}$ and during 2005, 12 patients would sustain superficial hand burns. Also we found that the number of patients with deep hand burns would increase by function $y=-444.87+0.25*\text{year}$ and a presumable number of patients will be 56.

**Conclusions**

The fire was the most common cause of burns followed by scalds and had the considerable lead particularly each year and usually caused the full-thickness injuries. The full-thickness hand burns occurred less to working people and urban patients in 2001 and 2002 and the downtrend of full-thickness burns for urban residents is observable. The non-drunkens patients had more full-thickness hand burns each year but less in 2001 and 2002. The early skin grafting was found to give better results in the length of hospital stay and should be the first choice in the treatment of deep hand burns.

**Suaugusių pacientų, nudegusių plaštakas 1985, 1995, 2001 ir 2002 metais ir gydytų hand burns.**

Kęstutis Maslauskas, Rytis Rimdeika, Žilvinas Saladžinskas, Tadas Ramanauskas

Kauno medicinos universiteto klinikose, epidemiologija ir gydymas

**Raktas:** rankos nudegimas, rankos sužeidimas, epidemiologija, etiologija, autodermoplastika, ankstyvoji autodermoplastika.


Adresas susirašinėjimui: K. Maslauskas, KMUK Chirurgijos klinikos Plastinės chirurgijos skyrius, Eivenių 2, 50010 Kaunas. El. paštas: m.kestas@one.lt

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