THE INDEX OF BURNING AND ITS PRACTICAL SIGNIFICANCE

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It is known from practice that between the degree of combustion and the extent of the burned surface exists a certain proportional inter-relation. The greater the burned surface is, the higher the possibility is that areas of deep burning exist. As far as prognosis of burning is concerned, age plays an important role, as well as some concurrent disorders.

Various authors in different years have made efforts to approach these problems mainly from four directions:


4. To combine the foregoing moments in order to foresee the outcome of the disorder (J. J. Janelidze, 1960, G. Frank, 1960).

No doubt that the burned surface is a very important key point in the treatment and prognosis of burns. Although up to the present there exists no precise method for its calculation, it may be estimated with sufficient precision even at the very beginning, with the first examination of the patient. As far as depth of burns is concerned, nowadays no reliable method exists for its elucidation in the initial moment, at the first processing of the combustion. A minimum of 4—5 days should elapse before the degree of the depth of burns is delineated, particularly in burns of IIIa, IIIb and IV degree (partial burn of the skin, burning of all cutaneous layers and carbonization). At the beginning it is even more difficult to establish the precise surface of the different degrees of burns.

In older statistics the material is usually processed with no regard for the age of the patient and the existing relation between age factor and mortality rate. In this regard modern statistics offer a somewhat more precise data.
Some institutions and authors claim that total mortality rates in individuals aged between 45—60 years are about threefold higher than mortality rates in the age group between 15—44 years and in individuals over 60 years — nearly tenfold. Moreover, attempts are made to calculate probability values in mortality rates for each age group and for the various sizes of burned surfaces (Bull and Squire, 1949, Bull and Fischer, 1957, Burns, 1957). In this way, Bull and Fischer assume that with equal extent of the affected area, a III grade burn is fourfold more severe than a II grade burn. According to Arzt and Reiss — twofold. The authors themselves point out that to a large extent these are only theoretical suggestions.

G. Frank (1960) attempts to compensate the lack of precise method for recording the actual surface of burns and their depth by means of the so-called “prognostic index” (Pr. J.) which sums up in one figure the surface and the depth of burns. For each grade of burns he takes from practice one factor (a multiplier) by which he multiplies the percentile prevalence of the different grades and sums the resulting figures. For example, in a I grade burn, being the mildest form, in which no wound formation takes place, but only a slight lesion and hyperemia, the multiplier is 0.5. In superficial burns of II grade this index is equal to 1. In deeper burns, but with preserved elements of the germinative layer and sweat and sebaceous glands, Frank uses as a factor or multiplier the number of 2, in complete burning of the III grade burn — the factor equals 3, and in a IV grade burn — 4. Expressing the characteristics of a burn in a mathematical fraction, he takes into consideration the age and some of the accompanying disorders (which according to him represents a further development of the thought of Djanelidze) (after Vilyavin). In this way, according to Frank, a IV grade burn in a patient aged 54 years with diabetes will be expressed in the following fraction:

\[
\frac{48\% \text{ I gr.} + 10\% \text{ II, gr.} + 10\% \text{ III, gr.} + 8\% \text{ IV, gr.} + 10\% \text{ 54 diabetes}}{101} \quad \text{(Pr. J)}
\]

The number 101 in the denominator represents the prognostic index and results from summing up of the separate products (I gr. 10%*0.5+ II gr. — 10%*1+III gr. = 10%*3+IV gr. — 10%*4= 5+10+16+30+40=101. The author has investigated this method in 2000 cases of burned patients, treated in the department for burned patients at the Kun-Utica Hospital in Budapest. He claims that between the prognostic index and mortality rates there exists a definite relationship. In his opinion, the higher the index of burning is, the higher the mortality rates are.

This index cannot be estimated during the first hours after burning, i.e. at the moment of primary surgical aid. Therefore, it cannot be used as an index determining also the necessary therapeutic measures. Inadequacy exists also in the evaluation of the separate components of burns. For all these reasons we elaborated a burn index after some other criteria, which provide not only a prognostic value, as is the index of Frank, but also have a certain diagnostic and therapeutic meaning. The grades IIIa and IIIb (respectively II_1 and II_2 of Frank) are not
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The index of burning is taken into consideration in evaluating the index. The reason for that is the fact that in the early hours, in the primary dressing of the burns, they are not always well delineated and may advance in the following hours and eventually become even more marked. Only the deepest degree is therefore recorded (I, II, III, IV).

The factors-multipliers in calculating the index of burns for the various grades are the following — I grade — 0.5; II grade — 1; III grade — 2; IV grade — 3.

As far as the surface is concerned, instead of calculating the surface for each grade separately, as Frank does (the error would inevitably be greater) we calculate only the total surface of burning, which may be determined even at the first examination of the patient and, moreover, with a relatively high precision. For the purpose we use the net-schemes of Vilyavin, the tables of Berkov, etc., the respective corrections for burns in children being also made.

To calculate the index of burning we multiply the figure of the total burned surface with the respective factor-multiplier, corresponding to the deepest degree of burning in the definite case. For example, in a burning involving 40% of the body surface, in which along with other degrees of burning, there are areas of grade IV burns (carbonization) we multiply 40 by the factor 3 = 120. If we have another burn with the same surface of 40%, but the deepest areas belong to grade III (IIIa or IIIb), the product will be expressed as 40X2 = 80. Recording the relationship between age and the course of the morbid process, we add another factor-multiplier, related to the different age groups, and take into consideration the particularities of each age group and the way each group tolerates burns. Children under the age of 3 years and old people above 60 years tolerate burns poorly. Comparatively best tolerated are burns by individuals aged between 14 and 40 years. The remaining age groups take an intermediate position. Old people over 60 years of age exhibit identical tolerance with children under 3 years for one more reason: old people are age affected as concerns their cardiovascular, respiratory and other systems, they also suffer from other accompanying disorders. The factors-multipliers, corresponding to the various age groups are the following: from 0—3 years — factor 3; from 3—4 years — factor 2; from 14—40 years — factor 1; from 40—60 years — factor 2, and over 60 years — factor 3.

Therefore the aforementioned examples would acquire the following appearance: in a child aged 2 years the product of burn index would be: 40X3X3 = 360 (or the burn index in this case would equal 360). The same burn of 40% with the deepest areas belonging to grade III in the same 2 years old child would have a burn index 240 (which is the result of multiplying the surface 40 by the depth factor 2 and the age factor 3 = 240). If the same percentage of grade III burned surface is observed in an individual aged 20 years, the burn index would be: 40X2X1 = 80 — the two figures correspond to the clinical course and represent an indication concerning the outcome of the disorder. One and the same burning in a 20 years old individual would run a considerably more favourable course as compared with that in a child aged 2 years (in this case threefold milder). It becomes evident from the aforementioned examples that
the greater the product, the more severe the burn and the higher the mortality rates would be. Therefore, a more energetic intervention is required for control of shock and for the accomplishment of other measures of resuscitation.

We treated 62 patients with burns hospitalized in the Clinic of Propedeutic Surgery at the Higher Medical Institute in Varna for the period of 1962—1963. Our observations convinced us in the practical value of our method of calculation of the index of burns. In order to study the problem on a large number of patients we made calculations with the case histories of the District Hospital in Varna for 10 years (1950—1960) and once again our results were confirmed (a total of 200 burns).

On the basis of the clinical picture, the surface, the depth and the paraclinical findings we distributed the patients into 4 groups according to the severity of the course of burns, as follows:

I group — mild burns — from I and II grade, small surface (up to 5%), discharged on the first week after the onset of the disorder with no changes in the paraclinical examination and unaffected by the age factor.

II group — burns of moderate severity, belonging mainly to grade II, with a greater surface (up to 30%), affected or unaffected by the age factor with inconsiderable findings on the paraclinical examination, mandatory or not of resuscitating intravenous infusions on admission to hospital.

III group — severe burns — involving considerable surface (above 30%), usually belonging to grade III, with marked disturbance of fluid, electrolyte and protein balance demanding systematic measures for resuscitation, plastic operations being on some of them.

IV group — extremely severe burns — which borders with life incompatibility, up to grade IV (carbonization, of a surface up to 70%), requiring incessant measures for resuscitation, multiple plastics and energetic attempts to control of cahexia of the wound.

The following table represents the burn indices calculated for the different clinical groups. Figures in parenthesis represent the number of deaths.

It becomes clear from the Table that the higher the value of burn index is, the more severe the burning is and the higher the mortality rates are. Figures above 300—400 are frequently incompatible with life, whereas index between 80—100 almost never gives lethal outcome. The great diversity of the various burns, their clinical course depending upon the surface, the depth and the age of the patient are expressed in a wide diapazone between the figures of 0 and 1200.

In this way a better notion is created on the diversity of clinical material, on life incompatibility in severe burns and on the value of diagnostic and therapeutic achievements. Comparatively low values for burn index in some patients belonging to grade III (below 10 in number) may be explained with space limited, but deeper burns on the face, hand and other functionally important areas of the human body. Index 24, encountered in one patient in group I is related to a broad I grade burn, running a mild course and healed for several days.
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<table>
<thead>
<tr>
<th>Table 1</th>
<th>Index of burns in 200 patients for the period 1950—1963</th>
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<tr>
<td>I group (53 patients)</td>
<td>4, 5, 5, 4, 5, 5, 5, 5, 5, 5, 4, 5, 4, 5, 2, 5, 4, 5, 5, 3, 5, 1, 1, 11, 7, 10, 10, 7, 8, 12, 8, 8, 8, 14, 10, 10, 15, 10, 10, 10, 10, 10, 10, 10, 10, 10, 2, 8, 6, 6, 6, 2, 6, 7, 9, 2, 24, 6.</td>
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<tr>
<td>II group (106 patients)</td>
<td>60, 30, 48, 40, 30, 9, 30, 18, 30, 18, 30, 15, 30, 36, 36, 27, 42, 27, 36, 12, 30, 42, 27, 12, 45, 42, 15, 15, 30, 30, 30, 24, 40, 45, 45, 9, 36, 20, 30, 20, 8, 16, 24, 16, 30, 30, 14, 18, 20, 20, 20, 4, 16, 16, 20, 22, 30, 10, 4, 10, 10, 10, 15, 16, 10, 10, 18, 24, 11, 20, 16, 10, 10, 18, 18, 40, 40, 40, 60, 32, 40, 30, 40, 40, 36, 36, 60, 7, 14, 15, 6, 8, 48, 6, 54, 6, 54, 36, 36, 24, 12, 3, 6, 18, 3, (66).</td>
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<tr>
<td>III group (29 patients)</td>
<td>90, 135, 108, 180, 120, 120, 150, 90, 36, 28, 36, 80, 160, 210, 148, 30, 72, 216, 60, 125, 120, 102, 72, 36, 96 (282), (180), (280), (270).</td>
</tr>
<tr>
<td>IV group (12 patients)</td>
<td>360, 320, 320, 200 (360), (376), (376), (450), (658), (560), (480), (560).</td>
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</table>

In conclusion, the proposed burn index renders evaluation of severity of burns more easy, gives a proper orientation for the necessary plastic procedures and determines the prognosis of burns.

Conclusions

1. In everyday practice with burned patients a necessity occurs of definite indices to determine the severity of burns and the appropriate measures to be undertaken. This may be of great importance in wartime conditions when mass burns occur. It may serve for proper assortment and evacuation of burned individuals.

2. The proposed burn index may be calculated at the very beginning, on admission to hospital, and first dressing of burned areas.

3. The index proposed is based on clinical experience and is indicative of the prognosis of the disorder.

REFERENCES

Индекс ожога и его практическое значение
Меруды Генова

Резюме

Автор предлагает при госпитализации больных с ожогами, наряду с другими исследованиями и данными, исчислять и т. н. индекс ожога, который представляет собой произведение общей площади ожога умноженного на специально выработанные факторы возраста и глубины ожога. Индекс вычислен у 200 больных с ожогами, леченных в Пропедевтической хирургической клинике МВИ и хирургических отделениях Варненской окружной больницы. Ожоги были группированы в зависимости от тяжести течения в 4 клинические группы: легкие, средние, тяжелые и крайне тяжелые. Указывается на значение индекса в отношении оценки прогноза, в особенности при массовых ожогах и во время войны.