PhD THESIS

CURRENT ETIOPATHOGENIC AND THERAPEUTIC CONSIDERATIONS IN SUDDEN DEAFNESS

SUMMARY

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**KEY WORDS:**

Sudden deafness, etiopathogenesis, audiometry, therapeutic protocol
I. IMPORTANCE OF THE PROBLEM, MOTIVATION OF THE PAPER

The sudden deafness is an important problem in otorhinolaryngology, representing a medical emergency and the rapid establishment of the treatment, by the presentation of the patients to the doctor, as early as possible, is essential in the recovery of hearing.

There is no diagnostic and therapeutic protocol of sudden deafness unanimously accepted in the specialty literature, so we tried to outline these protocols based on our personal clinical experience.
II. MATERIAL AND METHOD

1. SCOPE OF THE PAPER

- detection of neurosensorial hypoacusis type (cochlear or retrocochlear)
- establishment of a diagnostic protocol which shall help us in exactly establishing the causes of sudden deafness
- establishment of a therapeutic protocol applicable in all cases, which will be modeled depending on the needs, reactivity and comorbidities of each patient.

2. The objectives of the research were:

- analyzing and interpretation of data from the specialty literature in respect to sudden deafness
- comparing data obtained from our experience with those from specialty literature
- updating of deaf aid anatomy and physiology notions, establishing the particularities of inner ear vascularization
- research of diagnostic procedures which help us to establish the etiopathogeny of sudden deafness: clinical, paraclinical, co-morbidities
- synthesizing the treatment schemas used in sudden deafness with the particularities determined by possible etiologies of the disease
- evaluation of results obtained in our section, compared to those from the specialty literature.

2. MATERIAL AND METHODS

1. Clinical-statistical study

In the elaboration of the doctoral thesis, I had at my disposal the consultation sheets of the patients hospitalized during the period 1st of January 2006 – 31st of December 2010 in the ENT clinic from County Emergency Clinical Hospital Craiova. During this period, 90 patients were hospitalized. The realization method was clinical-statistical, making a prospective and retrospective study of idiopathic sudden deafness cases, which were hospitalized, investigated and treated within the clinic. The study is based on the observation of the particular case.

2. Anatomo-clinical study

A second study deployed by me was an anatomo-clinical study in order to research the vascularization of the inner ear starting from the unanimously accepted conclusion according to which the vascular etiology is the most frequently met in SBI.
III. SUMMARY OF THE MAIN RESULTS

1. Distribution of patients with sudden deafness on years of study

<table>
<thead>
<tr>
<th>Years of Study</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nr. patients</td>
<td>1672</td>
<td>1814</td>
<td>2680</td>
<td>2861</td>
<td>2218</td>
<td>11245</td>
</tr>
<tr>
<td>Rates</td>
<td>14.87%</td>
<td>16.13%</td>
<td>23.83%</td>
<td>25.44%</td>
<td>19.72%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Table no. 1 – Incidence of patients with sudden deafness depending on the other ENT diseases

2. Distribution of patients with sudden deafness on age groups

<table>
<thead>
<tr>
<th>Age</th>
<th>10-19</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
<th>70-79</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. patients</td>
<td>2</td>
<td>7</td>
<td>11</td>
<td>19</td>
<td>21</td>
<td>15</td>
<td>15</td>
<td>90</td>
</tr>
<tr>
<td>Rates</td>
<td>2.22%</td>
<td>7.78%</td>
<td>12.22%</td>
<td>21.11%</td>
<td>23.33%</td>
<td>16.67%</td>
<td>16.67%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
3. Distribution of patients depending on profession

<table>
<thead>
<tr>
<th>No. patients</th>
<th>Pensioners</th>
<th>Employees</th>
<th>Idles</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rates</td>
<td>46.67%</td>
<td>33.33%</td>
<td>13.33%</td>
<td>6.67%</td>
</tr>
</tbody>
</table>

4. Distribution of patients with sudden deafness depending on the presentation interval from the starting moment until hospitalization

The presentation interval from the starting moment of the deafness until the presentation to the doctor, respectively the establishment of the treatment, is essential in establishing the prognostic.

Analyzing the consultation sheets regarding the starting history of the disease until the presentation to the doctor, we found the following:

<table>
<thead>
<tr>
<th>Presentation Interval</th>
<th>No. patients</th>
<th>Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24 hours</td>
<td>15</td>
<td>16.67%</td>
</tr>
<tr>
<td>24-72 hours</td>
<td>22</td>
<td>24.44%</td>
</tr>
<tr>
<td>4-10 days</td>
<td>29</td>
<td>32.22%</td>
</tr>
<tr>
<td>10-30 days</td>
<td>20</td>
<td>22.22%</td>
</tr>
<tr>
<td>&gt;30 days</td>
<td>4</td>
<td>4.44%</td>
</tr>
</tbody>
</table>
5. Distribution of patients with sudden deafness from the point of view of associated diseases

<table>
<thead>
<tr>
<th></th>
<th>No. patients</th>
<th>Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardio-vascular diseases</td>
<td>65</td>
<td>72.22%</td>
</tr>
<tr>
<td>Metabolic diseases</td>
<td>51</td>
<td>56.67%</td>
</tr>
<tr>
<td>Viral diseases</td>
<td>11</td>
<td>12.22%</td>
</tr>
<tr>
<td>Other diseases</td>
<td>3</td>
<td>3.33%</td>
</tr>
</tbody>
</table>

From the study realized, we noticed that HTA is the most frequent associated disease, fact which confirms the vascular etiology that many authors consider primordial in the sudden deafness.
6. Distribution of patients depending on the subjective clinical symptomatology

<table>
<thead>
<tr>
<th>Symptom</th>
<th>No. patients</th>
<th>Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoacusis</td>
<td>90</td>
<td>100.00%</td>
</tr>
<tr>
<td>Tinnitus</td>
<td>63</td>
<td>70.00%</td>
</tr>
<tr>
<td>Vertigo</td>
<td>32</td>
<td>35.56%</td>
</tr>
<tr>
<td>Others: nausea, emesis, disequilibrium</td>
<td>12</td>
<td>13.33%</td>
</tr>
</tbody>
</table>

7. Distribution of cases studied depending on the degree of hearing losses

In the lot studied, we met 5 patients (5,56%) with slight hypoacusis (30-49 dB), 40 patients (44,44%) with average hypoacusis (50-59 dB), 24 patients (26,67%) with severe hypoacusis (70-89 dB), 21 patients (23,33%) with serious hypoacusis (>90dB).

8. Distribution of cases depending on audiometric frequencies affected

We met the affection of high frequencies to 48 patients (53,33%), of low frequencies to 24 patients (26,67%), and the affection of all frequencies to 18 patients (20%).
The frequencies taken in consideration for the study were: 250, 500, 1000 Hz – for low frequencies and 2000, 4000, 8000Hz – for high frequencies.

9. Distribution of cases studied depending on the ear affected

In most cases, the affection of the ears was unilateral (76 patients), compared with the unilateral with slight predominance of the affection of left ear (15,56%).

10. Distribution of patients with sudden deafness depending on the degree of hearing recovery

After the administration of the treatment with perfusions, we reevaluated the hearing function in 10 days and 1 month. We obtained the following distribution:

- 65 patients (72,22%) had a favorable evolution in 10 days
- 25 patients (7,78%) had a stationary evolution in 10 days

In 1 month from the hospitalization moment, the distribution of the patients with sudden deafness after the recovery of the hearing was the following:

- 51 patients (56,67%) had a favorable evolution in one month
- 18 patients (20%) had an unfavorable evolution in one month
- 21 patients (23,33%) weren’t presented in one month
DISCUSSIONS ON THE THERAPEUTIC STUDY

1. DISCUSSIONS RELATED TO THE DISTRIBUTION OF PATIENTS WITH SUDDEN DEAFNESS ON YEARS OF STUDY

In the study effectuated for a period of 5 years, we noticed an increase of cases of sudden deafness. We explained the increase by the augmentation of risk factors: high environmental and occupational disease, trepitations, smoking, alcohol consumption, stress, hyperglucidic and hyperlipidic alimentation, sedentary lifestyle, increase of autoimmune, metabolic, cardiovascular and neurologic diseases, etc. Herewith, the number of specialists increased and the diagnostic methods improved in last years. It shall be also considered that the degree of sanitary education of patients increased.

2. DISCUSSIONS RELATED TO THE DISTRIBUTION OF PATIENTS WITH SUDDEN DEAFNESS DEPENDING ON AGE GROUPS

After the study effectuated, we found that the incidence of the disease increased once with the age; 77 patients representing 76% from patient had the age over 40 year, and the maximum incidence was situated in the age group 50 – 59 years old (23, 33% from cases, respectively 21 patients), with connotations on the general health condition, on the comorbidities and on the possibilities of post-therapeutic recovery.

In this age group are included the active patients from the social point of view, so exposed to noxae both to the place of work and in their free time and, because of the age most of them present cardiovascular risk factors.

We registered a reduced number of cases in the extreme age group taken in study, 10 – 19 years (2,22% from the total of patients). They presented a viral etiology. It shall also be considered the fact that the sanitary education degree of patients increased.

3. DISCUSSIONS RELATED TO THE DISTRIBUTION OF PATIENTS WITH SUDDEN DEAFNESS DEPENDING ON ENVIRONMENT OF ORIGIN AND SE

In our study, we noticed a distribution of almost 3 times higher to patients in urban areas than those in rural areas. From the rural areas came 27 patients, representing 30% from cases, compared to 63 patients from the urban areas, representing 70% from cases. We put this distribution on the account of the greater exposure to noxe in the urban area, according to the rural area. Is about: phonic pollution, occupational activity in industry, traumas, stress, and sedentary lifestyle. Herewith, there is the lower possibility of access to medical specialty services in the rural area and of the medical education degree and availability to present to the doctor, more reduces in rural areas.
4. DISCUSSIONS RELATED TO THE REPARTITION OF PATIENTS WITH SUDDEN DEAFNESS AFTER THE PRESENTATION TO THE DOCTOR

There is an inverse correlation between the time passed from SBI establishment, the first visit to the doctor and the autiometric progression (the difference between the initial level of the audiogram and the final level). Thus, if the period between the debut of hypoacusis and the moment of the presentation to the doctor is bigger, then the difference between the levels of audiogram at presentation moment and after the treatment is lower.

In our study, we also noticed a correlation between the age of the patient and the moment of the presentation to the doctor, as it can be seen in the table below:

<table>
<thead>
<tr>
<th></th>
<th>&lt;24 hours</th>
<th>24-72 hours</th>
<th>4-10 hours</th>
<th>10-30 hours</th>
<th>&gt;30 hours</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40 years</td>
<td>7 (35.00%)</td>
<td>6 (30.00%)</td>
<td>3 (15.00%)</td>
<td>3 (15.00%)</td>
<td>1 (5.00%)</td>
<td>20</td>
</tr>
<tr>
<td>40-60 years</td>
<td>6 (15.00%)</td>
<td>7 (17.50%)</td>
<td>19 (47.50%)</td>
<td>7 (17.50%)</td>
<td>1 (2.50%)</td>
<td>40</td>
</tr>
<tr>
<td>&gt;60 years</td>
<td>2 (6.67%)</td>
<td>9 (30.00%)</td>
<td>7 (23.33%)</td>
<td>10 (33.33%)</td>
<td>2 (6.67%)</td>
<td>30</td>
</tr>
<tr>
<td>No. patients</td>
<td>15 (16.67%)</td>
<td>22 (24.44%)</td>
<td>29 (32.22%)</td>
<td>20 (22.22%)</td>
<td>4 (4.44%)</td>
<td>90</td>
</tr>
</tbody>
</table>

Evaluating, by means of the test Chi quadrate, the influence of the age of patients of the rapid presentation to doctor, we objectified the existence of a relation between these two factors, the value p being significant from the statistic point of view p = 0.042 < 0.05. In general, younger patients, under 40 years old, go to the doctor in the first 3 days, those with ages between 40 – 60 years, who are part of the active population, go to the doctor in the period 4 – 10 days, and those with ages over 60 days go to the doctor in similar proportions, between 24 – 72 hours, between 4 – 10 hours or between 10 – 30 days.

5. DISCUSSIONS

Discussions related to the distribution of patients with sudden deafness depending on the associated vascular diseases.

In our study, we met the vascular ethnology to most of cases with sudden deafness.

There are several mechanisms involved in the vascular pathogeneses: spasm, thrombosis, embolism, coagulopathies etc, all these determining the interruption of circulation at the level of cochlea with secondary ischemia, more or less serious, depending on the duration of the interruption of the flux and the degree of lesions produced.
In order to better understand the vascular mechanism responsible for most of cases of sudden deafness, we effectuated an anatomo-clinical study by means of which we illustrated the vascularization of inner ear by the injection of colored gelatin in the inner carotid artery to cadavers. Thus, we illustrated the various variants of origin of labyrinthic artery and the reports with adjacent anatomic structures and the different localization in the region of the inner hearing conductive, fact which explains the diversity of the manifestations in this affection.

Dissection with operatory microscope of vascular-nervous elements at the level of inner hearing pore (adult, case 1). After the selection of facial (5) and vestibulocochlear nerves (4) are noticed fine arteriolar branches which break from the antero-inferior cerebellar artery (1) and enter in the inner hearing meatus (2); 3 – entry in the inner hearing meatus;

Dissection with operatory microscope of vasculo-nervous elements at the level of inner hearing pore (adult, case 1). Branches of antero-inferior cerebellar artery (1) in the proximity of inner hearing pore; 2 – labyrinthic artery; 3,4 – branches for the vestibulocochlear.

6. DISCUSSIONS RELATED TO THE ASSOCIATION OF PATIENTS WITH SUDDEN DEAFNESS WITH RESPIRATORY DISEASES.

In the lot studied by us were 11 patients who presented an episode of IACRS in last 10 days before the establishment of hypoacusis, representing 12.22% from cases taken for the study. These patients were young persons who presented suggestive symptoms for the presence of a viral infection: skin sores, acute rhinopharyngitis, inflammatory adenopathy, fever. 4 patients from them (36.66%) presented bilateral hypoacusis.
7. DISCUSSIONS RELATED TO THE DISTRIBUTION OF PATIENTS WITH SUDDEN DEAFNESS DEPENDING ON THE ASSOCIATED METABOLIC DYSFUNCTIONS

a) dyslipidemias represent a major risk factor in SBI

Excepting the genetic factors involved in the diminution of HDL level, the studies showed the association of three factors: smoking, sedentary lifestyle and obesity. An increase of the level of triglycerides, associated with the decrease of cholesterol HDL concentration represents an important atherogenic factor and the high level of triglycerides induces a slight hypercoagulability which predisposes to thrombosis on small cerebral and coronary vessels

b) diabetes determines microangiopathy and neuropathy, representing an important risk factor in SBI.

c) obesity determines systemic atherosclerotic lesions

8. DISCUSSIONS RELATED TO THE ASSOCIATION OF SUDDEN DEAFNESS WITH IMMUNE AFFECTIONS

In our study, we effectuated various tests in order to find the autoimmune cause, to patients with bilateral neurosensorial hypoacusis (14 patients), and also to other young patient to whom we didn’t suspect another etiology. We found 8 cases (representing 8,8%) with changed unmentioned laboratory tests (serum complement, VSH, rheumatoid factor, anti-nuclear factor, anti-microsomial factor and anti-cardiolipidic factor), for which we recommended the continuation of investigations.

9. DISCUSSIONS RELATED TO THE DISTRIBUTION OF PATIENTS WITH SUDDEN DEAFNESS DEPENDING ON THE DIAGNOSTIC PROTOCOL

Tonal laminar and vocal audiograms were recommended to all patients taken in the study, immediately after presentation, they being the base of the diagnostic and, at the same time, the reference point for its treatment and efficiency.

10. DISCUSSIONS RELATED TO THE DISTRIBUTION OF PATIENTS WITH SUDDEN DEAFNESS DEPENDING ON THE THERAPEUTIC PROTOCOL AND THE RECOVERY OF HYPOACUSIS

The therapeutic scheme used was represented by perfusions which included: corticosteroids, vasodilators, vitaminotherapy, anticoagulants, diuretics, antivirals (in case of the suspicion of a viral component), treatments of affections associated. After this treatment, the hypoacusis ameliorated
in greater or lower rate, depending on several factors, but all patients affirmed the disparity of acuphones after the 7 perfusion.

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>% Recovery</th>
<th>No. Patients Recovered</th>
<th>No. Patients Presented</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24 hours</td>
<td>86.67%</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>24-72 hours</td>
<td>77.27%</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>3-10 days</td>
<td>55.17%</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>10-30 days</td>
<td>35.00%</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>&gt;30 days</td>
<td>25.00%</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Comparing the average recovery of the deficit to patients whose low frequencies, respectively high frequencies were affected, by the test t of Student, we obtained a value $p = 0.047$, under the statistical significance threshold, fact which shows us that the recovery on low frequencies is, in an objective way, bigger than that from high frequencies.
IV. CONCLUSIONS

1. The sudden deafness represents the sudden increase of the hearing, in a higher or lower degree, with diverse etiopathogeny, being an unilateral or bilateral neurosensorial hypoacusis, of at least 30 dB, which affects 3 audiometric frequencies adjoined, produced in a period of maximum 72 hours.

2. The particular aspects of the anatomy and embryogenesis of inner ear, respectively of cochlea, explain its increased sensitivity to ischemia, and the variability of the vascularization so inter-individual, and also between the two ears, explain the preponderantly unilateral localization of the affection.

3. The incidence of sudden deafness in the years taken in consideration for the study was of 0,8% (90 patients) from the total of 11 245 patients hospitalized during the respective period (2006-2010), with a progressive annual increase.

4. The vascular pathology presents several mechanisms: spasm, thrombosis, embolism, hemorrhage, explained both by the anatomic particularities of cochlea and by the frequent association with various cardio-vascular affections (HTA, arterial fibrillation, ischemic cardiopathy, carotid atheromatosis etc.). Vascular changes were illustrated by imaging studies: carotid-vertebral Doppler echography and angioRMN.

5. The incidence of cardiovascular diseases was of 72,22%, from which we most frequently met HTA in 35,56% from cases, carotid atheromatosis in 21,11% from cases, ischemic cardiopathy in 18,89% from cases, and peripheral venous insufficiency in 13,33% from cases.

6. The association of metabolic dysfunctions with sudden deafness came in the support of vascular etiopathogenesis. After the study of audiograms of patients with diabetes, we noticed hearing losses firstly on the acute frequencies and then on the other frequencies.

7. We met the viral etiology of SBI in 12,22% from cases, these patients presenting a viral episode in last 10 days, most of them (80%) being patients from the age group 10-19 years old.

8. I suspected the immune etiology of sudden deafness to 8 patients (8,8%) who had unspecific changed markers (serum complement, rheumatoid factor, anti-nuclear factor, anti-microsomal factor, anti-cardiolipidic factor).
9. I found that the maximum incidence was situated in the age group 50-59 years old (23,33%), patients who were exposed both to the place of the work and during the free time, many of them also having cardiovascular diseases.

10. The distribution of cases depending of the environment of origin showed a greater distribution of patients from the urban areas (70%) compared to those from the rural areas (30%).

11. It was proved that an exposure to a noise greater than 85 dB determines a sudden hypoacusis and the smoking and the alcohol can be considered only favorable factors.

12. The tinnitus was the most frequent symptom associated with the hypoacusis, present in 50% cases (45 patients). For several times, the tinnitus represented the reason for the presentation to doctor and it was an infaust prognostic factor when it persisted after the hearing recovery.

13. The vertigo, debut sign of sudden hypoacusis, was met in 22 cases (25% from cases).

14. We found an inverse linear correlation between the time from the establishment of deafness, the first visit to the doctor and the audiometric progression. In the lot studied, the average time for the presentation to the doctor was 15 days with a maximum presentation during the interval 2 – 10 days, respectively 36%.

15. In the diagnostic protocol of sudden deafness, the audiogram was at the base of the diagnostic, filled with other investigations which helped us to establish the cochlear and retrocochlear location of the lesion.

16. The treatment was complex with vasodilators, cortisones, neuroborants, antioxidants, anticoagulants, antiviral depending on the etiopathogenesis of current deafness and comorbidities.

17. Hearing functional results after 10 days from perfusions were: favorable in 72% from cases and unfavorable in 28% from cases. Shall be mentioned the fact that in all cases the tinnitus and the vertigo disappeared (after the 7 perfusion).

18. The full hearing recovery was better to patients with a sudden deafness on grave frequencies (21,65% from patients), than to those with deafness of acute frequencies (43,2% from patients) or on all frequencies (16,2% from patients), but the presence of recurrences was bigger in case of affection of grave frequencies. The hearing deficit greater than 70 dB met to 50% from patients determined a reduced degree of recovery, especially in case of aged patients.

19. Being a vasculopathy, in most cases, in the diagnostic protocol of the sudden deafness carotid-vertebral Doppler echography and angioRMN should be included.
V. SELECTIVE BIBLIOGRAPHY