Age-Related Morphologic Changes in Hypoglossal Nerve Nuclei

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Abstract

Age-related damages in neural tissue may play a significant role in senescence manifestation. Morphologic changes in hypoglossal nerve nuclei dependent on aging were studied. The statistically significant loss of mean number of neurons in n. hypoglossus nuclei was revealed with age increase. The loss of neurons at maximal level was revealed in patients aged 91-100 years. These damages may result in impairment to the function of n. hypoglossus in elderly persons.
Keywords: n. hypoglossus, neurons, aging, senescence, loss of neurons, brainstem

1. Introduction

Aging as a universal phenomenon is the subject of findings in a large number of biomedical disciplines. More than 300 theories and hypotheses of aging represent various aspects of the essence of this phenomenon. Now cellular senescence is estimated “as a “causal nexus” that bridges microscopic subcellular damage with the phenotypic, macroscopic effect of aging. It is important to understand how the various types of subcellular damage correlated with the aging process lead to the larger, visible effects of the anatomical aging” (Bhatia-Dey et al., 2016).

The processes of aging in the central nervous system as the universal regulation unit requires the most comprehensive study. Age-related damages in neural tissue may play a significant role in senescence manifestation (Kolomiytsev, 2012). A great number studies indicate that age-dependent neuronal loss is common in neocortex and less expressed in brainstem structures (Frolkis, 1988).

The hypoglossal nerve is the twelfth cranial nerve, it performs motor innervation of the majority of the tongue muscles. Its main functions are swallowing control and speech articulation regulation.

Age-related morphologic changes in n. hypoglossus nuclei are not studied at all. In the study by Becker et al. (2015) the deficits in swallowing with aging were observed in rats but the cause for these impairments were not revealed.

The aim of the study: to reveal age-dependent morphologic damages in hypoglossal nerve nuclei expressed in progressive loss of neurons which may result in functional impairments.

2. Study Design

The main aim of the research was to reveal age-dependent morphologic damages in hypoglossal nerve nuclei expressed in progressive loss of neurons which may result in functional impairments and persistence of pathologic processes which can be estimated as dysregulation pathology.

3. Materials and Methods

The study was performed on autopsy material. Fragments of human medulla oblongata were fixed in 10% formaldehyde; standard histological processing was applied. Cross-sections of medulla oblongata were made and stained by means of histological and histochemical methods: toluidine blue, hematoxylin and eosin. The calculation of numbers of neurons in right and left nuclei of n. hypoglossus per field of vision (420x) was undertaken with mean number identification.
4. Results and discussion

50 autopsies were studied from subjects varying in age from 31 to 99 years. Acute myocardial infarction, chronic ischemic heart disease and acute bacterial endocarditis were considered as a principal disease in this work. Sex groups distribution: male- 27 (54%), female- 23(46%).

The following results were obtained.

1. Mean number of neurons in the right and left nuclei n. hypoglossi varies insufficiently in every case.

2. The study revealed progressive neuronal loss in hypoglossal nerve nuclei as age-related process. In the age group of 31-40 years the mean number of neurons per field of vision equals 38.5, in the group of 41-50 years- 37.5, in the age group of 51-60 years-25.75, in the age group of 61-70 years- 24.61, in the group of 71-80 years- 23.64, in the group of 81-90 years- 23.35, in the group of 91-100 years- 19.9.

The study revealed an 48.32% decrease in the mean number of neurons in nuclei n. hypoglossi in the age group of 91-100 years as compared with the age group of 31-40 years (Table 1).

Table 1. Number of neurons in hypoglossal nerve nuclei as age-dependent value

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Mean number of neurons</th>
<th>Percentage ( to 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-40</td>
<td>(1) 38.5</td>
<td>100</td>
</tr>
<tr>
<td>41-50</td>
<td>(2) 37.5</td>
<td>97.4</td>
</tr>
<tr>
<td>51-60</td>
<td>(3) 25.75</td>
<td>66.88</td>
</tr>
<tr>
<td>61-70</td>
<td>(4) 24.61</td>
<td>63.92</td>
</tr>
<tr>
<td>71-80</td>
<td>(5) 23.64</td>
<td>61.4</td>
</tr>
<tr>
<td>81-90</td>
<td>(6) 23.35</td>
<td>60.64</td>
</tr>
<tr>
<td>91-100</td>
<td>(7) 19.9</td>
<td>51.68</td>
</tr>
</tbody>
</table>

3. Mean number of neurons varies insufficiently in male and female cases in every age group.

Statistics. The results presented are statistically significant. We applied the Pearson criterion $X^2$ which reflects the significance of distinction of parameters of the group.
We used Pearson criterion $X^2$ for comparison of 2 different conditions: presence and absence of neuronal loss with age increase. Criterion $X^2$ equals 12.25; this result exceeds critical meaning $X^2= 10.82$ for 0.1% level of significance.

We revealed the substantial age-related decrease of number of neurons in hypoglossal nerve nuclei. These damages may result in impairment to the function of n. hypoglossus in elderly persons.

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**References**


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