The Comparison of Core Olfactory Responses Registration to Subjective Elsberg Method

T. Świdziński¹, P. Świdziński², A. Obrębowski²

¹Department of Biophysics, ¹ Fredry Str. 10, 61-701 Poznań, Poland,
²Chair and Department of Phoniatrics and Audiology, Przybyszewski Str. 49, 60-355 Poznań, Poland,
Poznań University of Medical Sciences

Abstract

Subjective olfactory tests in humans according to the Elsberg-Levy method as modified by Pruszewicz have been conducted in the Department of Phoniatric and Audiology Poznań University of Medical Sciences from 1962 [1]. According to the method, the olfactory organ is provided with odour with the air from a tank by means of the air-flow method. In this study the modified own constructed device served automatically odour stimulus to nasal cavity allowed registration evoked cortical potentials in 30 patients with normal olfaction sensitivity and identification and 31 subjects with anosmia [2, 3]. Among all subjects researched the perception and identification thresholds of given odour were determined and measured in cm³ according to the Elsberg method as well as, latency potentials within a range of 180 to 700 ms were registered. 100% (30/30) of core olfactory responses registrations for subjects without disorders were consistent with subjective Elsberg method [4]. For 10 cases of lacking a subjective sense of smell olfactory elicited potentials were no registered. Subjectively evaluated 19 cases of partial anosmia were consistent with objectively measurements of elicited potentials.

Keywords: Objective olfactometry, anosmia, evoked potentials

Introduction

Testing of the olfactory system found considerable use, in an evaluation and complementation of clinical diagnoses of otorhinolaryngological disorders, e.g., following facial skeletal injuries, inflammation of the sinuses, operations of rhinopharyngeal tumors and also neurological changes, i.e., following craniocerebral trauma, following temporal lobotomies or in diagnoses of endocrinological diseases, i.e. hypothyroidism, hypoadrenalism or simple obesity [5, 6, 7].

Experimental procedures

The research concerned 30 patients with normal olfaction sensitivity and identification and 31 subjects with anosmia lacking a subjective sense of smell, 20 to 52 years of age. First sensory thresholds according to the Elsberg blast method were identified, next the functional potentials from the central nervous system were measured following stimulation by olfactory stimulants (mint oil, lemon oil) using the modified method of precisely applied doses [8]. The speed at which the odour air reached the nose was uniform and equal 10 cm/s. Registration of elicited responses was performed on a Madsen Electronics ERA 2250 apparatus by means of adhesive Beckman electrodes applied to the surface of the head (to the brow and simultaneously to both sides of the neck), applying the technique of summing and averaging responses. The number of averaged responses to a quantitatively identical stimulus was only 5 or 10 because of olfactory fatigue. Dosing with the stimulant was synchronized with the natural breathing phase of the subject. The measurement made use of an olfactory stimulant with a volume of 5, 10 and 15 cm³ within the scope of norms established by
Pruszewicz in applying the Elsberg method. Among all subjects with a normal olfactory response (sense of smell) researched, in response to mint oil and lemon oil, i.e. substances eliciting a response from 1st and 5th cranial nerve, a registration of two potentials was obtained: the first with a time of 180 to 370 ms and a second with a time of 380 to 640 ms. These potentials were respectively labeled as Pn-V and Pn-I in Fig.1 [9].

Results

Among 30 patients with normal olfaction when stimulated by 5, 10 and 15 cm³ of vapours, no statistical differences (according to nonparametric Wilcoxon test) in relation to latency times (for Pn-I: p=0,94 as well as for Pn V: p=0,80) were found. The test showed no significant differences among latency times (for Pn-I: p=0,84 as well as for Pn V: p=0,75) when the odour air reached the nose at 5,10 and 15 cm³/s.

Comparison of cases for total and partial anosmia as well as for increasing olfactory thresholds of perception for subjective Elsberg method to objective registrations of core olfactory responses has been presented in Table 1. For 10 cases of lacking a subjective sense of smell olfactory elicited potentials were no registered. Subjectively evaluated 19 cases of partial anosmia were consistent with objectively measurements of elicited potentials. The disagreement between registered olfactory responses and subjective anosmia only in two last cases in Table 1 was stated.

Conclusions

The olfactory organ in human subjects could previously only be evaluated subjectively with respect to quantity and quality. It appears that the method of registering elicited potentials may serve as a tool in an objective evaluation of the neuritic olfactory path. This requires further research in order to differentiate specific core responses. Attempts at

Fig. 1. The examples of registering elicited potentials when subjected to stimulation by mint oil: (a) 50-year-old male with proper olfactory response, two potentials were obtained and labeled as Pn-V and Pn-I (b) 18-year female with partial anosmia – lack of a response of nerve I labeled as Pn-I
registering late potentials with a time greater than 100 ms from the neuritic olfactory path may constitute an objective evaluation of the state of the olfactory organ, which may be useful in broadly understood audiological and otoneurological diagnostics [10].

References