

CORPORA AMYLAECIA DEPOSITION IN THE OLFATORY BULB AND TRACT IN AGEING AND ALZHEIMER'S DISEASE

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ABSTRACT

Background: The olfactory system has several interesting anatomical and physiological features although olfaction has remained a 'neglected sense'. Olfactory functioning is a valid indicator of the ageing brain so present study was designed to investigate the age of appearance of corpora amylaeia in the olfactory bulb and tract and compare with well known cases of Alzheimer's disease.

Aims of the study: To detect deposition of corpora amylaeia in the human olfactory bulb and tract in different age groups and Alzheimer's disease.

Materials and Methods: 22 brain specimens were collected from cadavers from Anatomy department of MGM Medical College, Navi Mumbai and from National Institute of Mental Health and Sciences (NIMHANS), Bangalore. The study was carried out in 20 undemented specimen, divided into four groups (5 samples in each) according to age: group I (20-39yrs), group II(40-59yrs), group III (60-79yrs), group IV(80 yrs and above) and 2 specimen of Alzheimer's disease as a control group. Histological evaluation was done with Haematoxylin and Eosin stain, Luxol fast blue stain and Immunohistological stain, Glial fibrillary acidic protein (GFAP) antibody to study corpora amylaeia. Statistical analysis was carried out using Chi Square test.

Results: In group II, 20%, in Group III and Group IV 80% samples have showed presence of corpora amylaeia. In controls 100% samples had corpora amylaeia. This difference between five groups was statistically significant. In group II, corpora amylaeia was small in size, circular, deeply basophilic and scattered. In group III, IV and V, corpora amylaeia was large in size, more in number and condensed.

Conclusion: The present study concluded that corpora amylaeia appear as early as fifth decade of life. Corpora amylaeia are age and neurodegeneration related phenomena and their number and size increase with age. Deposition of the corpora amylaeia in the olfactory bulb and tract may be responsible for olfactory dysfunction in advanced age and neurodegenerative disorders

KEY WORDS: Corpora Amylaecia, Olfactory Bulb, Olfactory Tract.

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INTRODUCTION

The olfactory system has several interesting

anatomical and physiological features although olfaction has remained a 'neglected sense'. The

olfactory system consists of olfactory nerves, bulb, tract and the olfactory cortex. It is the most primitive sensory system. Olfactory dysfunction manifests early in the neurodegenerative diseases such as Alzheimer's disease and may represent an important early clinical symptom suggestive of neurodegeneration.

The olfactory bulb is considered as the first synaptic station in the olfactory pathway. It receives axons of olfactory nerves and is continuous posteriorly with the olfactory tract, through which the output of the bulb passes directly to the olfactory cortex [1].

Corpora amylaecia (CA) are spherical, basophilic, glycoprotein-based hyaline-like bodies that form in the normal aging brain and various neurodegenerative diseases. Corpora amylaecia are frequently found along the margin of blood vessels or beneath the pia of brain [2]. These commonly originate within astrocytic processes but neuronal and glial origin has been also documented [3,4]. Corpora amylaecia are also found in other organs and tissues, such as normal and malignant prostate glands, and several other malignant tissues

Since olfactory functioning is a valid indicator of the ageing brain, present study was designed to investigate the age of appearance of corpora amylaecia in the olfactory bulb and tract and compare with well known cases of Alzheimer's disease. This work will provide a baseline data for further correlative studies of functional modalities of olfaction.

MATERIALS AND METHODS

22 brain specimens (age 20-80 years and above) from donated bodies were collected from MGM Medical College, Navi Mumbai and from National Institute of Mental Health and Sciences, Bangalore after obtaining written informed consent from close relatives permitting use of brain for research and permission to obtain necessary clinical and functional information and ethical committee clearance.

They were grouped as follows: I) 20-39 yrs-05 samples II) 40-59 yrs-05 samples III) 60-79 yrs -05 samples IV) 80 yrs and above – 05 samples V) Disease Controls–02 brain samples, from confirmed cases of Alzheimer's disease, sourced from the Human Brain Tissue

Repository (Brain Bank) at NIMHANS, Bangalore.

The exclusion criteria were included history of any neurological disease, occupational exposure to potential neurotoxins, nasal pathology, nasal surgery and head trauma.

After checking weight, brain specimens were preserved in 10% buffered formalin for 4 weeks with neutral pH. Olfactory bulb and tract were taken out from the olfactory sulcus which is situated at the orbital surface of the frontal lobe. Samples were processed for paraffin embedding, block making, sectioning and staining. The specimens were properly oriented in paraffin blocks and longitudinal sections of 5 µm and 9 µm thick were obtained from olfactory bulb and tract. Histological evaluation of corpora amylaecia was done with Haematoxylin and Eosin stain for 5 µm thick sections and Luxol fast blue stain for 9 µm thick sections. Immunohistochemical staining was done by indirect immunoperoxidase method to study astrocytes and corpora amylaecia using Glial fibrillary acidic protein (GFAP) antibody. All the sections were digitalized and analyzed by using compound microscope with camera under 10X and 40X.

Statistical analysis: SPSS 22 software was used for statistical analysis. **Chi-square test** was used as test of significance for qualitative data to compare the possible difference between groups.

OBSERVATIONS AND RESULTS

Our results showed, in Group I, corpora amylaecia was absent in all samples. In group II, 20%, in Group III and Group IV 80% samples have showed presence of corpora amylaecia. In controls 100% samples had corpora amylaecia. This difference between five groups was statistically significant.

Table 1: Corpora Amylaecia in Olfactory bulb and tract.

Group	Corpora Amylaecia in Olfactory bulb and tract			
	Absent		Present	
	Samples	%	Samples	%
I (20-39 yrs)	5	100.00%	0	0.00%
II (40-59 yrs)	4	80.00%	1	20.00%
III (60-79 yrs)	1	20.00%	4	80.00%
IV (80->80 yrs)	1	20.00%	4	80.00%
V (controls)	0	0.00%	2	100.00%

$\chi^2 = 13.38$, df = 4, p = 0.010*

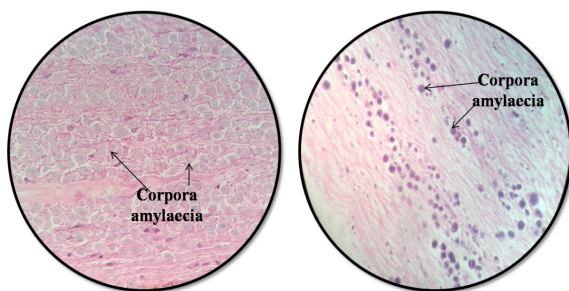


Figure no.1: a- Corpora amylaecia in olfactory tract of Alzheimer's Disease H & E (40X)

b- Corpora amylaecia in olfactory tract of normal aged individual H & E (40X)

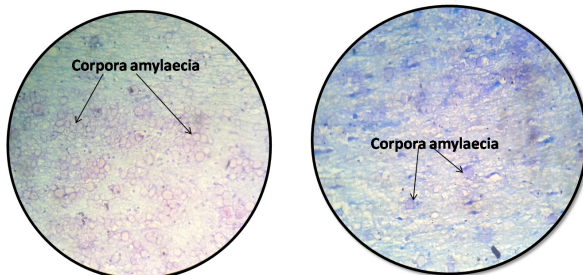


Figure no.2: a- Corpora amylaecia in olfactory tract of Alzheimer's Disease Luxol fast blue stain (40X)

b- Corpora amylaecia in olfactory tract of normal aged individual Luxol fast blue stain (40X)

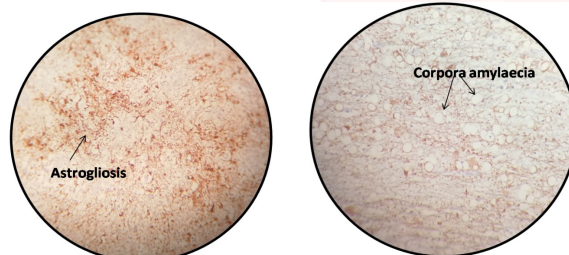
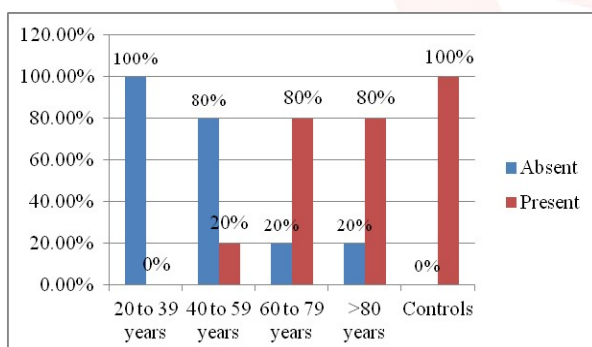


Figure no.3: Astroglisis in olfactory bulb of Alzheimer's Disease AntiGFAP antibody immunostaining (40X)

b- Corpora amylaecia in olfactory tract of normal aged individual AntiGFAP antibody immunostaining (40X)

Chart 1: Corpora Amylaecia in Olfactory bulb and tract.



In group II, corpora amylaecia was small in size, circular, deeply basophilic and scattered. In group III, IV and V, corpora amylaecia was large in size, more in number and condensed. There were not any difference between number and size of corpora amylaecia in group IV and control group of Alzheimer's disease. Corpora amylaecia is found more in number in olfactory tract than olfactory bulb.

Reduction in olfactory tract fibres observed due to presence of corpora amylaecia in H&E and

Luxol fast staining.

In the Immunohistochemical staining with antiGFAP antibody, olfactory bulb and tract showed astroglisis and abundant corpora amylaecia.

DISCUSSION

Although corpora amylaecia documented in both the brain of normal aging individuals and Alzheimer's disease showed morphological similarities, there have been reported differences, in their size, biochemical and elemental composition [5]. Kovács et al [6] reported that corpora amylaecia were very abundant in olfactory tract than olfactory bulb in both normal aging individuals and Alzheimer's disease. Similarly, in the present study we found abundant corpora amylaecia with similar morphological structures in normal ageing and Alzheimer's disease. The present study showed increase in the number and size of corpora amylaecia after sixth decade.

Daniel Pirici [7] reported the neuronal origin of corpora amylaecia which is underlined by positivity for anti-neurofilaments antibodies and for the NeuN marker; the glial origin of corpora amylaecia (CA) was demonstrated by a membranous-like reactivity for anti-S100, anti-GFAP antibodies and antiubiquitin antibodies. In the present study we also found positive reactivity to anti-GFAP antibodies.

Corpora amylaecia are divided of myelin deriving phospholipids as ascertained by Luxol fast blue staining [7]. Leopold Liss [8] documented the presence of perivascular astroglisis and abundant corpora amylaecia in olfactory bulb and tract of normal aged persons. In the present study, we also observed abundant corpora amylaecia and astroglisis in olfactory bulb and tract. Ayesha Maqbool [9] reported that the presence, size and number of corpora amylaecia is age related and it interferes with the function of neurons and presumably affects the memory. Similarly, our data indicated that corpora amylaecia are age related phenomena and their number and size increase with age.

CONCLUSION

The present study concluded that corpora amylaecia appear as early as fifth decade of life.

Corpora amylacea are age and neurodegeneration related phenomena and their number and size increase with age.

Deposition of the corpora amylacea in the olfactory bulb and tract may be responsible for olfactory dysfunction in advanced age and neurodegenerative disorders.

Conflicts of Interests: None

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