eISSN 1303-1775 • pISSN 1303-1783

Neuroanatomy (2005) 4: 10–12

Original Article

Morphometric measurements of the thalamus and interthalamic adhesion by MR imaging

Published online 13 July, 2005 © http://www.neuroanatomy.org

Fikret SEN [1] ✦
Hakan ULUBAY [2]
Pelin OZEKSI [1]
Mustafa F. SARGON [1]
A. Beliz TASCIOGLU [1]

Department of Anatomy Hacettepe University Faculty of Medicine [1] and Visart Imaging Center [2] Ankara–Turkey.

✦ Dr. Fikret Sen
Hacettepe University, Faculty of Medicine,
Department of Anatomy,
06100 Ankara, TURKEY
☎ 90-312-305 21 01
90-312-310 71 69
fikret@hacettepe.edu.tr
fikretsn@yahoo.com

Received 4 March 2005; accepted 11 July 2005

ABSTRACT

In this study, the morphometric measurements of the interthalamic adhesion and thalamus using MRI with regard to age and sex was assessed. Additionally, the incidence of the absence of the interthalamic adhesion was analysed. 161 patients (100 females and 61 males) without neuropathological changes and symptoms were included in this study. In the 60 and above age group, the transverse length of the interthalamic adhesion was measured as longest, while the vertical length was measured as the shortest. The anteroposterior and vertical lengths decreased gradually correlated with ageing, but the decrease in the anteroposterior length was not found related to the changes in thalamus sizes. No connection was found between the age groups and transverse, vertical and anteroposterior lengths of the thalamus. In the examination of the mean values of thalamus size with regard to age groups, the vertical length of thalamus was found to be shortest in the 60 and over years group. When investigating the mean values of the interthalamic adhesion size with regard to sex, the transverse length was found longer in males than in females. The vertical and anteroposterior lengths, however, were longer in females. When the mean values of the sizes of the thalami were evaluated according to sex, it was found that the transverse length was longer in males. The vertical and anteroposterior lengths were similar in both sexes. Additionally, the interthalamic adhesion was absent in 14 patients. ***Neuroanatomy; 2005; 4: 10–12.***

Key words [thalamus] [interthalamic adhesion] [morphometry] [MRI]

Introduction

The thalamus is a highly differentiated gray matter structure, comprising many subnuclei, each with specialized functional links to different cortical, subcortical and cerebellar sites and has been characterized as a dynamic conduit linking subcortical with cortical areas [1]. However, while normal ageing effects on thalamus have been studied in previous MRI studies, no report has covered normal ageing effect on both interthalamic adhesion (massa intermedia) and thalamus in the same sample.

Some authors stated that in about 20% of cases it is even absent [2]. Human interthalamic adhesion except decussating, contains commissural fiber systems connecting some thalamic nuclei. The significance and eventual manifestation of its presence or absence is not known in humans. Knowledge of the morphology, size and position of interthalamic adhesion is important in neurosurgery as well as in neuroradiology and neuroanatomy. It is especially important because of its great variability in the human brain [3, 4].

The variability in presence and size of interthalamic adhesion is sexually dimorphic, with interthalamic adhesion being present more often in females, when compared with males [3]. Nopoulos at al. showed that female patients with schizophrenia had significantly higher incidence of absent interthalamic adhesion (32.76%) compared with their healthy controls (13.50%) [5].

In this study, we compared the morphometric measurements of the interthalamic adhesion and thalamus using MRI with regard to age and sex. Additionally, we analyzed the incidence of the absence of interthalamic adhesion.

Material and Methods

161 patients (100 females and 61 males) without neuropathologic changes and symptoms being admitted to the Visart MRI center were included in this study. MR images (1.5 Tesla magnetom vision) were acquired in the axial and vertical planes by using flair T1-T2 weighted sequences. The patients were divided into six age groups. The groups were 19 years old and under, 20-29; 30-39; 40-49; 50-59; 60 and over years. The transverse and vertical lengths of the interthalamic adhesion were measured in the coronal sections, while the anteroposterior and transverse length measurements of the thalami were obtained in the axial plane, and vertical length in the mid-sagittal plane. The anterior boundary of thalamus was defined as the posterior point of the interventicular foramen and the posterior boundary coincided with the section in which pulvinar thalami were seen. The lateral boundary of the thalamus was defined at the plane, where the posterior limb of the internal capsule was seen. The superior and inferior boundaries of thalamus was defined at the level of body of the fornix and hypothalamic sulcus respectively (Figures 1 and 2).

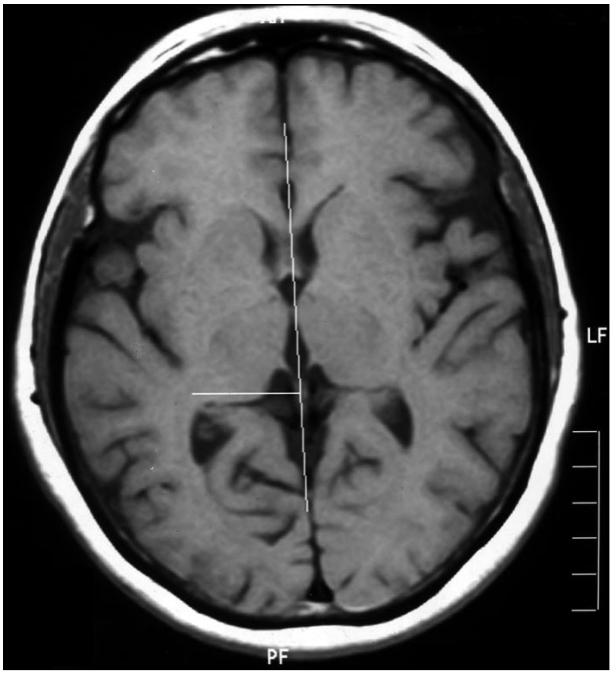

Figure 1. Measurement of the tranverse length of the thalamus.

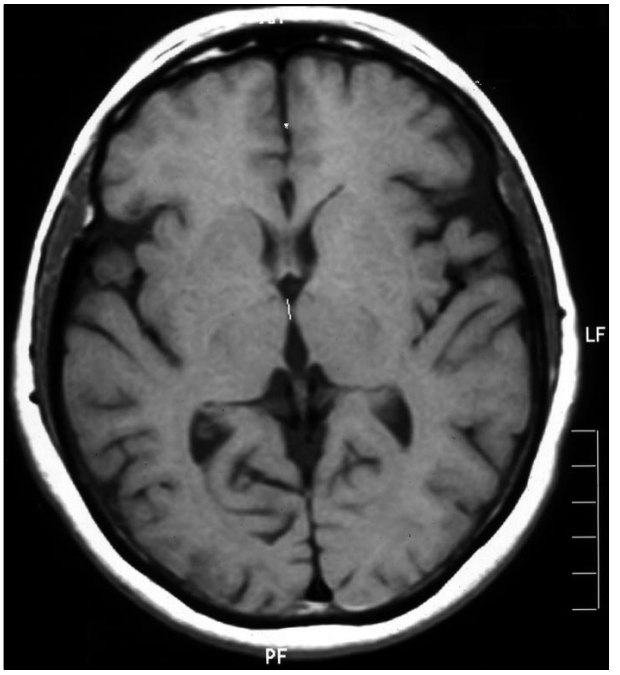

Figure 2. Measurement of the anteroposterior length of the interthalamic adhesion.

Results

In the 60 and over years group, the transverse length of the interthalamic adhesion was measured as longest, but the vertical length was measured as the shortest (Table 1). The anteroposterior and vertical lengths decreased gradually correlated with ageing, but the decrease in the anteroposterior length was not found parallel to the changes of thalamus sizes (Tables 1 and 2). No correlation was found between the age groups and transverse, vertical and anteroposterior lengths of the thalamus ($p>0.05$; Pearson correlation statistical test) (Table 2). In evaluation of the mean values of thalamus size with regard to age groups, the vertical length of thalamus was found to be shortest in 60 and over years group (Table 2).

When investigating the mean values of interthalamic adhesion size with regard to sex, the transverse length was found longer in males than in females, however; the vertical and anteroposterior lengths were longer in females (Table 3). As the mean values of the thalamus sizes were assessed according to sex, it was found that the transverse length was longer in males than in females, while the vertical and anteroposterior lengths were similar in both sexes (Table 4). Additionally it was determined that the interthalamic adhesion was absent in 14 patients (8.7%).

Discussion

The incidence of the absence of interthalamic adhesion was found to be 13.3% [6], 13.79% [7] and 22% [3] in different studies. Additionally, it has been reported that the absence of the interthalamic adhesion was more frequent in patients with schizophrenia compared to healthy subjects [7]. In a study measuring the thalami,

Table 1. Mean values of the dimension of the interthalamic adhesion in age groups (mm).

Age groups	Transverse	Vertical	Anteroposterior
19 and under	2.41±0.89	5.66±2.44	9.52±3.24
20–29	2.67±0.73	4.81±2.21	8.05±2.85
30–39	3.22±1.03	4.51±2.63	7.61±3.28
40–49	3.11±1.00	3.87±2.22	7.95±3.04
50–59	3.09±1.00	4.61±2.74	7.95±3.15
60 and over	3.78±1.77	2.89±1.87	6.31±2.38

Table 2. Mean values of the dimension of the thalamus in age groups (mm).

Age groups	Transverse	Vertical	Anteroposterior
19 and under	20.74±3.51	16.82±1.63	33.98±2.35
20–29	24.35±3.81	16.15±2.00	36.4±3.11
30–39	22.95±3.34	16.42±1.58	34.97±2.44
40–49	23.00±3.43	17.06±1.91	34.8±3.21
50–59	23.87±4.45	16.19±1.13	34.58±3.68
60 and over	23.98±4.70	14.55±1.73	35.72±4.17

Table 3. Mean values of the dimension of the interthalamic adhesion in sex groups (mm).

Sex	Transverse	Vertical	Anteroposterior
Female	2.97±1.02	4.45±2,38	8.31±3.09
Male	3.26±1.40	4.19±2,66	6.98±2.88

Table 4. Mean values of the dimension of the thalamus in sex groups (mm).

Sex	Transverse	Vertical	Anteroposterior
Female	2.66±3.36	16.39±2.08	35.05±2.93
Male	24.31±4.67	16.00±1.37	35.23±3.71

it was concluded that the development of interthalamic adhesion did not depend on the size of the human thalamus. Next, it was also found that the volume of the interthalamic adhesion usually increased with age, probably caused by the widening of the third ventricle [3]. Rosales at al. showed that in elder persons, the interthalamic adhesion underwent atrophy and might disappear [8].

Absence of the interthalamic adhesion was found to be 8.7% in our study. In literature, we couldn't find any data about the morphometric changes of interthalamic adhesion and thalamus with age examined within the same study. We found no correlation between size of thalamus and interthalamic adhesion with regard to age. Additionally we observed that as the anteroposterior and vertical lengths of the interthalamic adhesion decreases with age, the transverse length increases. This finding shows that the thalamus doesn't undergo any significant changes with age, while the interthalamic adhesion becomes thin and lengthened.

References

[1] **Sullivan EV, Rosenbloom M, Serventi KL, Pfefferbaum A.** Effects of age and sex on volumes of the thalamus,pons and cortex. **Neurobiol. Aging. 2004; 25: 185-192.**

[2] **Carpenter MB, Sutin J, Strong OS.** Human neuroanatomy. **Williams&Wilkins, Baltimore 1984; pp:52-54.**

[3] **Malobabic S, Puskas L, Blagotic M.** Size and position of the human adhaesio interthalamica. **Gegenbaurs Morphol. Jahrb. 1987; 133: 175-184.**

[4] **Clarck DL, Boutros NN.** The brain and behaviour. **Blackwell Science, Massachusets. 1999; pp:121.**

[5] **Nopoulos PC, Rideout D, Crespo-Facorro B, Adreasen NC.** Sex differences in the absence of massa intermedia in patients with schizophrenia versus healthy controls. **Schizophren. Res. 2001; 48: 177-185.**

[6] **Meisenzahl EM, Frodl T, Zetzsche T, Leinsinger G, Heiss D, Maag K, Hegeri U, Hahn K, Möller HJ.** Adhesio interthalamica in male patients with Schizophrenia. **Am. J. Psychiatry. 2000; 157: 823-825.**

[7] **Erbagci H, Yildirim H, Herken H, Gumusburun E.** A magnetic resonance imaging study of the adhesio interthalamica in schizophrenia. **Schizophr. Res. 2002; 55: 89-92.**

[8] **Rosales RK, Lemay MJ, Yakolev PI.** The development and involution of massa intermedia with regard to age and sex. **J. Neuropat. Exp. Neurol. 1968; 27: 166.**

N