

Original Article

The double massa intermedia

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Abstract**Background:** To describe the rare finding of a double massa intermedia (MI). Typically, the MI (interthalamic adhesion) is a single bridge of gray matter connecting the medial surfaces of the thalami.**Methods:** Twelve formalin- and alcohol-fixed human third ventricles were examined from superior to inferior by fiber dissection technique under ×6 to ×40 magnifications and with the endoscope.**Results:** In all hemispheres, the anterior and posterior commissure were defined. The MI, which bridges the medial surfaces of the thalami, was defined in all hemispheres. In one hemisphere, there was a second bridge between the thalami, located posteroinferior to the common MI. Endoscopic view confirmed that there was a second MI in this specimen. The MI usually traverses the third ventricle posterior to the foramen of Monro and connects the paired thalami. The MI is an important landmark during endoscopic and microscopic surgeries of the third ventricle. Although a double MI is very rare, surgeons should be aware of the possibility in their surgical planning.**Conclusion:** The surgeon should be aware of the possibility of a double MI to avoid confusion during third ventricle surgery.**Key Words:** Double massa intermedia, endoscopic surgery, neuroanatomy, third ventricle**Access this article online****Website:**www.surgicalneurologyint.com**DOI:**

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Quick Response Code:**INTRODUCTION**

The massa intermedia (MI), also called the adhesio interthalamica, links the paired thalami across the midline of the third ventricle.^[22] The MI is located at the medial surface of the thalamus, posterior to the foramen of Monro and anterior commissure (AC), and anterior to the posterior and habenular commissure. The size and location of the MI are variable. Almost 50% of MI are located in the center of the third ventricle with an average 1 cm anterior to posterior diameter.^[6,11] Most authors report the MI to be absent in approximately 20% of normal hemispheres.^[2,3] In addition, some authors report a greater frequency of absence in males and psychiatric patients than in females and normal

population.^[5] Some reports attributed the absence of MI to brain atrophy in the elderly.^[11] In the literature, there was no significant clinical difference reported between patients with duplication, absence, and presence of the MI. The nucleus reuniens of the thalamic midline nuclei has a close relationship with the MI.^[13] The variation

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of location and size of the MI is important for surgical planning in microsurgical and endoscopic approaches to the third ventricle and pineal region in which it might be confused for a tumor. MI duplication is rare and has not been shown before in a surgical view. Malobabic *et al.* reported only one duplicated MI in an anatomic study of fifty human brains.^[11] Tubbs *et al.* reported a duplicated MI on magnetic resonance imaging in a patient with Dandy–Walker variant syndrome.^[21] In our study, we want to demonstrate the rare anatomy of a duplicate MI.

MATERIALS AND METHODS

The third ventricles of ten formalin- and alcohol-fixed human brains and two whole cadaveric heads were examined from superior to inferior in a fiber dissection study. All specimen were refrigerated at -10 – -20°C for 2 weeks. After thawing the specimens under the water, the fiber dissection technique was performed under $\times 6$ to $\times 40$ magnifications provided by a Zeiss Surgical Microscope (Carl Zeiss AG, Oberkochen, Germany), and using the 0° , 18 cm Hopkins endoscopes (KARL STORZ GmbH and Co., Tuttlingen, Germany) connected to a xenon light source and a high-definition camera.^[9,10]

RESULTS

Dissections proceeded from the superior surface of the cerebral cortex to the inferior. After opening the ventricle from superior, the paired fornices were retracted laterally to expose the third ventricle posterior to the foramen of Monro and AC, crossing the midline in the anterior

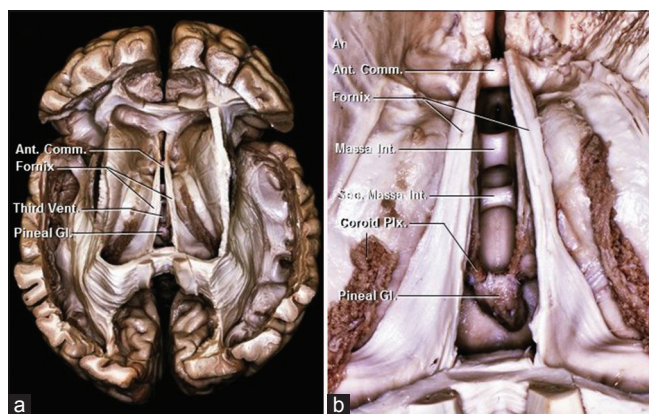


Figure 1: Fiber dissection. Superior view. (a) The cortex, U fibers, cingulum, callosal fibers, and ependyma were removed to expose the lateral ventricle. After opening the ventricle from superior, the paired fornices were exposed. The fornices were separated in the midline to expose the third ventricle. In the center part of the third ventricle, posterior to the anterior commissure and foramen of Monro and anterior to the posterior commissure and pineal gland, a massa intermedia connected the medial surfaces of the thalami. A second smaller round, smooth massa intermedia crossed the midline posteroinferior to the large massa intermedia. **(b)** Enlarged view of 1a. Ant.: Anterior, Comm.: Commissure, Gl.: Gland, Int.: Intermedia, Plx.: Plexus, Sec.: Second, Vent.: Ventricle

wall of the third ventricle. The posterior commissure, also called the epithalamic commissure, was identified crossing the third ventricle just anterior to the pineal gland in the posterior part of the third ventricle above the cerebral aqueduct. In the center part of the third ventricle, a single MI was identified crossing the midline in all but one specimen, in which a second round, smooth connection between thalami was found posteroinferior to the most anterior MI [Figure 1]. The anterior and posterior commissure, pineal gland, and MI were then examined with the 0° endoscope. The second MI was located posterior and inferior to the first MI [Figure 2].

DISCUSSION

Although morphology, relations, location, and size of MI are well-defined, its role in the central nervous system is not clear. The MI can be defined in approximately 75% of individuals during imaging procedures.^[22] Some authors reported a connection between schizophrenia and midline cerebral abnormalities of the brain including enlarged third ventricle and absence of MI.^[5,7,19] This could be associated with deterioration of midline neural circuits.^[7,19] The MI is described as larger than normal in patients with Chiari syndrome.^[22] Furthermore, Allen and Gorski reported greater MI size in females than males.^[1]

In this case, the second structure in the middle of the third ventricle, it was defined that the structure reported here was a second massa intermedia based on

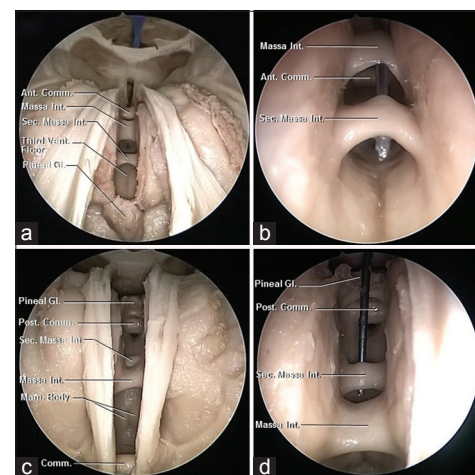


Figure 2: Endoscopic view. (a) The endoscope has been advanced from posterosuperiorly to expose the anterior part of the third ventricle. A large massa intermedia is seen posterior to the anterior commissure, and a second smaller massa intermedia is located posteroinferior to the larger massa intermedia. **(b)** Enlarged view of 2a. Both massa intermedia have been retracted superiorly with a nerve hook. **(c)** The endoscope has been advanced from anterosuperiorly above the anterior commissure to see the posterior part of the third ventricle. **(d)** Enlarged view of 2c. The second massa intermedia is retracted superiorly by a nerve hook. Ant.: Anterior, Comm.: Commissure, Gl.: Gland, Int.: Intermedia, Mam.: Mammillary, Plx.: Plexus, Post.: Posterior, Sec.: Second, Vent.: Ventricle

its location and connecting structures. There are some other commissural fibers that must be differentiated from secondary MI. These include the habenular, anterior, and posterior commissures.^[16] The AC is located at the anterosuperior border of the thalamus and divides the fornix into post- and pre-commissural parts. The AC connects the temporal and occipital lobes and basal forebrain, but there is no connection with the thalamus.^[15] The posterior commissure is located in the inferior pineal lamina at the posterior third ventricle just anterior to pineal gland and connects the superior colliculi and fronto-temporo-occipito-pontine region but not the thalami.^[14,16] Furthermore, there is habenular commissure which is thinner than the other commissures and is difficult to define. It crosses the midline just superior to the posterior commissure and anterior to the pineal gland connecting both habenula which are located adjacent to the dorsomedial thalamus.^[8] In light of this information from recent literature, our location-based definition is secondary MI for the commissural structure which we observed in the middle part of the third ventricle connecting both thalamus.

The morphology, size, and position of MI are important in neurosurgery as well as in neuroanatomy and neuroradiology. It is especially important in endoscopic third ventricular interventions. There are also some classifications of third ventricle tumors that use the MI as a landmark.^[12,17,20] In these studies, better location and count of burr hole and angle of the endoscope are wanted to be described with using location and size of MI and its relations with the tumor, especially the pineal tumors.^[12,17,20] Morgenstern *et al.* suggested that using a single burr hole approach is convenient for approaches to the third ventricle and pineal gland when the tumor is located anterior to the MI, the MI is small, ventriculomegaly is severe, or the surgical procedure is only for biopsy. In other cases, two entry sites are suggested.^[12] Other studies described the anatomy of third ventricle using MI as a landmark.^[4,18] Characteristics of the MI and its variations should be defined preoperatively if possible in selecting the optimal approach.

CONCLUSION

Awareness of duplicate MI may prove helpful in surgical planning for third ventricle or pineal region approaches.

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Conflicts of interest

There are no conflicts of interest.

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