

한 것은, 攝取性 抗原에 있어서 生鮮, 貝類 等 海産物의 出現頻도가 높고, 이에 反해서 鷄卵, 牛乳, 菓子類 (초코레이트 따위)의 出現頻도가 낮은 것은, 食生活의 差異에 緣由하는 것이라고 생각된다.

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Anatomic Asymmetry in Temporal Speech Area in Developing Human Brains

Je G. Chi, M.D. and Young Whan Kim*

Department of Pathology, College of Medicine, Seoul National University

The observation of marked differences between the two cerebral hemispheres in the intellectual functions in man sparked a search for corresponding anatomic asymmetry. Numerous studies looked for left-right differences. However, no consistent anatomic differences between the left and right hemispheres were observed for gross measures of total length, weight or volume.

Within the last decade a revival of interest in anatomic asymmetry, particularly in certain portions of the brains, was ushered in by Geschwind and Levitsky(1968). They examined the language areas in the temporal lobes and found that the left planum temporale (posterior portion of Heschl gyrus) was much larger than the right. This difference was confirmed by several subsequent studies (Witelson et al., 1973; Wada et al., 1975; Rubens et al., 1976).

If the neuroanatomic asymmetry is present in adults, one obvious question that follows is whether it is present in the brains of human infants. And the available studies(Witelson et al., 1973; LeMay and Culebras, 1972; Chi et al., 1977) with infants indicate that the left planum temporale is consistently larger than the right and to an extent comparable to that in adults.

The neuroanatomic asymmetry observed in neonates might indicate that there may be a preprogrammed neural substrate for the left hemisphere to be specialized for linguistic functions, and the anatomic asymmetry is not the result of ontogenetic environmental influences and learning.

This study was aimed to observe the development of the temporal speech area in human fetuses, from its first appearance to its full establishment at terms.

MATERIALS AND METHODS

A total 100 brains of embryos and fetuses were used for the study. The gestational age ranged from 10 weeks to 40 weeks. Specimens were made available through collections of Registry of Congenital Malformations, Department of Pathology, College of Medicine, Seoul National University. Only those brains of the bodies that did not show any sign of congenital malformation were used. And most of them were the specimens of artificial abortions.

The brains were removed from the cranial cavity with minimal damage, under the water, and fixed in 10 per cent neutral formalin in hanging position for a week. After fixation the leptomeninges were stripped off to show a clear gyral pattern and also to make it cut easier.

In order to expose the planum temporale a slanted horizontal cut was usually made in the plane of the Sylvian fissure, thus exposing the superior surface of the temporal lobe for measurement. This procedure was carried out separately for both hemispheres of each brain since the plane of each fissure may be different.

Various measurements were made in situ after exposing temporal speech area. For the determination of primary auditory gyrus (Heschl gyrus), any transverse gyrus with a sulcus was classified as a second Heschl gyrus and not part of the planum temporale, regardless of the hemisphere in which it occurred.

Gestational age was calculated with reference to the

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*junior medical student

date of the last menstrual period, given by the mother. When there was obvious discrepancy between given gestational age and body length and weight, maturational index of individual organ particularly kidney was used for the clarification.

RESULTS

Delineated by the dorsolateral extension of the Sylvian fissure and the appearance of the parietooccipital fissure, the temporal lobe remains smooth until approximately 23 weeks gestation, when the superior temporal gyrus may become recognizable in the mid to posterior part.

An obvious right-left asymmetry marks the development of the transverse temporal gyrus. First recognized at the medial border of the superior temporal gyrus, the transverse temporal gyrus extends posteriorly and medially to its terminal junction with the posterior end of the insula. The right transverse temporal gyrus develops at 28 weeks' gestation in most cases. In very few brains does the left transverse temporal gyrus appear before the right. The left transverse temporal gyrus appears at 29 weeks gestation in most cases. The left transverse temporal gyrus is

shorter in height and runs at a more obtuse angle to the anteroposterior axis of the brain.

Secondary gyri of the transverse temporal gyrus appear 32 weeks gestation. The right transverse temporal gyrus is more complex, consisting of the anterior and posterior transverse temporal gyri, whereas the left side is more often single than double. As Table 1 shows the right transverse temporal gyrus was two in 70% of the cases and the left transverse temporal gyrus was two in 30% and one in 70% of the cases.

Measurement of the planum was carried out by measuring lateral margin of the area posterior to the transverse temporal gyrus or gyri. As Table 2 sum-

Table 1. Anatomical asymmetry in number of transverse temporal gyrus in developing brains

Gestational Age(weeks)	number of brains	R ₂ /L ₂	R ₂ /L ₁	R ₁ /L ₂	R ₁ /L ₁
28~32	10	2	4	2	2
33~38	18	4	12	1	2
39~43	12	2	5	1	4
Total(%)	40 (100%)	8 (20%)	20 (50%)	4 (10%)	8 (20%)

R: right transverse temporal gyrus
L: left transverse temporal gyrus

Table 2. Anatomic asymmetry in length of planum temporale in developing brains.

Gestational Age(weeks)	number of brains	Right (cm S.D.)	Left (cm S.D.)	R/L(%)	L>R n(%)	L=R n(%)	R>L n(%)
28~32	10	1.0±0.4	1.6±0.4	63	7(70%)	2(20%)	1(10%)
33~38	18	1.2±0.4	1.7±0.4	71	11(61%)	5(28%)	2(11%)
39~43	12	1.4±0.3	1.9±0.5	74	8(67%)	3(25%)	1(8%)
Total	40			70%	26(65%)	10(25%)	4(10%)

n: number of brains

S.D.: standard deviation

L: left

R: right

maries, the right planum temporale is only about 70% as large as the left planum temporale. And the left planum temporale was larger than the right in 65% of the cases, and in 25% the relation was reverse. In 10% there was no difference.

COMMENTS

The posterior of caudal portion of the superior te-

mporal gyrus is the core of Wernicke's language region, the area well documented to be important for the comprehension of language. However, there seems to be some debate whether a second transverse gyrus should be considered as part of the planum or not. The results of cytoarchitectonic work revealed that the cell structure of the primary auditory cortex was confined to the first and usually the only transverse gyrus (Heschl's) in the left hemisphere. It was also

noted that the cell structure of Heschl's gyrus might extended into part of the second transverse gyrus, if present, on the right. This is the reason why we classified any transverse gyrus with a sulcus as a second Heschl gyrus and not part of the planum, regardless of the hemisphere in which it occurred.

Despite the great individual variation between brains, the anatomic ambiguities and the methodologic difficulties, there is remarkable consistency in the results of the studies that measured the planum temporale. This is again confirmed in this material. And this study shows that this asymmetry takes place early in fetal period, when cortical cell differentiation starts in this region.

This study confirms left-right asymmetry of the number of transverse temporal gyru and the lateral length of the temporal planum in fetal brains as soon as they gyri are recognizable.

The transverse temporal gyrus could be delineated from the superior temporal gyrus by 28 weeks of gestation, and there was no significant difference between the right and left. There is a minimal discrepancy between these data and the data obtained through the analysis of serial sections of the brains(Chi et al). Fixation and strining procedure could have been the reason. There could be racial difference since the other study comes from brains of mostly Caucasians.

In 65% of the brains examined, the auditory association area (planum temporale) was larger on the left than on the right. The presence of double transverse temporal gyri seen more often on the right side may indicate a larger primary auditory cortex on the right side, if the primary auditory cortex includes both the first and second transverse temporal gyri.

《國文抄錄》

人體言語腦野의 左右非對稱

서울대학교 醫科大學 病理學教室
池 堤 根·金 永 煥

著者들은 胎齡 20週에서 43週에 이르는 人胎兒 100例

의 腦를 檢索하여 側頭葉, 特히 그 上部에 該當하는 橫行側頭回轉 및 그 後部에 位置하는 側頭葉面의 發達過程을 觀察하였다.

그 結果 一次性 聽覺皮質에 該當하는 橫側頭回轉은 胎齡 27週 前後에 發生하여 漸次 著明하여짐을 나타내었다. 한편 이들 回轉은 그 크기가 左右 相異하여 右側에서는 더욱 흔히(70%)에서 2개로 되어 있음에 반하여 左側에서는 30%에서만 2개이고 그외에는 전부 한개로 되어있었다.

그리고 聽覺의 聯合腦野로 알려진 側頭葉面의 크기를 比較하여 본 결과 左右에 顯著的한 差異가 있음을 確認하였다. 즉 左側側頭葉面이 右側보다 현저히 크고 이는 전체의 65%에서 나타났으며 25%에서는 큰 差異가 없었으며 다만 10%에서만 右側이 左側보다 현저히 크게 나타났다.

이러한 所見들은 모두 大腦半球의 優位性을 뒷받침하는 것이며, 이러한 解剖學的 非對稱은 이미 胎生期에 決定됨을 나타내는 것임을 나타낸다고 생각되었다.

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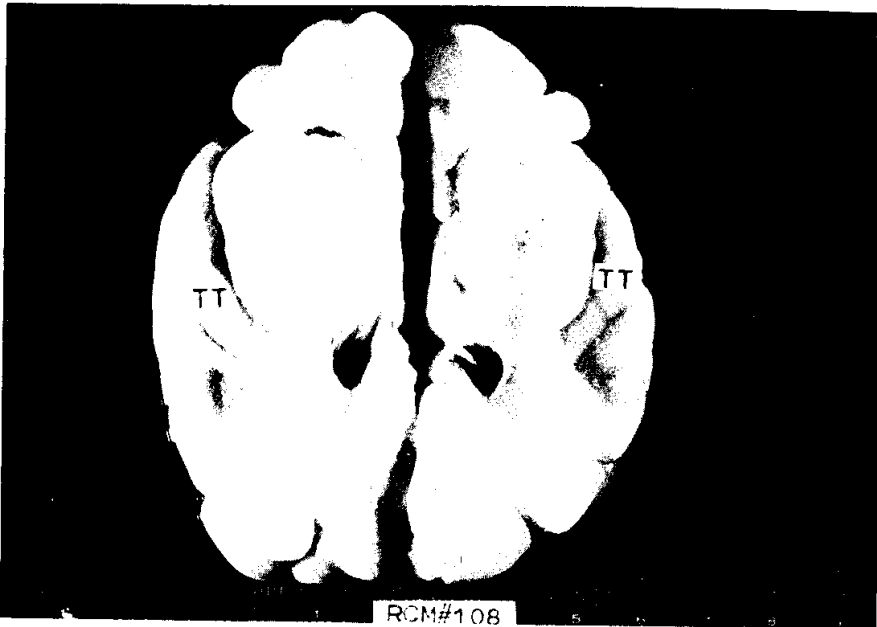


Fig. 1. Oblique horizontal section of the 34 weeks fetal brain. Transverse temporal gyrus (TT) is recognized on the superior surface of the temporal lobe in each side. A difference in size between areas posterior to TT i.e., planum temporale is apparent.

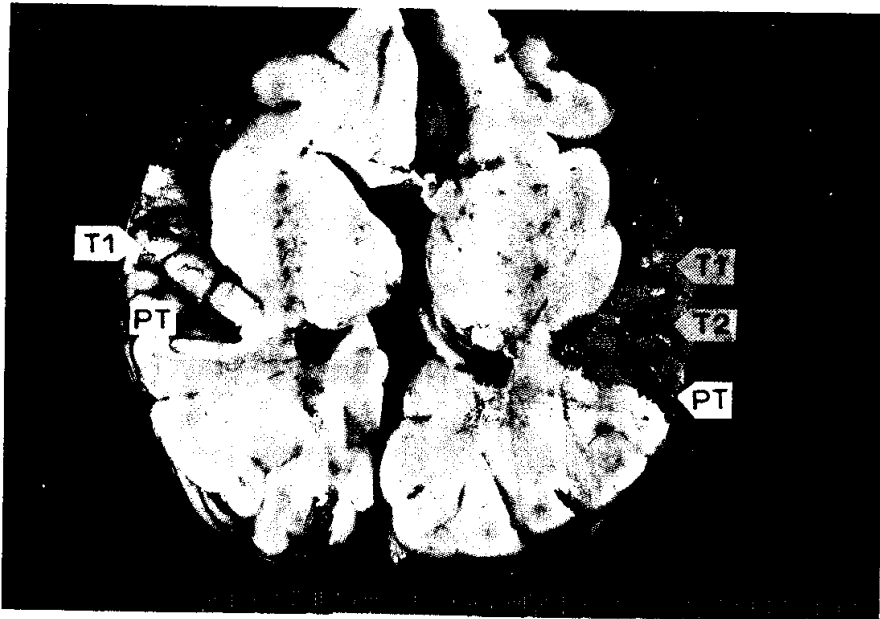


Fig. 2. Oblique horizontal section along the Sylvian fissure in a brain of 40 weeks gestational age. Superior surfaces of the temporal lobes are exposed. Note two transverse temporal gyri in the right (T₁&T₂) and one (T₁) in the left. Planum temporale (PT) is asymmetric in its length of lateral margin.