

## CORRELATION OF APPERANCE OF GYRI ON SUPEROLATERAL SURFACE OF FOETAL BRAIN WITH GESTATIONAL AGE

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### ABSTRACT

**Background:** Localisation of gyral structures of human cerebral cortex is important for interpretation of morpho-functional data. Gyral pattern of human brain is responsible for mankind intelligence. Cerebral convolutions are extremely complex, hence it is often difficult to define them precisely. Gyration proceeds with the formation of sulci and help in the brain maturation.

**Materials:** This study was conducted on 50 dead fetuses in anatomy department brought from the department of Obstetrics and gynaecology.

**Results:** The brain surface is smooth up to 4<sup>th</sup> month, lateral cerebral fossa appears on the supero lateral surface at 14 weeks with complete formation of insula by 20<sup>th</sup> week. The supero lateral surface of brain showed the remarkable change between 24-28 weeks, this reflects the rapid growth spurt of brain. Growth of adjoining lobes of brain make surface more convoluted with well-defined gyral pattern between 24-30 weeks.

**Conclusion:** Cortical folding is due to consequence of restricted space and rapid growth of brain with in the cranial cavity. There is no differences between male and female brains of same gestational age, with no obvious asymmetrical development of gyri on different lobes of brain. Cerebral gyri form the main surgical corridors of modern microsurgery.

**KEY WORDS:** Cortical maturation, gyri, Gestational age, convolutions.

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### INTRODUCTION

Cortical folding is a hallmark of many, but not all mammalian brains. The degree of folding increase with brain size across mammals, but at different scales of species and families. During foetal period there is ongoing growth in

size, weight and surface area of brain. Causation of sulci & gyri was a matter of diverse opinion since long time. Herophilus equated, the more elaborate gyral pattern of human brain is responsible for mankind intelligence and brain size [1]. Vesalius in 1543

described gyri as "Clouds painted by children in school". Gyration is a phenomenon occurring late during foetal development and can be observed by 2<sup>nd</sup> month of intra-uterine life. It goes on to the end pregnancy and even later after birth. Gyration proceeds with formation of side branches from primary sulci, this branch to form secondary sulci which branch to form tertiary sulci. Time of appearance of gyri is considered to be reliable estimate of foetal age and brain maturation [2]. The present study aim was to study and describe the gyri on foetal brain according to gestational age. Advances in imaging technology allows the surgeon to visualize the entire brain surface during surgery. However cerebral convolution are extremely complex, so it is often difficult to define area precisely [3].

## MATERIALS AND METHODS

The present study was conducted in Kamineni Institute of Medical Sciences, Narketpally. 50 dead fetuses/stillbirth of various cause are collected from department of Obstetrics and gynaecology. Foetal brain is embalmed with concentrated 40% formalin and dissected after 48 hours. Gestational age of the dead fetuses is calculated by Crown - rump length, Biparietal diameter, Head circumference, abdominal circumference [4] and grouped into 5 groups with an interval of 6 weeks.

**Table 1:** Distribution of number fetuses into 5 groups according to sex.

Group	Gestational age (weeks)	Female	Male	Total no of fetuses (n)=50
Group -1	12-18	5	7	12
Group -2	>18-24	5	8	13
Group -3	>24-30	7	9	16
Group -4	>30-36	3	3	6
Group- 5	>36-40	1	2	3

Brain is removed with dissection method [5]. Skin of the scalp is reflected in four flaps, later followed by reflecting the membranous vault bones again in four flaps, dura is cut and opened in four flaps. The falx cerebri is cut from crista galli and pulled back with one hand while the palm of other hand supports the brain from

posterior aspect. Frontal lobes are gently separated and lifted back from anterior cranial fossa, olfactory bulbs are separated from cribriform plate of ethmoid, and later optic nerves are cut close to optic foramina. Later brain is detached from spinal cord by cutting at foramen magnum and examined macroscopically for description of sulci.

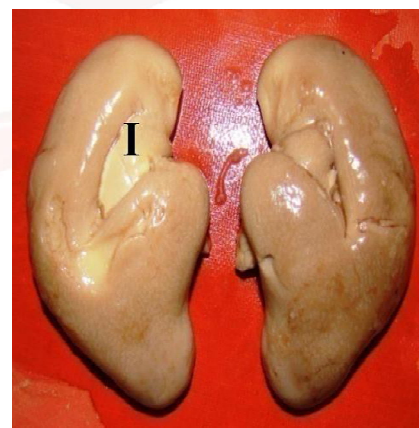
## RESULTS

**Fig. 1:** Showing the Brain Surface in GROUP-1 (12-18wks):



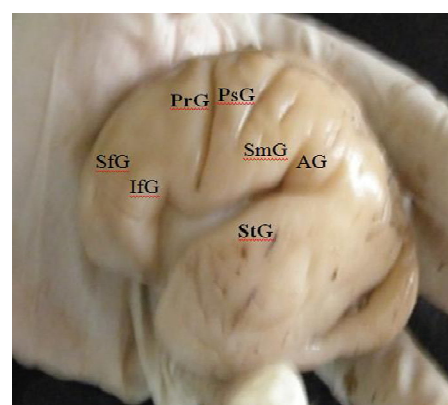
Gyri not observed, surface of brain is smooth (i.e. lissencephalic)

**Fig. 2:** Showing the Brain Surface in GROUP- 2 (>18-24wks).



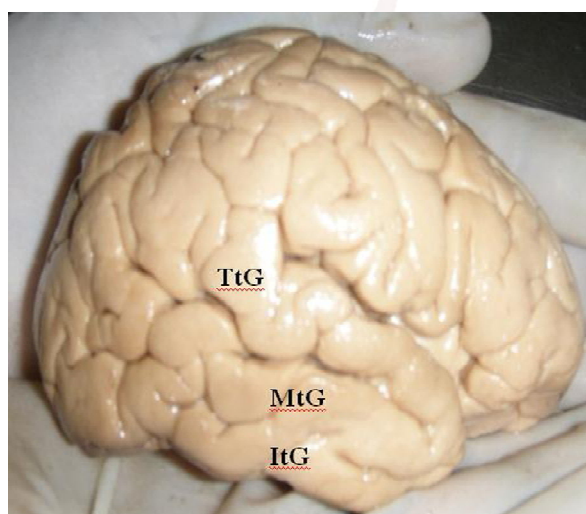
Appearance of insula (I) between 18-20weeks

**Fig. 3:** Showing the Brain Surface in GROUP-3 (>24-30wks).



Pre central gyrus (PrG) appear in front of central sulcus between 24-26weeks. Superior frontal gyri (SfG) and superior temporal gyri (StG) become definite between 24-26weeks. Superior and inferior parietal lobule are distinguished between 24-26weeks. Angular (AG) and supra marginal gyri (SmG) appear between 26-28weeks. Post central gyrus (PsG) appear between 26-28weeks posterior to central sulcus. Inferior and middle frontal gyri appear between 26-28weeks.

**Fig. 4:** Showing the Brain Surface in GROUP-4 (>30-36weeks).



Inferior temporal gyri (ItG) and middle temporal gyri (MtG) appear between 30-32weeks.

Transverse temporal gyri (TtG) appear at medial border of superior temporal gyri between 34-36 weeks.

**Fig. 5:** Showing the Brain Surface in GROUP-5 (>36-40wks).



Secondary gyri appear.

## DISCUSSION

Brain surface is smooth up to 12-14weeks [6], but V.I.Savel'ev observed at 16week [7]. Insula

appear as lateral cerebral fossa between 14-16weeks with full formation by 18-20weeks, but A.Afif et al observed insula at 13-17weeks with complete formation by 30-32weeks [8]. Brain demonstrates a growth spurt that is reflected by, well defined gyral pattern between 24 to 30 weeks, Chi et al observed during 26-28weeks. Secondary gyri are formed during 36- 38 weeks, Chi et al observed during 30-32weeks [9]. There was no difference between male and female brain the same gestational age, with no obvious asymmetrical development of gyri on the different lobes and it supports the study of Chi et al [9].

**Table 2:** Comparison of present study with other studies.

Characteristics	Present study	Chi et al, 1977. [9]
No of foetuses	50	107
Gestational age in weeks	12-40	10-44
Superolateral surface(weeks)		
Insula	18-20	19
Precentral gyrus	24-26	24
Superior frontal gyrus	24-26	25
Middle frontal gyrus	26-28	27
Inferior frontal gyrus	26-28	28
Post central gyrus	26-28	25
Superior parietal lobule	24-26	26
Inferior parietal lobule	24-26	26
Angular gyrus	26-28	28
Supra marginal gyrus	26-28	28
Superior temporal gyri	24-26	23
Middle temporal gyri	26-28	26
Inferior temporal gyri	30-32	30
Transverse temporal gyri	30-32	31

## CONCLUSION

There is no asymmetrical development of gyri on the different lobes of the brain. The convolutions pattern is known to be dependent upon hereditary tendencies Gyri become well defined within a relatively short period of time i.e. 24-28weeks. Cerebral gyri knowledge helps to understand the functional and morphological changes in developing brain in terms of treatment and protection of vital structures. The cortical maturation is often delayed in foetuses with central nervous system gyral abnormalities i.e. micropolygyry [10]. The gyral appearance key points helps to compose a framework to localise space occupying lesion of hemisphere, placement of supra tentorial craniotomies and

help in anatomical removal of gyral sectors that contain infiltrative tumour.

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**Conflicts of Interests: None**

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