Anatomy of the Cerebral Cortex, Lobes, and Cerebellum

Behroze Adi Vachha, MD, PhD[a,b], Tarik F. Massoud, MD, PhD[c], Susie Y. Huang, MD, PhD[d,*]

KEYWORDS

• Cerebral cortex • Cerebellum • Central sulcus • Parieto-occipital sulcus • Sylvian fissure • Cingulate gyrus • Precentral gyrus • Inferior frontal gyrus

KEY POINTS

- Each cerebral hemisphere is divided into 4 lobes based on key fissures and sulci: the Sylvian fissure (lateral sulcus), central sulcus, parieto-occipital sulcus, and cingulate sulcus.
- The central sulcus is an important anatomic landmark separating the frontal and parietal lobes.
- The Sylvian fissure is a key landmark that separates the insula medially and the frontal lobe superiorly from the temporal lobe.
- The frontal lobe is the largest lobe within the cerebral hemisphere and is composed of 4 major gyri: the superior, middle, and inferior frontal gyri and the precentral gyrus.
- The parietal lobe is located posterior to the central sulcus and is divided into 4 regions: the postcentral gyrus anteriorly, the superior and inferior parietal lobules posteriorly, and the precuneus medially.

INTRODUCTION

A strong grasp of cerebral cortical, lobar, and cerebellar anatomy is essential for any practitioner of neuroimaging. Neuroanatomy provides the map to identify and communicate the locations of lesions and understand their functional implications. This understanding is especially relevant to the localization of lesions before biopsy or neurosurgical intervention. Detailed knowledge of neuroanatomy is also necessary for clinical correlation with neurologic symptoms in patients presenting with suspected neurologic diseases. Neuroanatomical knowledge provides an essential foundation to help guide the search for potential lesions based on the clinical presentation and known focal neurologic deficits.

Advances in neuroimaging techniques over the past few decades have enabled the detailed visualization of brain structures at unprecedented spatial and contrast resolution. High-resolution 3-dimensional cross-sectional imaging is now acquired routinely, leveraging the latest computed tomography (CT) and MRI technology to enable the precise localization of small lesions in the cerebrum and cerebellum. Therefore, the ability to identify the location of key gyri and sulci within the cerebral cortex has become an essential skill for the practiced clinical neuroimager and will be of paramount importance as noninvasive techniques for imaging the brain continue to evolve and become more sophisticated.

The cerebral cortex of each cerebral hemisphere is part of the telencephalon that covers

[a] Department of Radiology, Memorial Sloan Kettering Cancer Center, 1275 York Avenue, New York, NY 10065, USA; [b] Brain Tumor Center, Memorial Sloan Kettering Cancer Center, 1275 York Avenue, New York, NY 10065, USA; [c] Division of Neuroimaging and Neurointervention, Department of Radiology, Stanford University School of Medicine, Center for Academic Medicine, 453 Quarry Road, Palo Alto, CA 94304, USA; [d] Division of Neuroradiology and Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, 149 13th Street, Room 2301, Charlestown, MA 02129, USA
* Corresponding author.
E-mail address: susie.huang@mgh.harvard.edu

Neuroimag Clin N Am 32 (2022) 463–473
https://doi.org/10.1016/j.nic.2022.04.008

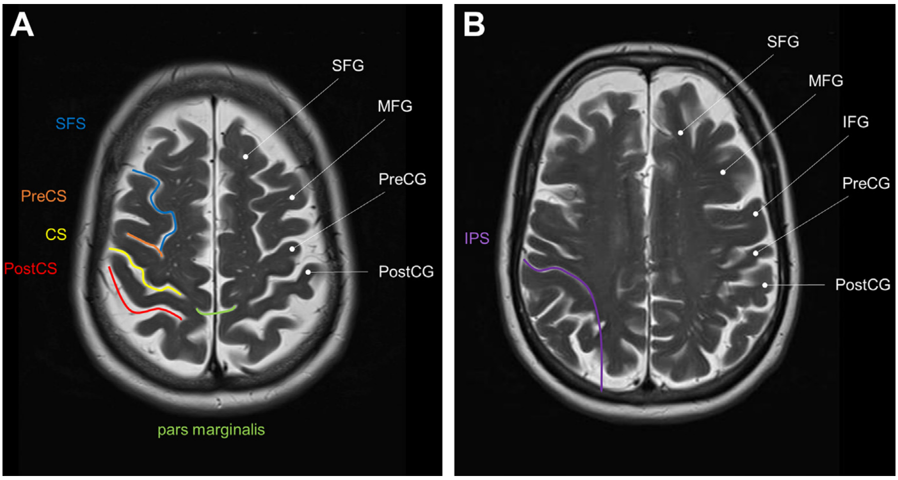

Fig. 1. Axial T2-weighted spin-echo images at the level of the (*A*) central sulcus and (*B*) intraparietal sulcus. Labeled gyri include the superior frontal gyrus (SFG), middle frontal gyrus (MFG), precentral gyrus (PreCG), and postcentral gyrus (PostCG). Labeled sulci include the superior frontal sulcus (SFS, *blue*), precentral sulcus (PreCS, *orange*), central sulcus (CS, *yellow*), postcentral sulcus (PostCS, *red*), pars marginalis of the cingulate sulcus (*green*), and intraparietal sulcus (IPS, *purple*).

the deeper diencephalic structures of the forebrain (the prosencephalon). Each hemispheric cortex is divided into 4 lobes based on key fissures and sulci, namely, the Sylvian fissure (lateral sulcus), central sulcus (CS), parieto-occipital sulcus, and cingulate sulcus. These fissures and sulci are large and readily identifiable between individuals based on their well-defined and characteristic configurations, locations, and depths along the cerebral hemispheres. The 4 major lobes are divided into smaller sulci and gyri that also exhibit defined patterns that can be recognized and learned through systematic review and practice in identifying these landmarks on routine neuroimaging studies.

The normal brain is almost but not quite perfectly symmetric across the interhemispheric fissure, and subtle inherent structural asymmetries may be apparent on neuroimaging, as reviewed recently by Kuo and Massoud.[1] Brain structural asymmetries can be rotational or pure right-left asymmetries. Yakovlevian torque results from the right hemisphere rotating slightly forward relative to the left, which may make the right frontal lobe bigger and wider, and the left occipital lobe wider and extend rightward. This torque also makes the left Sylvian fissure longer and flatter, resulting in a larger planum temporale. There are also right-left asymmetries in the cortex, white matter structures, deep gray nuclei, lateral ventricles, and hindbrain.[1] Brain asymmetries are not entirely random but result from distinct patterns in evolutionary structural design that confer functional advantages.

Frontal Lobe

The frontal lobe is the largest lobe within the cerebral hemisphere and is located anterior to the CS and above the Sylvian fissure. The frontal pole represents the most anterior portion of the frontal lobe. The prefrontal cortex corresponds to the anterior part of the frontal lobe. The prefrontal cortex plays a key role in the regulation of higher-order cognitive, emotional, and behavioral functioning. The frontal lobe is composed of 4 major gyri: the superior, middle, and inferior frontal gyri and the precentral gyrus. On axial images, the superior frontal gyrus is a vertically oriented gyrus along the superiormost margin of the frontal lobe (**Fig. 1**, SFG). The middle frontal gyrus (see **Fig. 1**, MFG) is a wide bar of tissue that parallels and is separated from the superior frontal gyrus by the superior frontal sulcus (see **Fig. 1**). The precentral gyrus crosses the superior frontal gyrus along the superior frontal convexity, which is well seen on axial images (see **Fig. 1**, PreCG). The precentral gyrus delineates the most posterior portion of the frontal lobe and extends inferiorly to the Sylvian fissure.

The inferior frontal gyrus is part of the lateral and inferior surface of the frontal lobe that overlies the insula anteriorly and is separated from the middle frontal gyrus by the inferior frontal sulcus.[2,3] The Sylvian fissure lies along its inferior edge; the anterior and ascending rami arising from the Sylvian fissure divide the inferior frontal gyrus into 3 parts, giving it the shape of the letter "M," known as the

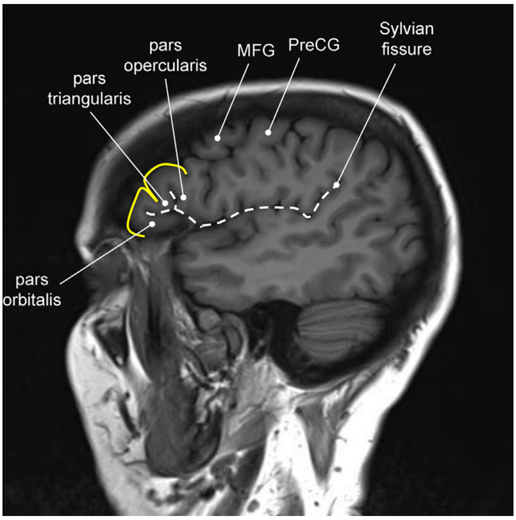

Fig. 2. Far lateral sagittal T1-weighted image at the level of the Sylvian fissure and frontal operculum. Labeled gyri include the yellow M-shaped inferior frontal gyrus, consisting of the pars orbitalis, pars triangularis, and pars opercularis; middle frontal gyrus (MFG), and precentral gyrus (PreCG). The Sylvian fissure courses horizontally across the image as denoted by the dashed line, with its anterior and ascending rami separating the pars orbitalis, pars triangularis, and pars opercularis of the inferior frontal gyrus, respectively.

"M sign" (Fig. 2, yellow line).[2] From anterior to posterior, the 3 parts of the "M" shape are the pars orbitalis, the pars triangularis, and the pars opercularis (see Fig. 2). Traditionally, the pars opercularis and pars triangularis are considered to form the Broca area (Brodmann areas 44 and 45) in the left hemisphere.[4] The functions of the traditional Broca and Wernicke areas are discussed in detail in the article "Brain Functional Imaging Anatomy" in this issue. The pars opercularis overlies the anterior insula and abuts the orbitofrontal cortex, which runs parallel to the gyrus rectus along the inferior surface of the frontal lobe (Fig. 3). The orbitofrontal cortex rests upon the orbital portion of the frontal bone and is composed of 4 gyri delineated by a distinctive H-shaped sulcus on axial views: the anterior, medial, posterior, and lateral orbital gyri (see Fig. 3B). The medial orbital gyrus abuts the vertically oriented olfactory sulcus, which is bordered superiorly by the olfactory tract and divides the orbital gyri from the gyrus rectus (see Fig. 3A).

Central Sulcus

The CS of Rolando separates the frontal and parietal lobes and is an important anatomic landmark when interpreting structural neuroimaging.[2,5,6] The CS is flanked by the precentral gyrus, which houses the primary motor cortex anteriorly, and the postcentral gyrus, which houses the primary somatosensory cortex posteriorly.[2,7] Along the medial surface of the brain, near the interhemispheric fissure at the apex of the CS, the precentral and postcentral gyri fuse to form the paracentral lobule, whereas inferolaterally these gyri fuse to form the subcentral gyrus.[2,3,8,9] This continuous loop of tissue surrounding the CS has been proposed as a separate lobe referred to as

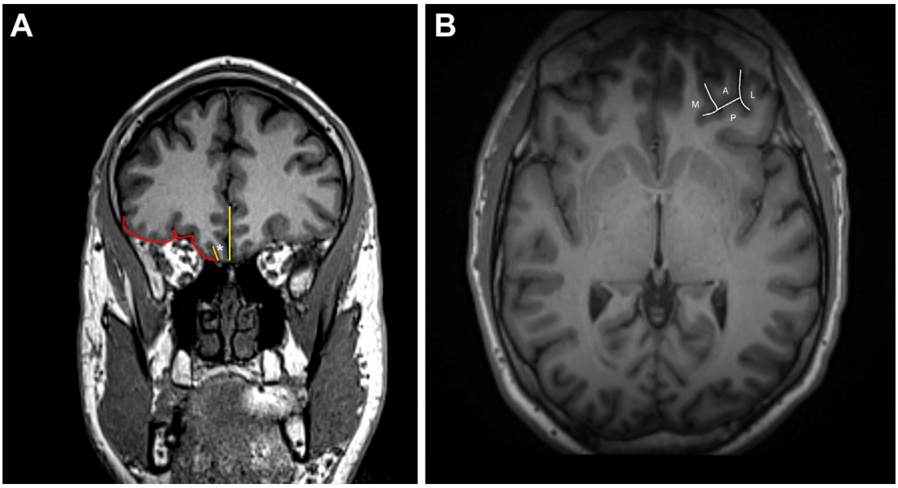

Fig. 3. Coronal and axial T1-weighted magnetization-prepared gradient echo (MPRAGE) images through the level of the orbitofrontal cortex. (*A*) Far anterior coronal image shows the orbitofrontal cortex (*red outline*), which is separated from the gyrus rectus (*asterisk*) by the vertically oriented olfactory sulcus (*orange line*). The interhemispheric fissure is delineated as a yellow line dividing the cerebral hemispheres. (*B*) Axial image shows the H-shaped orbital sulcus separating the anterior (*A*), lateral (*L*), posterior (*P*), and medial (*M*) orbital gyri.

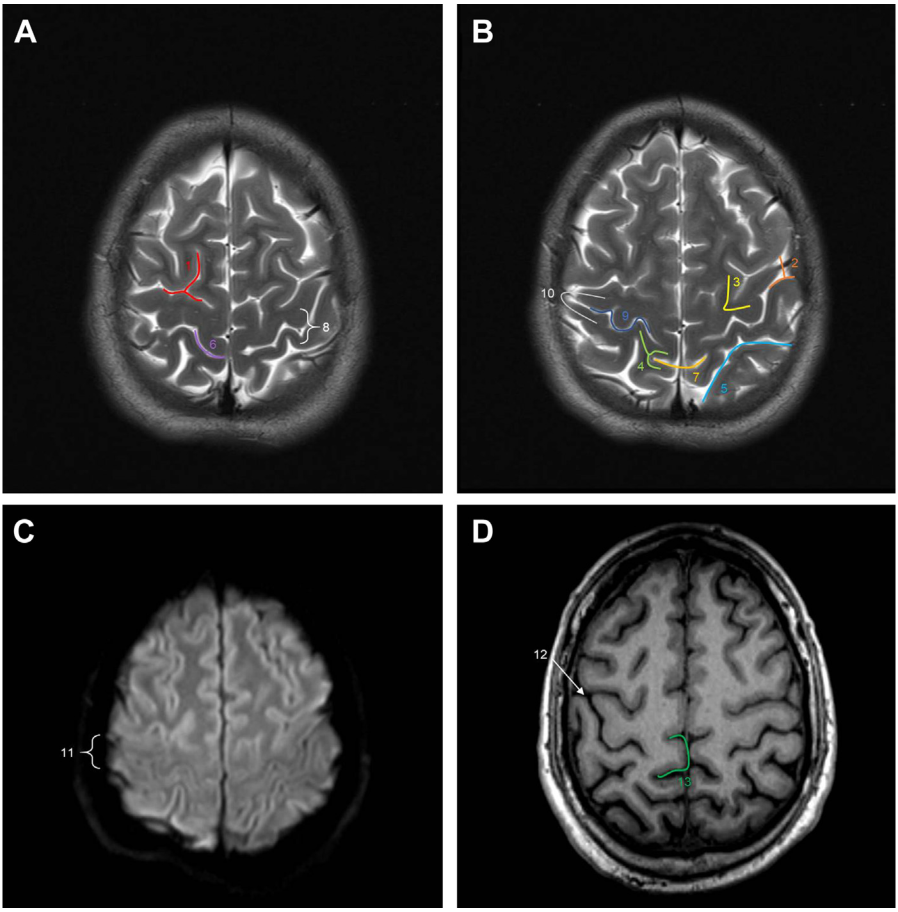

Fig. 4. Montage of signs indicating the location of the central sulcus on (*A*, *B*) axial T2-weighted images, (*C*) axial diffusion-weighted image, and (*D*) axial T1-weighted MPRAGE image along the superior convexity. 1, Superior frontal sulcus-precentral sulcus sign (upper T sign); 2, inferior frontal sulcus-precentral sulcus sign (lower T sign); 3, L sign; 4, bifid postcentral gyrus sign; 5, intraparietal sulcus sign; 6, midline sulcus sign; 7, pars bracket sign; 8, thin postcentral gyrus sign; 9, handknob or reverse-omega sign; 10, U sign; 11, invisible cortex sign; 12, white gray sign; 13, white paracentral lobule sign.

the central lobe, although the term has yet to gain wide acceptance.[2]

Several signs and landmarks have been described on structural imaging using CT and MRI to identify the CS, most of which rely on relationships and patterns between sulci and gyri (**Fig. 4**). Although most of these signs are 85% to 98% reliable in localizing the CS, morphologic variations or changes owing to adjacent cerebral lesions (**Fig. 5**) can be limiting factors, suggesting the need to combine several signs in concert to increase confidence in localization.[2] **Table 1** lists the most commonly described signs for identification of the CS, which are also illustrated in **Fig. 4**.

Cingulate Gyrus

Along the medial surface of the cerebral hemisphere, the cingulate gyrus parallels the corpus callosum, separated from it by the callosal sulcus, as best seen on sagittal imaging (**Fig. 6**). The cingulate gyrus is bordered superiorly by the superior frontal gyrus and paracentral lobule. The cingulate gyrus is separated from the superior frontal gyrus and paracentral lobule by the cingulate sulcus (see **Fig. 6**),[2] which runs parallel to the corpus callosum along its anterior portion and bends superiorly to form the pars marginalis.

The cingulate gyrus is a major limbic area and part of the Papez circuit (the medial or hippocampal limbic circuit), which begins at the hippocampus, continues as the fimbria and fornix, and ends in the mammillary body. From the mammillary body, the mammillothalamic tract reaches the anterior nuclear group of the thalamus and then the cingulum (the white matter core of the cingulate gyrus), which turns around the splenium of the corpus callosum to end as the radiation of

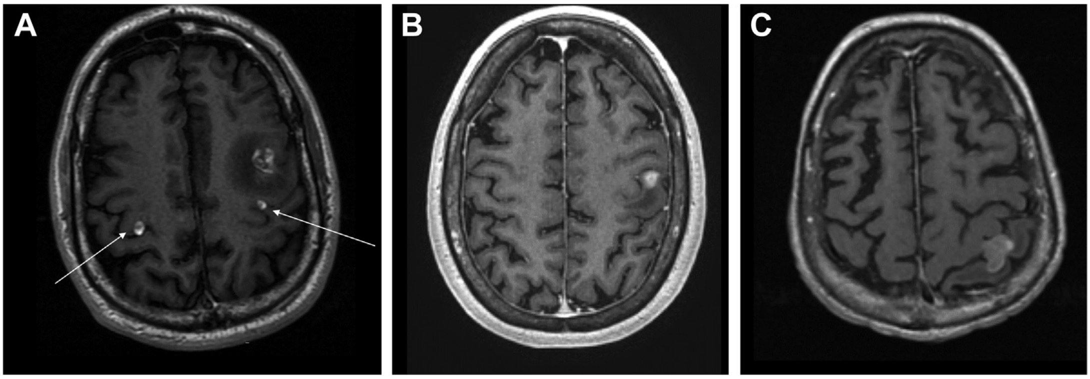

Fig. 5. Postcontrast axial T1-weighted fast spoiled gradient echo images demonstrating metastatic lesions involving the precentral and postcentral gyri. (*A*) Small enhancing metastases (*white arrows*) in the bilateral precentral gyri. A larger enhancing lesion in the posterior aspect of the middle frontal gyrus is associated with marked surrounding edema that extends into the precentral gyrus. (*B*) Enhancing metastasis involving the left postcentral gyrus with adjacent edema. (*C*) Lobulated enhancing lesion centered in the left postcentral gyrus extends into the central sulcus.

the cingulum into the hippocampus and uncus of the temporal lobe, thus completing the circuit[10]; this is in contradistinction to the basolateral or amygdaloid limbic circuit.[10,11]

Parietal Lobe

The parietal lobe is located posterior to the CS and can be divided into 4 regions: the postcentral gyrus anteriorly, the superior and inferior parietal lobules posteriorly, and the precuneus medially. The postcentral gyrus is located immediately posterior to and runs parallel to the CS (see Fig. 1). The postcentral gyrus is bordered posteriorly by the postcentral sulcus. The superior and inferior parietal lobules are located posterior to the postcentral sulcus and are divided by the intraparietal sulcus (see Fig. 1). The precuneus is located posterior to the postcentral sulcus and can be readily identified on the medial surface of the hemisphere on sagittal images (see Fig. 6). The precuneus is contiguous with the superior parietal lobule along the superior aspect of the parietal lobe. The parieto-occipital sulcus is posterior to the precuneus and divides the parietal lobe from the occipital lobe (see Fig. 6). The parieto-occipital sulcus is readily identified on sagittal images as a diagonally oriented sulcus that parallels and is located posterior to the ascending ramus of the cingulate sulcus. Between the pars marginalis of the cingulate sulcus and the parieto-occipital sulcus lies a sulcus known as the subparietal sulcus (see Fig. 6), which separates the precuneus from the posterior portion of the cingulate gyrus.

On the lateral surface of the brain, the posterior part of the Sylvian fissure angles superiorly to form the ascending ramus, which terminates in an inverted U-shaped gyrus known as the supramarginal gyrus (Fig. 7). The angular gyrus is usually located immediately posterior to the supramarginal gyrus. This relationship may vary anatomically even within an individual (see Fig. 7), with the interposition of accessory gyri between the supramarginal and angular gyri (see Fig. 7B).[12] Taken together, the supramarginal and angular gyri form the inferior parietal lobule. The inferior parietal lobule is separated from the superior parietal lobule by the intraparietal sulcus. The primary intermediate sulcus descends from the intraparietal sulcus to divide the supramarginal gyrus from the angular gyrus.

Temporal Lobe

The Sylvian fissure (also known as the lateral sulcus or lateral fissure) is a key landmark that separates the insula medially and the frontal lobe superiorly from the temporal lobe. The lateral aspect of the Sylvian fissure separates the frontal and parietal opercula from the temporal operculum. The temporal pole lies under the Sylvian fissure at the anterior margin of the temporal lobe, along the most rostral portion of the middle cranial fossa. The circular sulcus outlines the insular cortex and is best visualized on sagittal planes medial to the Sylvian fissure. The circular sulcus consists of anterior, superior, and inferior segments that separate the insula from the frontal, temporal, and parietal opercula.[13] The posterior segment of the Sylvian fissure is contiguous with the superior and inferior segments of the circular sulcus of the insula. The limen insula is located at the junction of the anterior and posterior segments of the Sylvian fissure and delineates the

Table 1
Central sulcus signs

Signs	Description
Superior frontal sulcus-precentral sulcus sign (upper T sign)	The easily identifiable superior frontal sulcus joins the precentral sulcus; this intersection has the shape of an upper case T (see **Fig. 1**) and is considered 85% specific.[2,9,19] The precentral sulcus lies at the posterior end of the superior frontal sulcus, the precentral gyrus is found posterior to the precentral sulcus; and the CS is the next posterior sulcus[2,9]
L sign	The intersection between the superior frontal gyrus and the precentral gyrus resembles the capital letter "L" with the CS immediately posterior to the precentral gyrus[9,20]
Bifid postcentral gyrus sign	The pars marginalis of the cingulate sulcus splits the postcentral gyrus into a bifid configuration near the interhemispheric fissure[9,19,]
Intraparietal sulcus sign	The intraparietal sulcus intersects the postcentral sulcus and can be used to identify the central sulcus.[2]
Midline sulcus sign	The CS is identified as the longest sulcus running horizontally and closely approaching the interhemispheric fissure[9]
Pars bracket sign	The bihemispheric pars marginalis formed by the posterior-superior extension of the cingulate sulcus takes the shape of an anteriorly shaped bracket. The CS passes anterior to the pars marginalis on each side and medial to the lateral edge of the pars bracket.[2]
Thin postcentral gyrus sign	The precentral gyrus is thicker than the postcentral gyrus in anteroposterior diameter.[2] In addition, the thickness of the cortical gray matter within the precentral gyrus is thicker than that of the postcentral gyrus.[2]
Handknob or reverse-omega sign	The motor hand knob area refers to the posterior convex bulge of the precentral gyrus resulting in a symmetric or asymmetrical reverse-omega or epsilon shape in the axial plane.[2,20,21,22] In the sagittal plane, the hand motor area resembles a backward-oriented hook known as the sigmoidal hook sign[2,20,21]
U sign	The inferolateral aspect of the CS is enclosed by the U-shaped subcentral gyrus[9]
Invisible cortex sign	The cortices abutting the CS appears isointense relative to adjacent white matter on diffusion-weighted MRI sequences.[6] This observation is highly accurate in identifying the inferolateral aspect of the CS[6]
White gray sign	Increased T1 signal of the anterior and posterior cortices along the CS; the reduced gray-white contrast around the central sulcus was noted to be a reliable sign for identification of the CS on T1-weighted 3D inversion recovery fast-spoiled gradient echo images[23]
White paracentral lobule sign	The high signal intensity of the paracentral lobule cortex on T1-weighted imaging compared with that in the superior frontal cortex is useful for CS identification.[5]
Disappearing central sulcus sign	On double inversion recovery sequences, the CS cortex signal intensity is lower than that of the adjacent sulci, and this characteristic can be used to identify the CS[24]

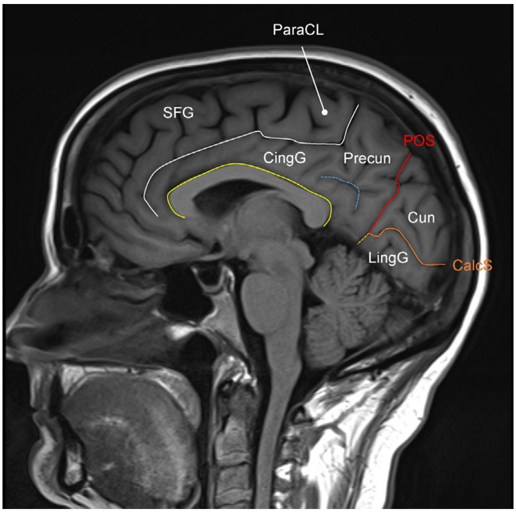

Fig. 6. Sagittal T1-weighted image demonstrating key gyri and sulci identifiable along the midline. Labeled gyri include the superior frontal gyrus (SFG), paracentral lobule (ParaCL), cingulate gyrus (CingG), precuneus (Precun), cuneus (Cun), and lingual gyrus (LingG). Outlined sulci include the cingulate sulcus (*white line*), callosal sulcus (*yellow line*), subparietal sulcus (*blue line*), parieto-occipital sulcus (*red line*, POS), and calcarine sulcus (*orange line*, CalcS).

point at which the insular cortex meets the amygdala and superior temporal gyrus.

The temporal lobe consists of 3 gyri: the superior, middle, and inferior temporal gyri (Fig. 8). The superior temporal sulcus separates the superior and middle temporal gyri, and the inferior temporal sulcus separates the middle and inferior temporal gyri. The traditional Wernicke area (Brodmann Area 22) is considered to lie in the posterior part of the superior temporal gyrus in the dominant hemisphere.[8] The inferior temporal gyrus is separated by the lateral occipito-temporal sulcus from the lateral occipito-temporal gyrus (see Fig. 8). The lateral occipito-temporal gyrus is separated from the parahippocampal gyrus by the collateral sulcus (see Fig. 8). The hippocampal fissure separates the parahippocampal gyrus from the hippocampus (see Fig. 8). The temporal stem connects the temporal and frontal lobes and lies in close proximity to the insula. The temporal stem is a key landmark that may be affected in several disorders, including seizures, tumors, and infection.

The demarcation between the insula and temporal lobes is readily identified on axial and sagittal views (Fig. 9). The insula is generally divided into 5 gyri. The anterior, middle, and posterior short insular gyri are separated from the anterior and posterior long insular gyri by the CS of the insula, which divides the insula into larger anterior and smaller posterior lobules.[14] On axial views, the posterior long insular gyrus is separated from the transverse temporal gyrus or Heschl gyrus (see Fig. 9), which is the location of primary auditory cortex. Heschl sulcus is posterior to Heschl gyrus and represents the anterior boundary of the planum temporale, an auditory association area.

Occipital Lobe

Along the medial surface of the cerebral hemisphere, the parieto-occipital sulcus separates the

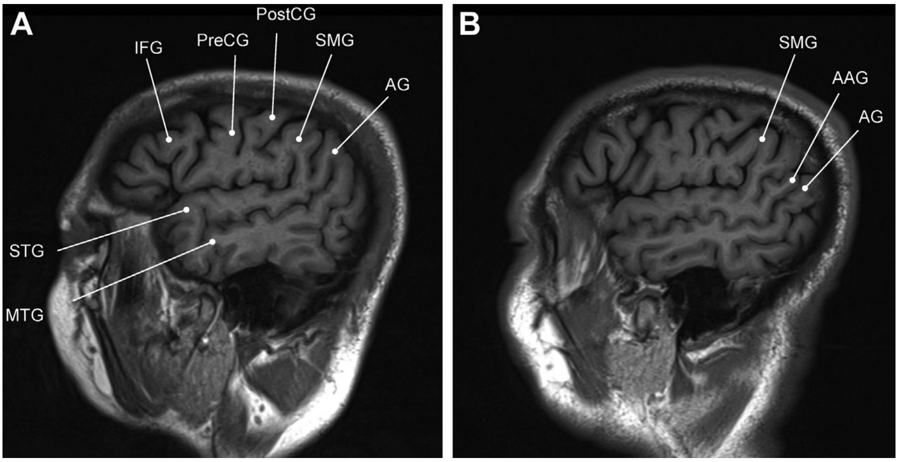

Fig. 7. Sagittal T1-weighted images along the lateral aspects of the cerebral convexities at the level of the Sylvian fissure illustrating variations in parietal lobe anatomy within an individual. (*A*) Right lateral view of the frontal, temporal, and parietal lobes. Labeled gyri include the inferior frontal gyrus (IFG), precentral gyrus (PreCG), postcentral gyrus (PostCG), supramarginal gyrus (SMG), angular gyrus (AG), superior temporal gyrus (STG), and middle temporal gyrus (MTG). (*B*) Sagittal image of the contralateral hemisphere demonstrates the presence of an accessory preangular gyrus (AAG) interposed between the supramarginal gyrus (SMG) and angular gyrus proper (AG).

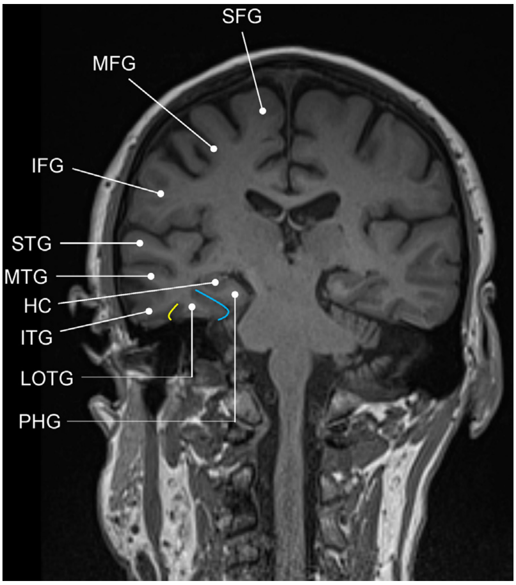

Fig. 8. Coronal image at the level of the foramina of Monro of the lateral ventricles demonstrating the major gyri and sulci of the frontal and temporal lobes. Labeled gyri include the superior frontal gyrus (SFG), middle frontal gyrus (MFG), inferior frontal gyrus (IFG), superior temporal gyrus (STG), middle temporal gyrus (MTG), hippocampus (HC), inferior temporal gyrus (ITG), lateral occipito-temporal gyrus (LOTG) and parahippocampal gyrus (PHG). Outlined sulci include the lateral occipitotemporal sulcus (*yellow line*) separating the inferior temporal gyrus and lateral occipitotemporal gyrus and the collateral sulcus (*blue line*) dividing the lateral occipitotemporal gyrus from the parahippocampal gyrus.

precuneus in the parietal lobe from the cuneus in the occipital lobe (see **Fig. 6**). The calcarine sulcus runs nearly orthogonal to the parietooccipital sulcus and divides the occipital lobe into the triangular-shaped cuneus superiorly and the tongue-shaped lingual gyrus inferiorly as seen on sagittal imaging (see **Fig. 6**). The calcarine sulcus separates the superior and inferior portions of the primary visual cortex. The anterior calcarine sulcus extends anteriorly and inferiorly from the junction of the parieto-occipital sulcus and calcarine sulcus to separate the lingual gyrus from the continuation of the cingulate sulcus.

Along the lateral surface of the cerebral hemisphere, the occipital lobe is composed of the superior, middle, and inferior occipital gyri, separated by the superior and inferior occipital sulci.[2] The superior occipital gyrus drapes over the convexity onto the medial surface to form the cuneus. The superior occipital sulcus or intraoccipital sulcus is contiguous with the intraparietal sulcus and parallels the interhemispheric fissure on axial views. The intraoccipital sulcus runs perpendicular to the parieto-occipital sulcus, which is readily identified on axial images as a bifid, barbell-shaped sulcus crossing midline. On axial views, the precuneus sits anterior to the parieto-occipital sulcus, and the cuneus is located posterior to the parieto-occipital sulcus.

The inferior occipital sulcus extends posteriorly from the inferior temporal sulcus. The middle occipital gyrus lies just posterior to the junction of the temporal and parietal lobes and abuts the

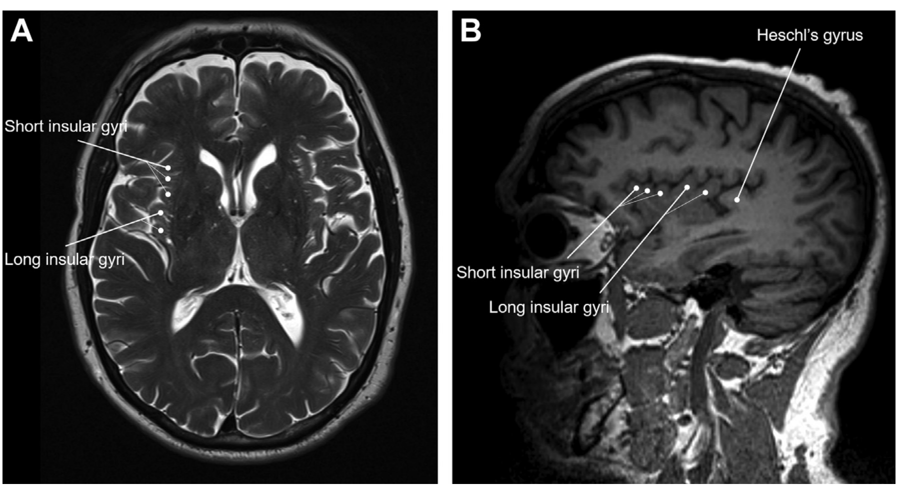

Fig. 9. Axial and sagittal images of the insula. (*A*) Axial T2-weighted spin-echo image demonstrating the division of the insula into the anterior, middle, and posterior short insular gyri anteriorly and the anterior and posterior long insular gyri posteriorly. (*B*) Sagittal T1-weighted image shows the short and long insular gyri separated by the central sulcus of the insula, and Heschl gyrus posteriorly.

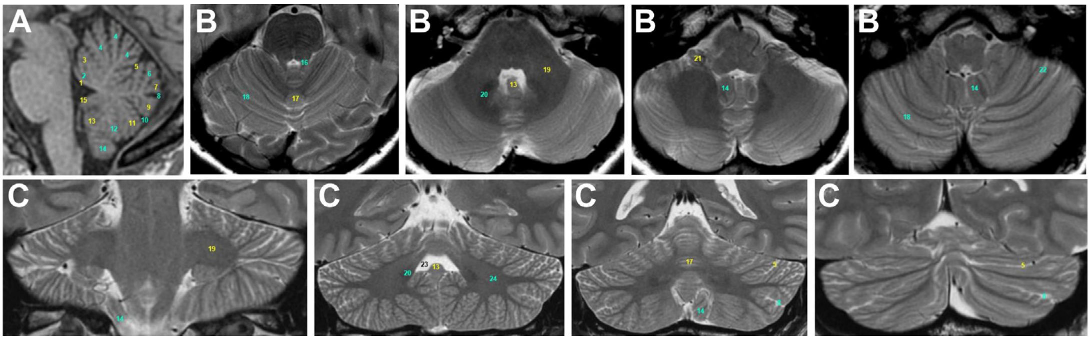

Fig. 10. (*A*) Sagittal, (*B*) axial, and (*C*) coronal images of the cerebellum. 1, Superior medullary velum; 2, lingula; 3, central lobule; 4, culmen; 5, tentorial fissure; 6, declive; 7, folium; 8, horizontal fissure; 9, tuber; 10, suboccipital fissure; 11, pyramid; 12, uvula; 13, nodulus; 14, tonsil; 15, inferior medullary velum; 16, superior cerebellar peduncle; 17, vermis; 18, cerebellar hemisphere; 19, middle cerebellar peduncle; 20, dentate nucleus; 21, flocculus; 22, cerebellar folia; 23, fourth ventricle; 24, cerebellar white matter (arbor vitae).

supramarginal gyrus, the angular gyrus, the superior temporal gyrus, and the middle temporal gyrus. The middle occipital gyrus occupies the most area along the lateral aspect of the occipital lobe and is divided into superior and inferior portions by the horizontally oriented middle occipital sulcus.[2]

Cerebellum

The cerebellum is located in the posterior cranial fossa and is a major feature of the hindbrain (the rhombencephalon). More specifically, along with the pons, it forms the metencephalon or the upper part of the hindbrain. All cerebellar connections with other parts of the brain pass through the cerebellar peduncles. The cerebellum consists of a highly-folded layer of cerebellar gray matter cortex overlying white matter surrounding a fluid-filled fourth ventricle at its base (**Fig. 10**). Four deep cerebellar nuclei are embedded in the white matter. The first detailed descriptions of cerebellar MRI anatomy were provided by Courchesne and colleagues[15] and Press and colleagues.[16,17]

The cerebellum is divided into 2 cerebellar hemispheres, connected by a narrow midline zone termed the *vermis* (see **Fig. 10**). The vermis has been described as consisting of 9 named lobules: lingula, central lobule, culmen, clivus, folium of the vermis, tuber, pyramid, uvula, and nodule or nodulus.[18] Three lobes can be distinguished within the cerebellum: the anterior or superior lobe (above the primary or horizontal fissure), the posterior or inferior lobe (below the primary fissure), and the flocculonodular lobe (below the posterior fissure). A set of folds divides the overall structure of the cerebellum into about 10 smaller lobules (I to V in anterior lobe, VI to IX in posterior lobe, and X is considered the flocculonodular lobe). Each surface ridge or gyrus in the cortex is called a folium. Underneath the gray matter folia lies white matter (the arbor vitae, or tree of life, because of its branched appearance on cross section), made up largely of myelinated nerve fibers running to and from the cortex. Embedded within the white matter is a cluster of 4 deep cerebellar nuclei, composed of gray matter, the dentate, globose, emboliform, and fastigial nuclei. Each of these communicates with different parts of the brain and cerebellar cortex. The dentate nucleus is the largest and is a thin, convoluted layer of gray matter. The flocculus of the flocculonodular lobe is the only part of the cerebellar cortex that does not project to the deep nuclei; its output goes to the vestibular nuclei.

Connecting the cerebellum to different parts of the brain and spinal cord are 3 paired cerebellar peduncles (superior, middle, and inferior). Each superior cerebellar peduncle (brachium conjunctivum) is made of white matter that connects the cerebellum to the midbrain. The middle cerebellar peduncle (brachium pontis) only contains fibers from the pons to the cerebellum arranged in 3 fasciculi: superior, inferior, and deep. The pontine nuclei (or griseum pontis) in the ventral pons are the nuclei involved in motor activity. Corticopontine fibers carry information from the primary motor cortex to the ipsilateral pontine nucleus, and the pontocerebellar projection then carries that information to the contralateral cerebellum through the middle cerebellar peduncle. The inferior cerebellar peduncle (made of restiform and juxtarestiform bodies) is at the lower part of the fourth ventricle and connects the cerebellum to the spinal cord and medulla oblongata. The inferior cerebellar peduncle carries several input and output fibers for integration of proprioceptive sensory input and motor vestibular functions such as balance and posture maintenance.

The cerebellopontine fissure, also called the cerebellopontine angle, is a V-shaped fissure formed by the cerebellum wrapping around the pons and middle cerebellar peduncle. Inferiorly, the cerebellar tonsil is equivalent to a rounded lobule on the undersurface of each cerebellar hemisphere, continuing medially into the uvula of the vermis and superiorly into the flocculonodular lobe.

CLINICS CARE POINTS

- Morphologic variations in the configuration of the CS or alterations in its configuration owing to adjacent cerebral lesions may require combining several imaging signs in concert to increase confidence in localizing this key anatomic landmark.
- The temporal stem connects the temporal and frontal lobes and is a key structure that may be affected in several disorders, including seizures, tumors, and infection.

FUNDING INFORMATION

NIH/NCI Cancer Center Support (Grant P30 CA008748, PI: Thompson). NIH grant numbers U01-EB026996, P41-EB030006, K23-NS096056, P41-EB017183, and R01-NS118187.

DISCLOSURES

None.

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