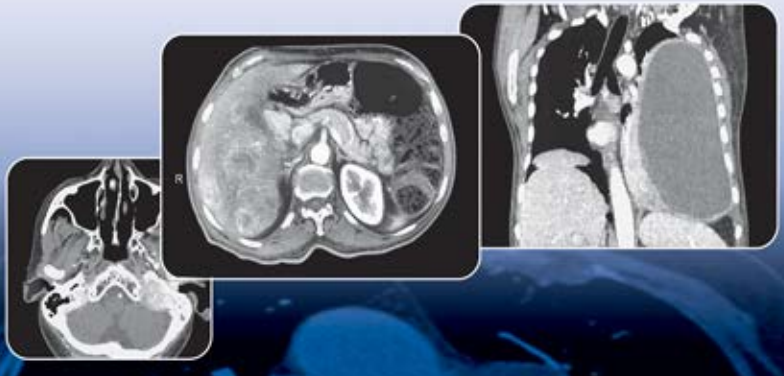
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Differential Diagnosis in
COMPUTED TOMOGRAPHY



THIRD EDITION

Sumeet Bhargava
Satish K Bhargava

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Differential Diagnosis in Computed Tomography

Third Edition

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Chapter 1

Brain

INTRACRANIAL CALCIFICATION

Details of intracranial calcification are given in Tables 1 and 2.

TABLE 1: Causes of intracranial calcification.

Criteria	*Physiological*	*Pathological*
Midline	• Pineal • Habenular • Falcine • Interclinoid ligament • Pituitary • Third and fourth ventricular choroid plexus	• Craniopharyngioma • Pinealoma • Chordoma/clival chondrosarcoma • Pituitary adenoma • Lissencephaly
Off-midline Unilateral		*Neoplasms* • Meningioma • Ependymoma • Papilloma of choroid plexus • Dermoid/epidermoid/ teratoma • Metastases

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Criteria	*Physiological*	*Pathological*
		Infections • Viral (CMV, herpes, rubella) • Bacterial (TB, *Staphylococcus spp.*) • Fungal (*Coccidioides*) *Infestations* • Cysticercosis • Echinococcosis • Toxoplasmosis • Paragonimiasis • Trichinosis • Torulosis *Vascular* • Atheroma • Glioma • Aneurysm • Angioma • Subdural/intraparenchymal hematoma • Sturge-Weber syndrome
Bilateral • Symmetrical	• Choroid plexus • Basal ganglia • Dentate nucleus • Petroclinoid ligaments • Tentorial	• Lipoma • Hypoparathyroidism • Pseudohypoparathyroidism • Fahr syndrome (Figs. 1A to E) • Neurofibromatosis
• Asymmetrical	• Pacchionian bodies	• Glioblastoma multiforme • Tuberous sclerosis

(CMV: cytomegalovirus)

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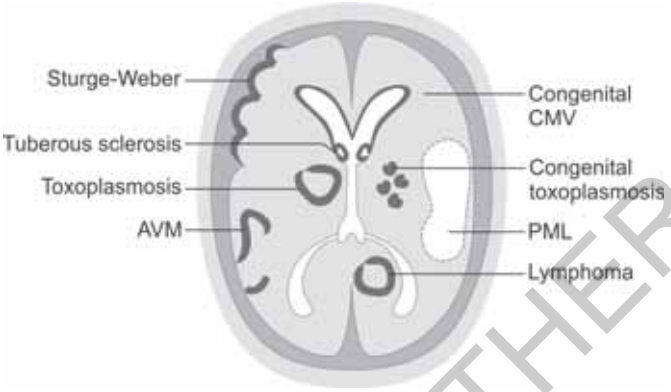


Fig. 1A: Pictorial representation of common causes of intracranial calcification.
(AVM: aneurysm and vascular malformation; CMV: cytomegalovirus; PML: progressive multifocal leukoencephalopathy)

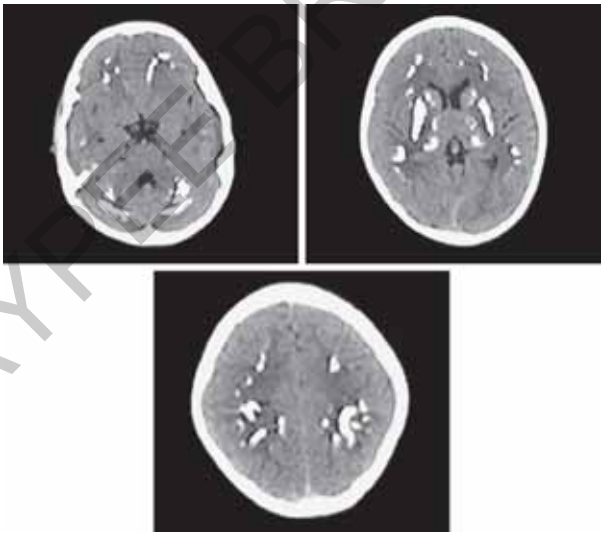


Fig. 1B: Axial computed tomography (CT) images showing extensive intraparenchymal calcification in a case of Fahr's disease.

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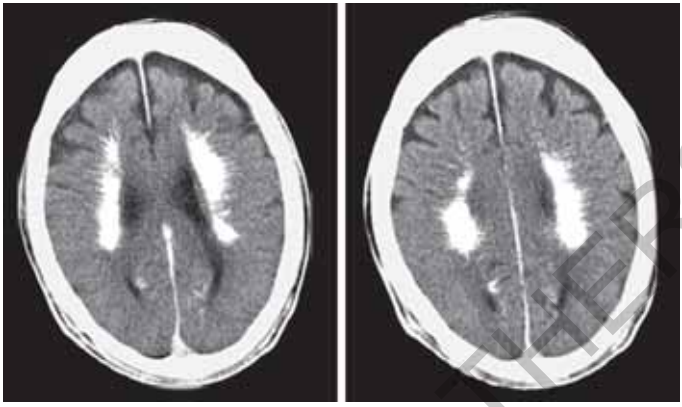


Fig. 1C: Intracranial calcification in hypoparathyroidism.



Fig. 1D: Intracranial calcification in pseudohypoparathyroidism.



Fig. 1E: Intracranial lipoma with Bracket calcification.

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TABLE 2: Differentiating features of various intracranial calcification.

Sites of calcification	*Differentiating features*	*Comments*
Pineal gland	It is seen as a punctate or nodular calcific density immediately posterior to the calcific density of habenular commissure	• It is seen in most adults • It may be seen as early as 1 year of life and in 90% cases by 10 years of age
Habenular	• It is usually 3–4 mm in diameter • It is seen as a crescentic, calcific commissure	The concavity of the crescent faces density at the back of the third ventricle posteriorly
Choroid plexus	It varies from punctate to large calcific density measuring up to 1 cm in diameter	Most common in the glomus at the trigone of lateral ventricle
Dural	It is seen as thin linear calcification of falx or sheet-like in cases of tentorium cerebelli	Commonly seen in the elderly
Petroclinoid ligaments	It is seen as a linear calcification extending from the tip of the dorsum sellae to the petrous apex	Commonly seen in the elderly
Interclinoid ligaments	It is seen as a thin linear calcification of ligaments between the clinoid processes	It gives rise to bridging sella extending across the midline appearance
Pacchionian bodies	They are seen as multifocal, punctate or nodular calcific densities usually near the vertex	They are usually bilateral and asymmetric in distribution
Pituitary gland	It is seen as a punctate calcification in the location of the gland in the sella	It is very rare and may be normal variant

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Sites of calcification	*Differentiating features*	*Comments*
Basal ganglia and dentate nucleus	It is seen as amorphous calcification in the basal ganglia and dentate nuclei, usually in symmetrical and bilateral pattern	• Globus pallidus is the first to calcify • This can be idiopathic or secondary to metabolic disorders
Glioma	• Any type of glioma can show any pattern of calcification • Oligodendroglioma are the commonest to show calcification (approximately half of the cases)	Slow growing and the less malignant glioma are the most likely to reveal calcification
Craniopharyngioma	• Punctate calcification is seen in three-fourths of the cases in children. • Occasionally, when the tumor is cystic, the calcification is curvilinear in the wall of the cyst with a characteristic location in midline just above the sella	The shape of the sella is changed as the anterior part is pressed downward from above
Meningioma	The calcification may be characteristically ball-like and amorphous in a characteristic parasagittal location and other specific sites	• Hyperostosis in the adjacent calvarium and increased meningeal vascular markings upto the site of the bony lesion are other clues to the diagnosis • Heavily calcified meningiomas: *Brain Rocks*!!
Dermoid	• They may show arcs of calcification • There may be associated central defect in the occipital bone in posterior fossa dermoid	• They are most common in the posterior fossa and the base of the skull • Teratoma can also be seen in the pineal and suprasellar region

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Sites of calcification	*Differentiating features*	*Comments*
	• Presence of the dental element confirms the diagnosis of the mature dermoid/teratoma	
Lipoma	They show characteristic marginal calcification giving rise to the bracket configuration in the region of the corpus callosum	Less specific calcification may also be seen
Chordoma	It shows irregular calcification associated with soft tissue mass in the region of the clivus that may present into the nasopharynx after basal erosion	The calcification is, however, seen in minority of cases
Aneurysm	They show characteristic arc-like or circular marginal calcification	The most common site is the circle of Willis
Angioma	Small proportion of these show scattered flecks of calcification along with one or more rings or arc-like calcification	The arc-like calcification is seen in the aneurysmally dilated venous channels
Subdural hematoma	It shows typical marginal calcification of the membrane in concavo-convex configuration	Characteristic location of being adjacent to the calvaria is typical
Atheroma	Linear flecks of calcification in the carotid siphons secondary to atherosclerosis is very characteristic	Similar findings can occasionally be seen in other intracranial vessels

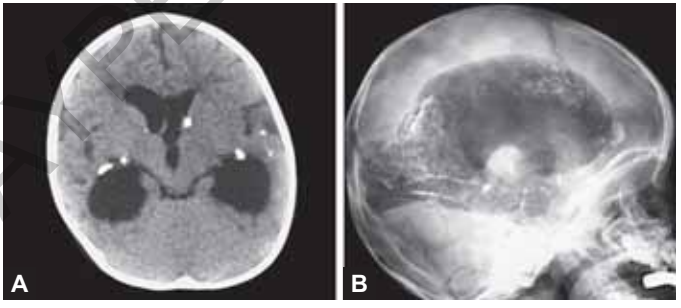
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Sites of calcification	*Differentiating features*	*Comments*
Postinfectious/Postinfestation	• Congenital toxoplasmosis typically shows linear streaks in the basal ganglia and multiple scattered calcific specks in the cortex (Figs. 2A and B) • Congenital CMV infection results in widespread periventricular calcification that may take the shape of the dilated ventricle; the calcification is typically stippled, bilateral and symmetric (Fig. 3) • *Paragonimus westermani* lesions are usually seen in the parietal region and often give rise to the extensive *soap bubble* calcification in the cysts that are usually 3–4 cm in diameter	• Treated cases of tuberculoma, cysticerci, and toxoplasma may also result in nodular and punctate calcification at the site of the inactive lesion • Active tuberculoma and cysticercus may also reveal speck of calcification within the lesion

Contd...



Figs. 2A and B: Axial CT and lateral skull X-ray images in a case of congenital toxoplasmosis shows foci of calcification in left basal ganglia, bilateral periventricular region, and in left temporal lobe.

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Sites of calcification	*Differentiating features*	*Comments*
Neurofibromatosis	Rare feature of neurofibromatosis is extensive calcification of the choroid plexi of the lateral and third ventricles	
Tuberous sclerosis	• Multiple, nodular, subependymal calcification are seen in this condition (Fig. 4) • Giant cell astrocytoma seen with this condition may also be the cause of calcification	The nodules are usually subcentimeter in size except in the case of the giant cell astrocytoma where larger nodules may be seen
Sturge-Weber syndrome (Figs. 5A to F)	• It is characterized by gyral pattern of calcification typically extensive and bilateral involving the parieto-occipital cortex • The calcification resembles *tram track* configuration	The cortex showing calcification is typically atrophic and may show areas of intense postcontrast enhancement representing angiomas with large choroid plexi
Lissencephaly	Characteristic calcified nodule is seen in the septum pellucidum just behind foramen of Monro	The nodule is typically subcentimeter in size, usually 3–5 mm in diameter

(CMV: cytomegalovirus)

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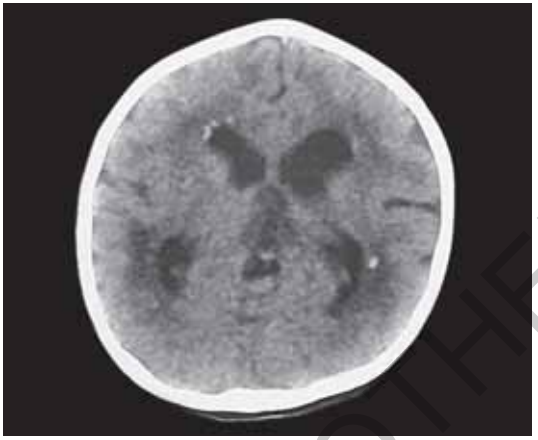


Fig. 3: Axial CT image in a case of congenital cytomegalovirus (CMV) shows bilateral symmetrical periventricular calcification.

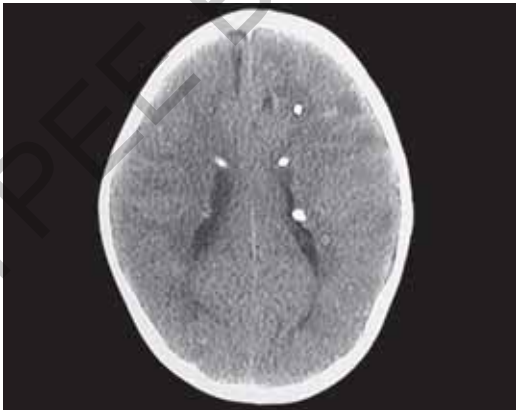
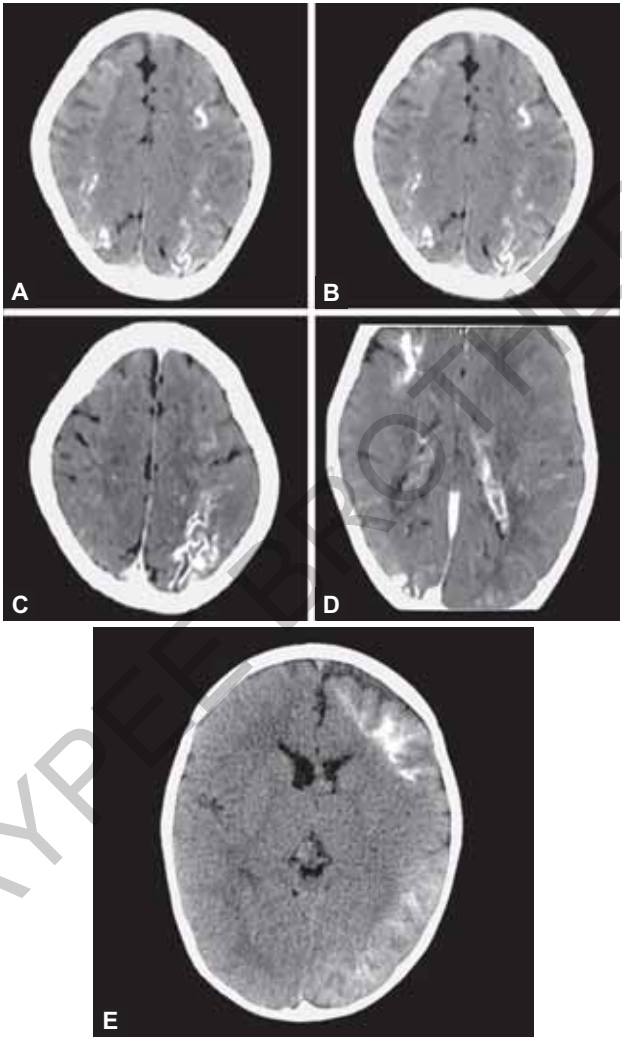


Fig. 4: Axial CT image in a 10-year-old boy with tuberous sclerosis shows bilateral calcified subependymal nodules and a partially calcified tuber in left frontal lobe.

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Figs. 5A to E: Axial CT images showing features in a typical case of Sturge-Weber syndrome.

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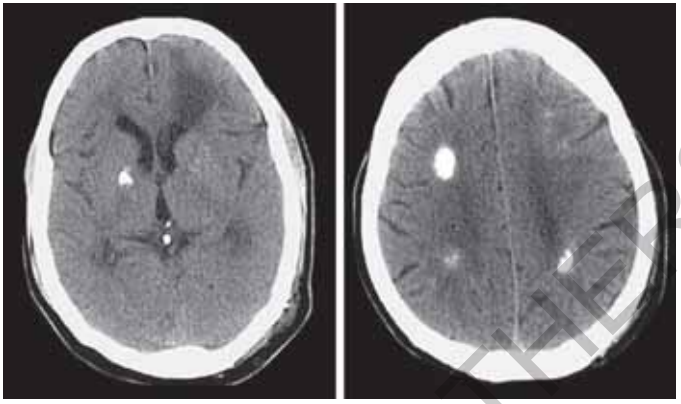


Fig. 5F: Leukoencephalopathy with intracranial calcifications.

DIFFERENTIAL DIAGNOSIS OF BRAIN LESIONS

Details of differential diagnosis of brain lesions are given in Tables 3 and 4.

Supratentorial Midline Tumors

- Optic and hypothalamic glioma
- Craniopharyngioma
- Astrocytoma
- Pineoblastoma
- Germinoma
- Lipoma
- Teratoma
- Pituitary adenoma
- Meningioma
- Choroid plexus papilloma.

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COMPUTED TOMOGRAPHY

The purpose of this book is to discuss various lesions giving similar imaging findings/appearances on CT scan. Their differential features have also been dealt with in a clear, and concise way so as to make a diagnosis. Mostly, lesions are shown with illustrations so as to make a visual impact of the CT findings. The causes and relevant features are being provided with the help of tables so as to give better and clear understanding. We are sure the book will definitely serve as an essential guide to practicing radiologists, physicians and surgeons in their day-to-day practice and also to postgraduate students in their examinations.

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He has been an author of many textbooks, excellent teacher and contributed more than 350 research papers in various national and international journals. Due to his wide academic contribution, he has been awarded Sir JC Bose Memorial Oration, Distinguished Medical Teachers Award, BC Roy Award, Brig SK Majumdar Oration Award, Swami Vivekanand Oration Award, Prithvinath Bhargava Memorial Oration Award, and GEMS International Award. He was working as the Chairman, Board of Research Studies, University of Delhi. He has also been awarded distinguished Excellence DNB Teachers Award by Vice President of India; Lifetime Academic Excellent Award by Vice Chancellor, Aligarh Muslim University; Lifetime Achievement Award by National Indian Radiological and Imaging Association on 23rd, January 2020; Lifetime Achievement Award by Delhi State of Indian Radiological and Imaging Association on 8th, Feb 2020.

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