



# Basal Ganglia Calcification (BGC)



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# Agenda

1. Our Patient's Clinical History
2. BGC: Generalities
  1. BGC: Differential Diagnosis
3. Anatomy of the Basal Ganglia
4. Radiologic Modalities
  1. SXR
  2. CT
  3. MRI
5. Take Home Points



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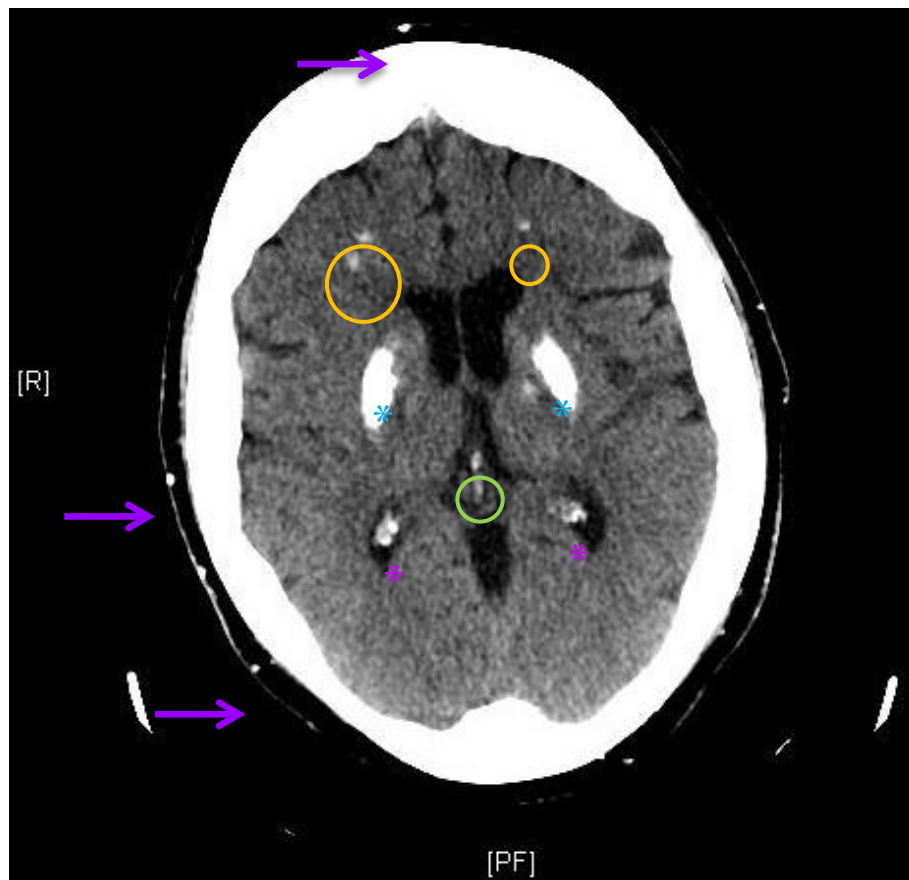
# Our Patient's Clinical History

- Female
- 57 years old
- Date of the study:
  - January 9, 2014 14:55h
  - January 11, 2014 08:49h
- The patient presented with history of R sided weakness.
- Our patient has a history of hypothyroidism and hypoparathyroidism.



# Our Patient:

## Calcifications in basal ganglia - Axial view



**Calcifications:**  
Basal Ganglia  
Frontal Lobe  
Pituitary Gland  
Coroidal Plexus  
Dermal

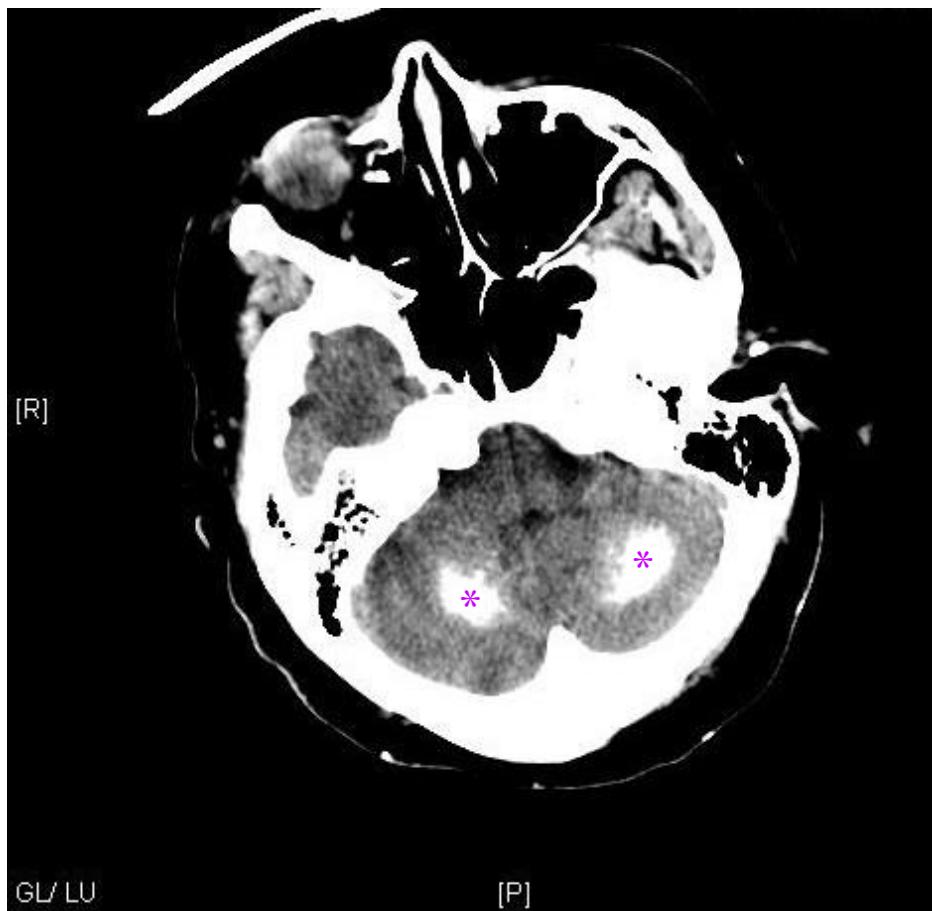
Source:  
PACS, BIDMC

C- Axial head CT



# Our Patient:

## Calcifications in cerebellum - Axial view



Source:  
PACS, BIDMC

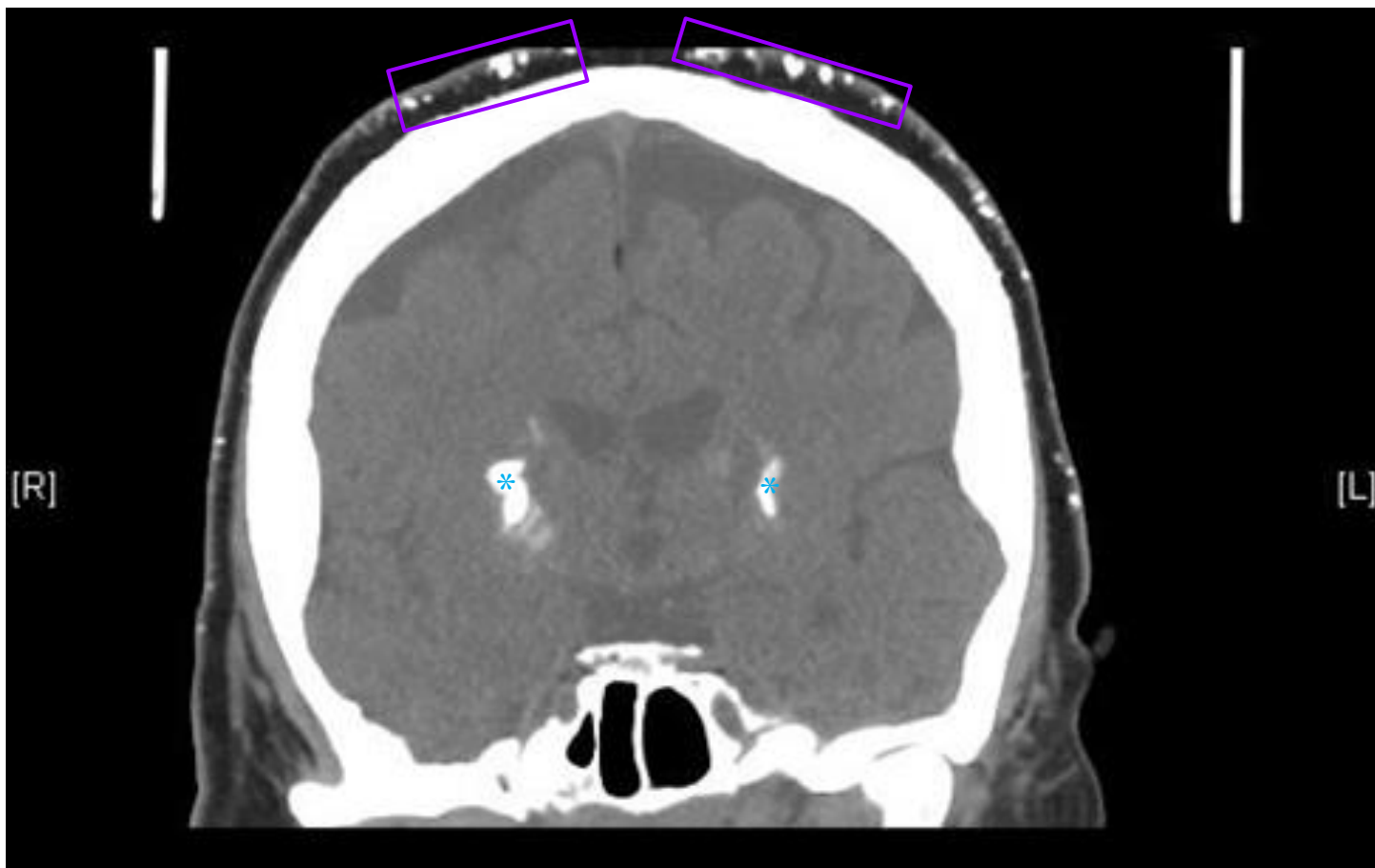
**Calcifications:**  
Cerebellum

C- Axial head CT



# Our Patient:

## Calcifications in basal ganglia - Coronal view



Source:  
PACS, BIDMC

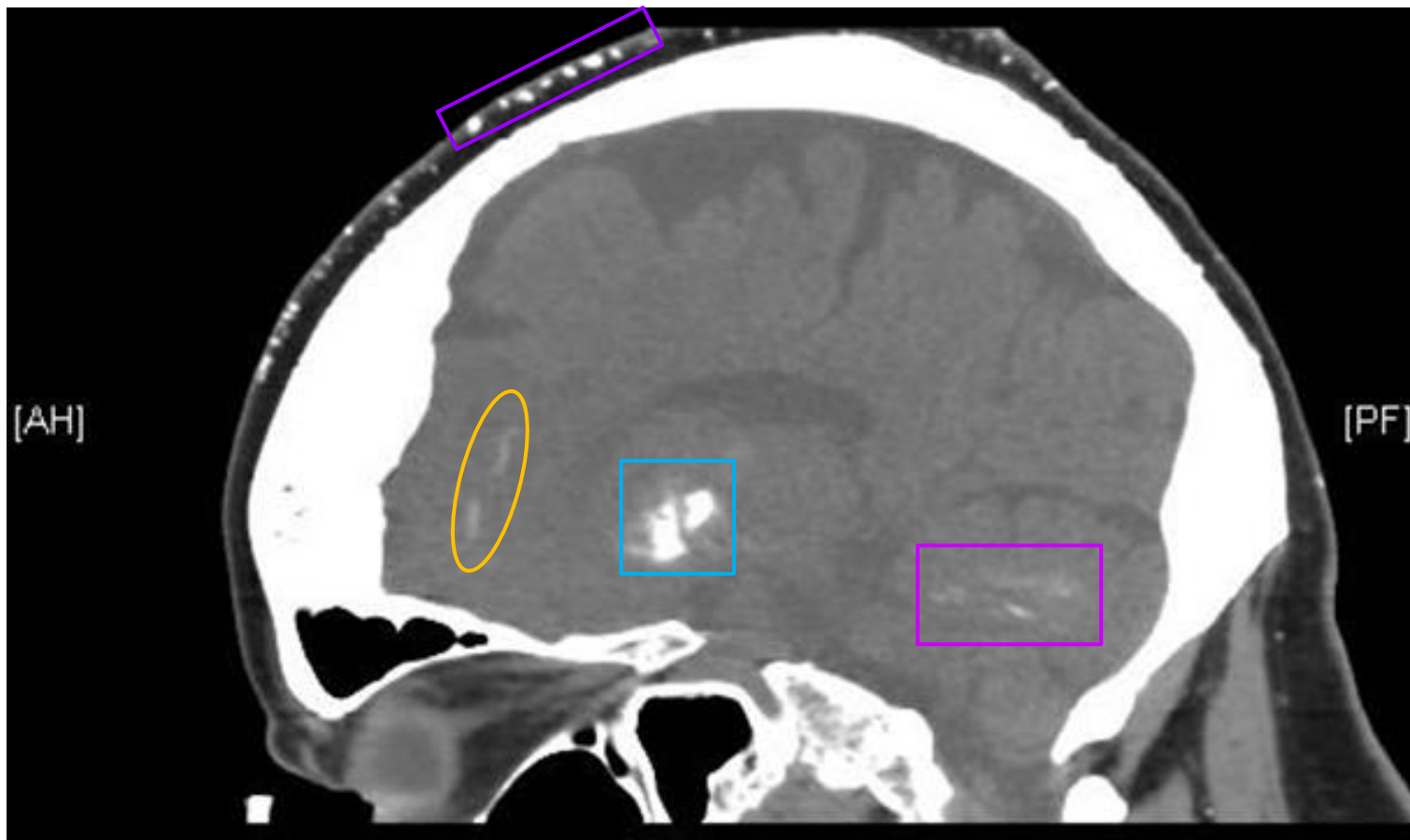
C- Coronal head CT

**Calcifications:**  
Basal Ganglia  
Dermal



# Our Patient:

## Calcifications in basal ganglia - Sagittal view



Source:  
PACS,  
BIDMC

C- Sagittal head CT

**Calcifications:**  
Basal Ganglia  
Frontal Lobe  
Cerebellum  
Dermal





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# BGC: Generalities

- Common: 1% CT
- Incidental & idiopathic finding
  - Elderly people
- Pathological
  - Less than 40 years



# BGC: Differential Diagnosis

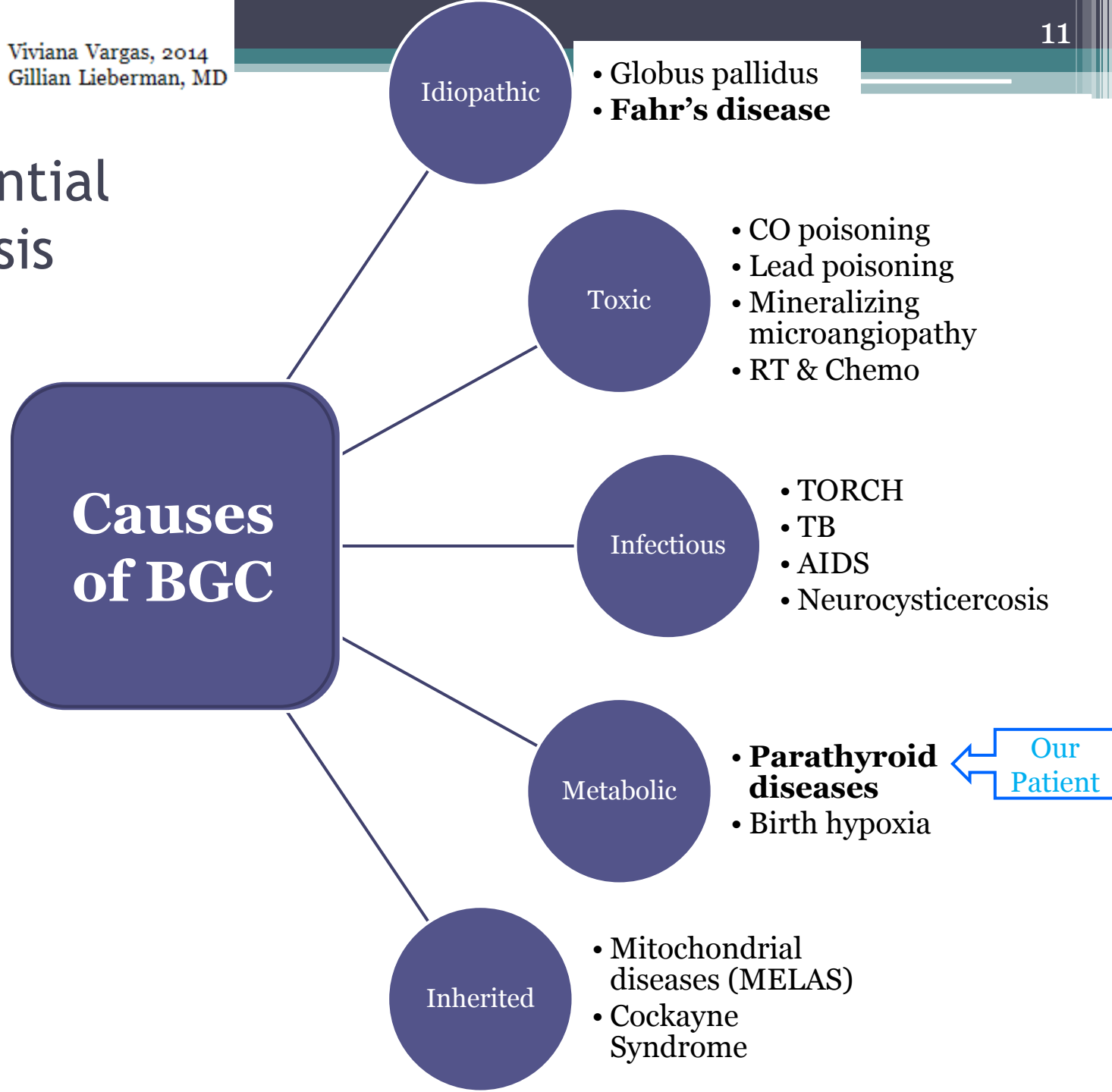




Table 5  
Disorders associated with basal ganglia calcification

Endocrine	Congenital/development	Inflammatory/infectious	Toxic/anoxic	Degenerative/metabolic	Miscellaneous
Hypoparathyroidism, Pseudohypoparathyroidism, Pseudo-pseudohypoparathyroidism, Addison's disease, Hyperparathyroidism, Hypothyroidism (cretinism), Kallman's syndrome, Allbright's disease, Kenny-Caffey syndrome, Maternal inherited diabetes and deafness	Familial idiopathic cases (Fahr's disease), Cockayne syndrome, Tuberous sclerosis, Oculocranio-somatic disease, Amaurotic idiocy, Mitochondrial encephalomyopathy, Hidrotic ectodermal dysplasia, Morgagni-Morel syndrome, Dyskeratosis cogenita, Lipomembranous polycystic osteodysplasia, Down's syndrome, Hyperphenylalaninemia (dihydropteridine reductase deficiency), Lipod proteinosis (hyalinosis cutis), Hastings-James syndrome (idiopathic lenticulo-dentate calcification), Aicardi-Goutières syndrome, Raine's syndrome, Coat's syndrome, Pearson's syndrome.	Cytomegalic inclusion disease, Encephalitis (measles, chicken pox, mumps etc.), Toxoplasmosis, Cysticercosis, AIDS, Tuberculosis, Congenital rubella, Epstein-Barr virus, Syphilis, Brucellosis	Carbon monoxide intoxication, Lead intoxication, Birth anoxia, Therapeutic radiation, Methotrexate therapy, Anticonvulsant medications, Stroke/anoxia/hypoxia, Methanol intoxication, Cerebral hemorrhage, Necrotic brain tissue, Mercury poisoning	Hallervorden-Spatz, Paramyloidosis, Myotonic dystrophy, Parkinsonism, Huntington's chorea, Type I gangliosidosis, Membranous lipodystrophy, Wilson's disease, Pick's disease, Alzheimer's disease, Renal tubular acidosis, Mitochondrial diseases, Dentato-rubro-pallidolusian atrophy (DRPLA), Progressive supranuclear palsy, Mitochondrial encephalopathy with lactic acidosis and stroke-like episodes (MELAS), Kearns-Syre syndrome, Diffuse neurofibrillary tangles with calcification.	Systemic lupus erythematosus, Scleroderma, Carbonic anhidrase II deficiency, Osteopetrosis, Tumors (germinoma, ganglioglioma), Folate deficiency, Celiac disease, Normal aging.

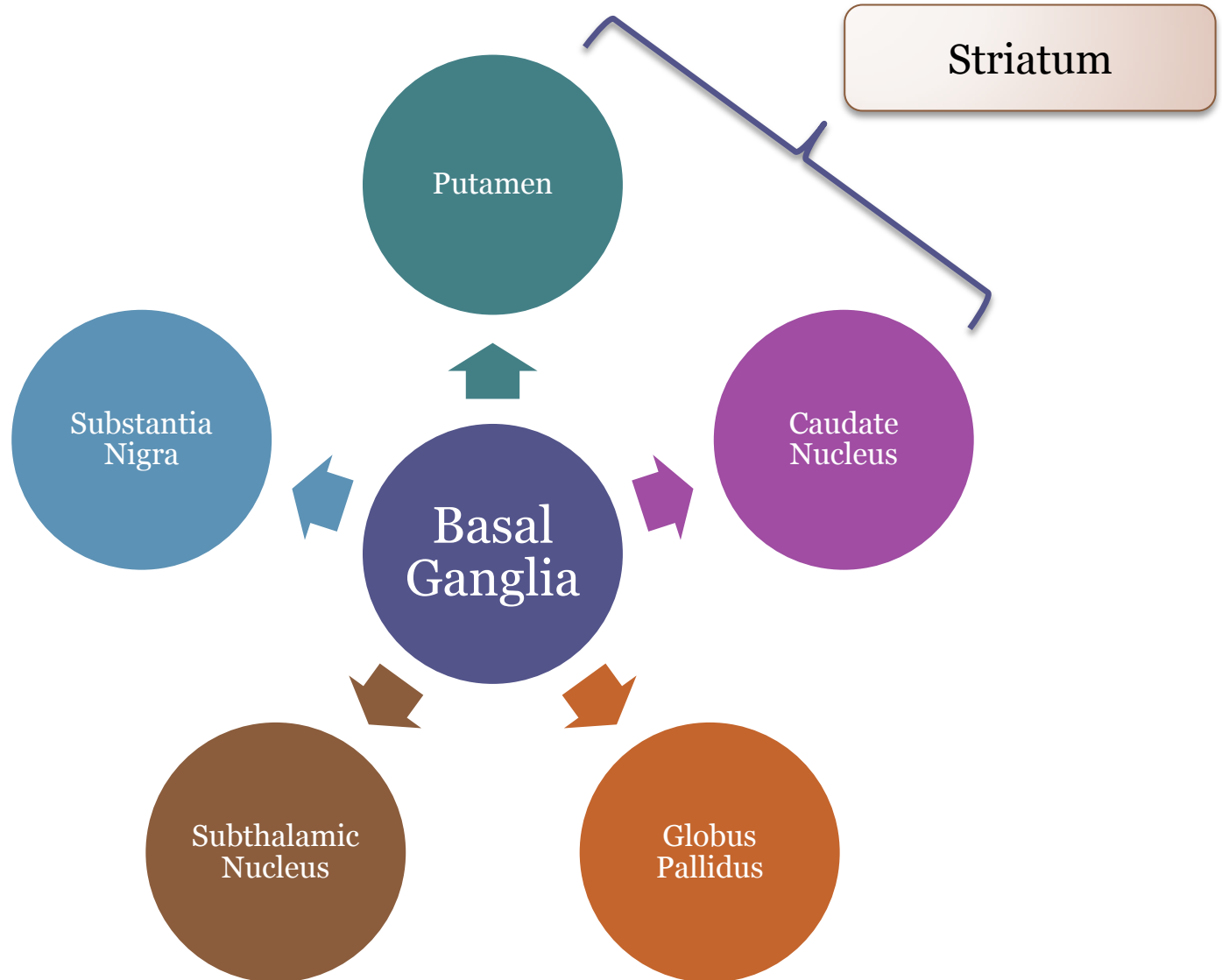


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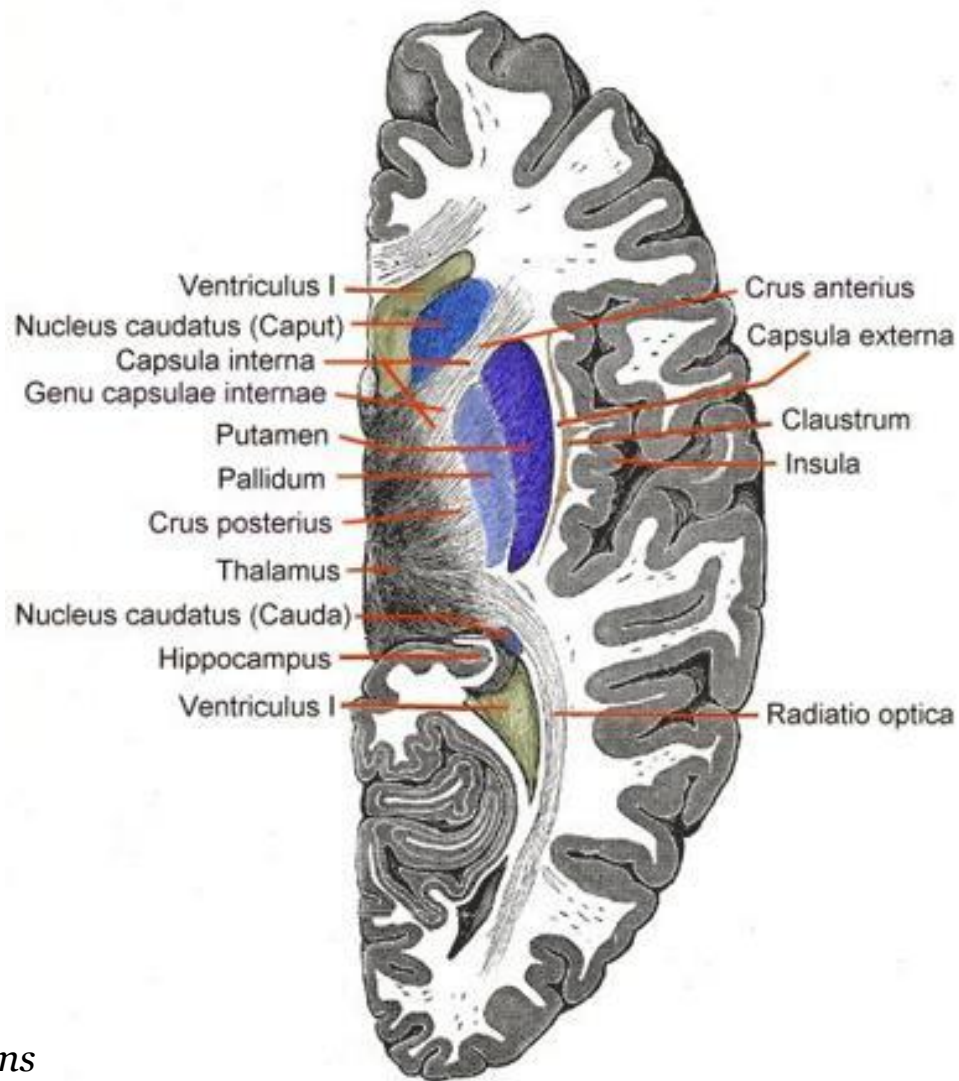


# Anatomy of the Basal Ganglia





# Anatomy Image of the Basal Ganglia





## Companion Patient #1: Head CT



**E**, Caudate nuclei (C);  
lentiform nuclei (L);  
calcified pineal gland  
(solid white arrow).

Source:  
Herring: *Learning  
Radiology, 2e. 2012.*

C- Axial head CT





## Companion Patient #2: Head CT



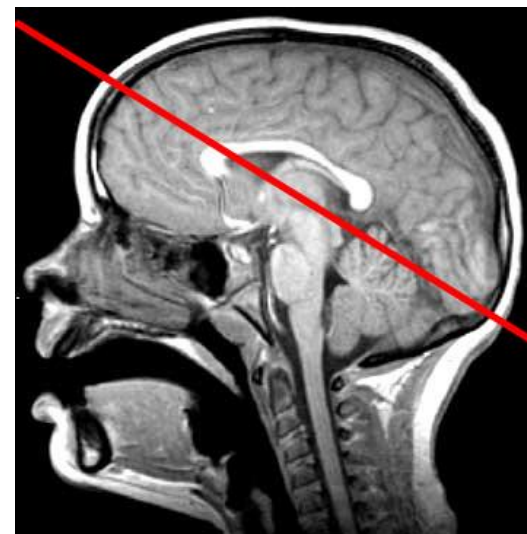
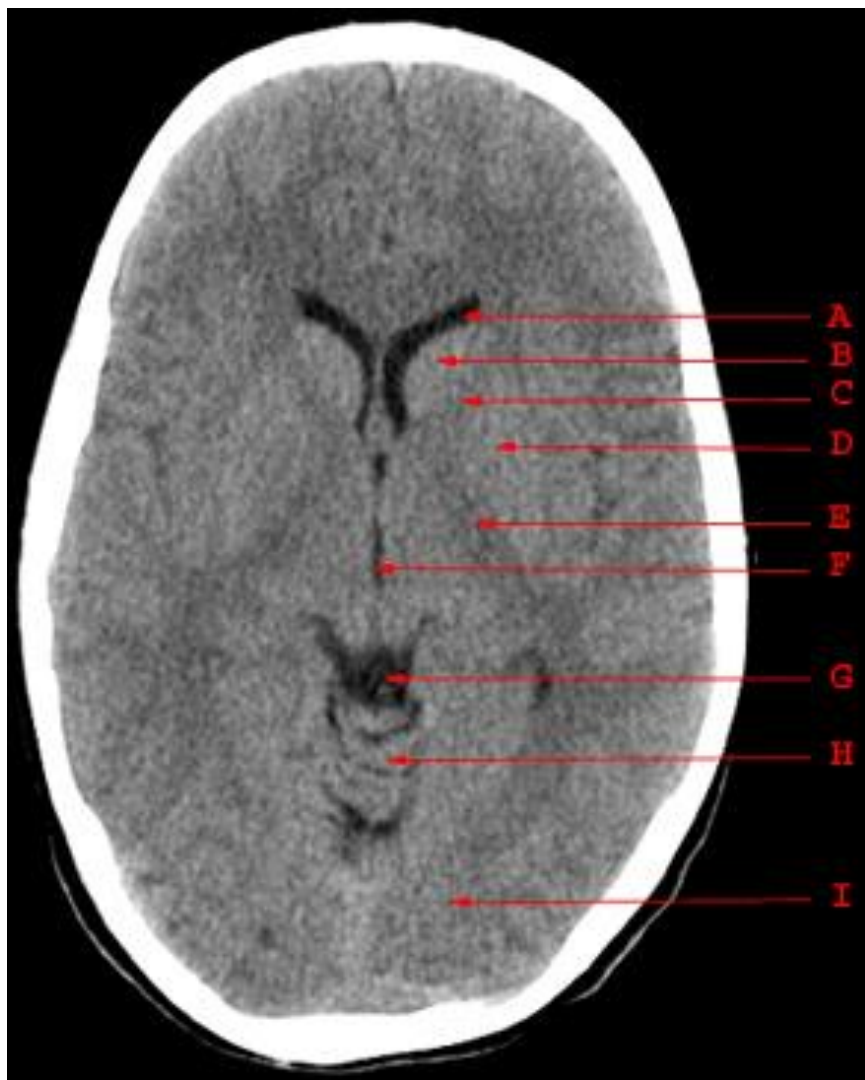
**A**, There are small, punctate calcifications in the basal ganglia (*white circles*) and calcification of the pineal gland (*solid white arrow*).

Source:  
Herring: *Learning  
Radiology, 2e. 2012.*

C- Axial head CT



## Companion Patient #3: Head CT



- A. Anterior Horn of the Lateral Ventricle
- B. Caudate Nucleus**
- C. Anterior Limb of the Internal Capsule
- D. Putamen and Globus Pallidus**
- E. Posterior Limb of the Internal Capsule
- F. Third Ventricle
- G. Quadrigeminal Plate Cistern
- H. Cerebellar Vermis
- I. Occipital Lobe

C- Axial head CT

Source:  
Website of  
the University of  
Virginia, 2013.

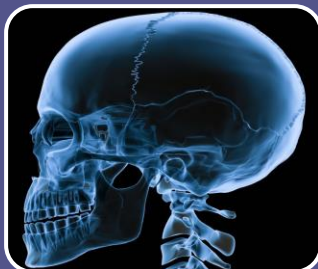


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# Radiologic Modalities



## SXR

- Minimal appearance



## CT

- 5-15 times the sensitivity of SXR
- Preferred to localize and assess the extent of cerebral calcifications



## MRI

- Versatile to determine extent of tissue damage by different elements (iron, minerals, amount of water).
- The low proton density of calcium usually exhibits areas with low signal in T1 and T2 images, making it difficult to detect calcium in MR images.
- Hyperintense in T1 possible to happen.

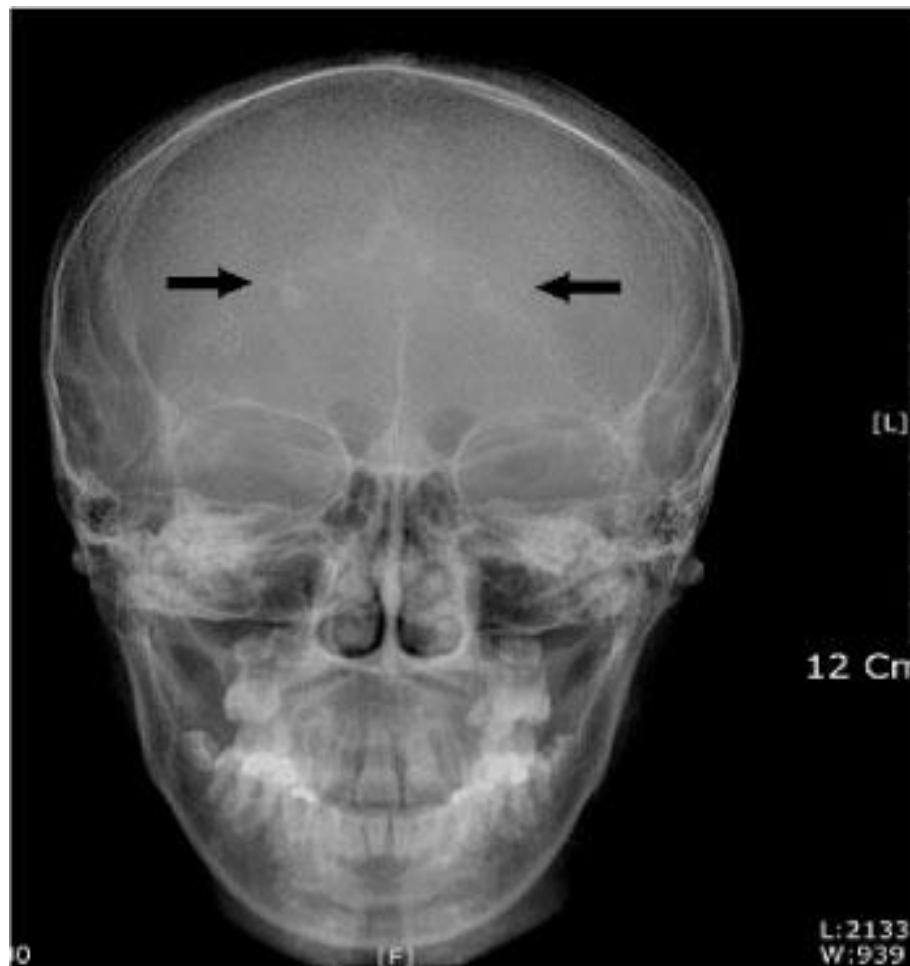


# Examples

*Now we are going to review some examples of the different **modalities** in which we can identify BGC in different health conditions.*



# Companion Patient #3: Skull Radiograph - PA Projection



Source:  
*J Korean Soc Endocrinol.*  
2006 Aug;21(4):338-344.

## **Skull Radiograph – PA Projection**

The abnormal calcifications (arrows) were observed  
in patient with pseudohypoparathyroidism.



# Companion Patient #3: Skull Radiograph - Lateral Projection



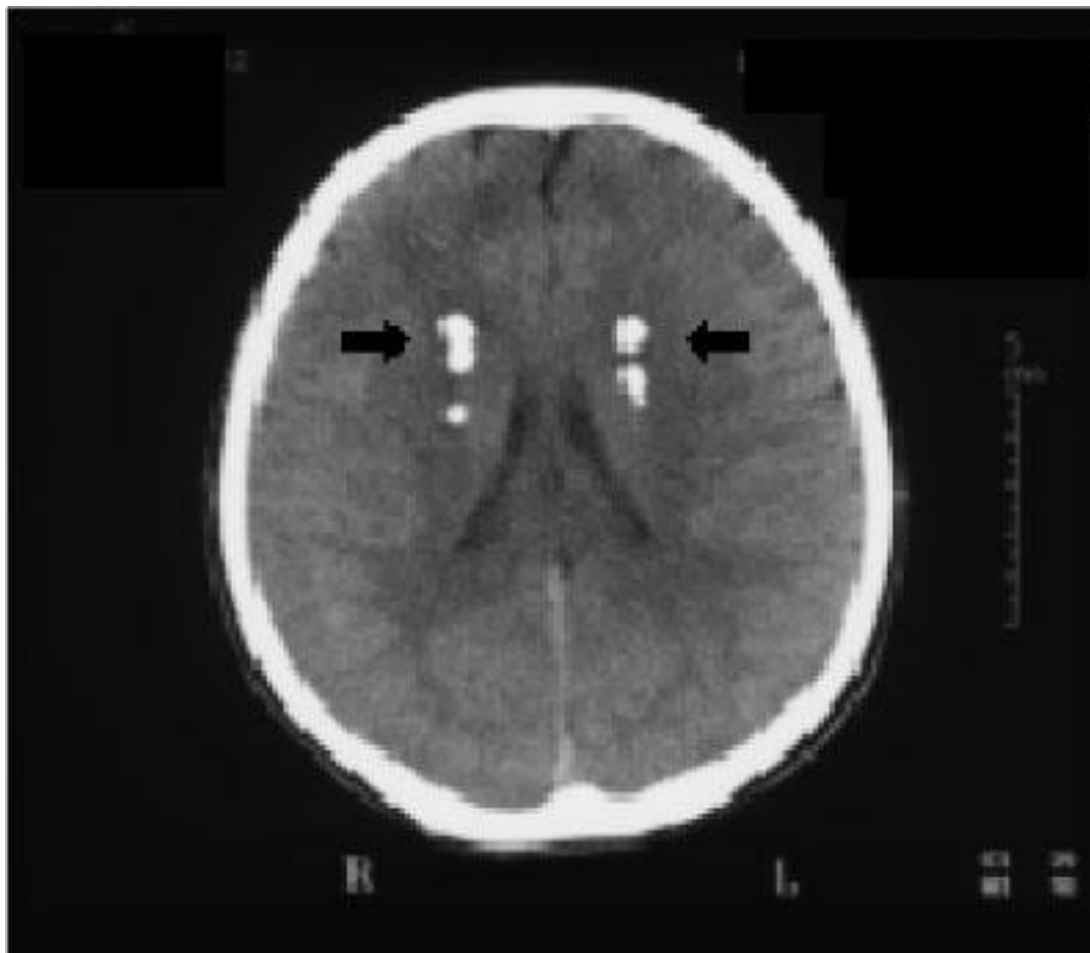
Source:  
*J Korean Soc Endocrinol.*  
2006 Aug;21(4):338-344.

## Skull Radiograph – PA Projection

The abnormal calcifications (arrow) were observed  
in patient with pseudohypoparathyroidism.



## Companion Patient #3: Pseudohypoparathyroidism - Axial Head CT



Source:  
*J Korean Soc Endocrinol.*  
2006 Aug;21(4):338-344.

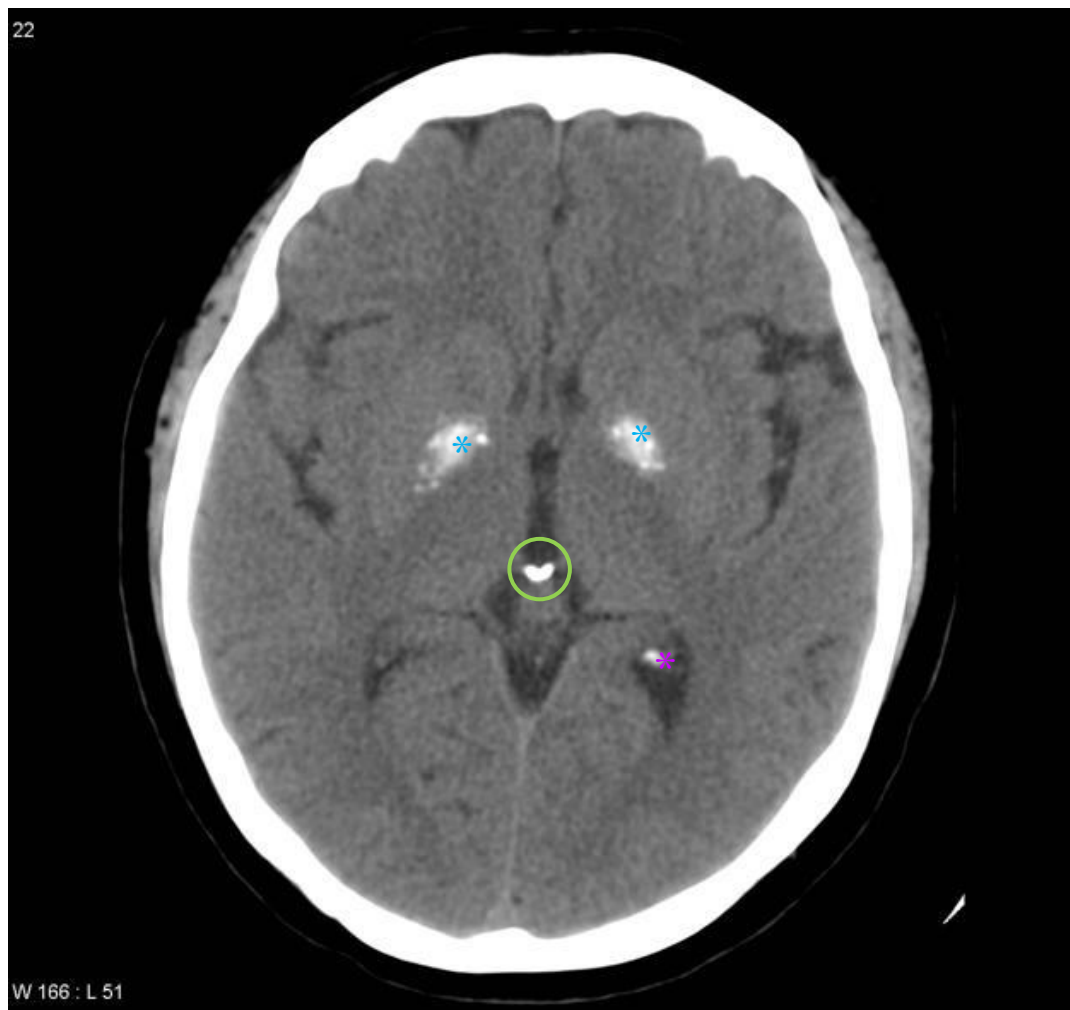
### **C- Axial head CT**

Abnormal calcification of basal ganglia (arrows) in patient with pseudohypoparathyroidism.





# Companion Patient #4: Senile BGC - Axial Head CT



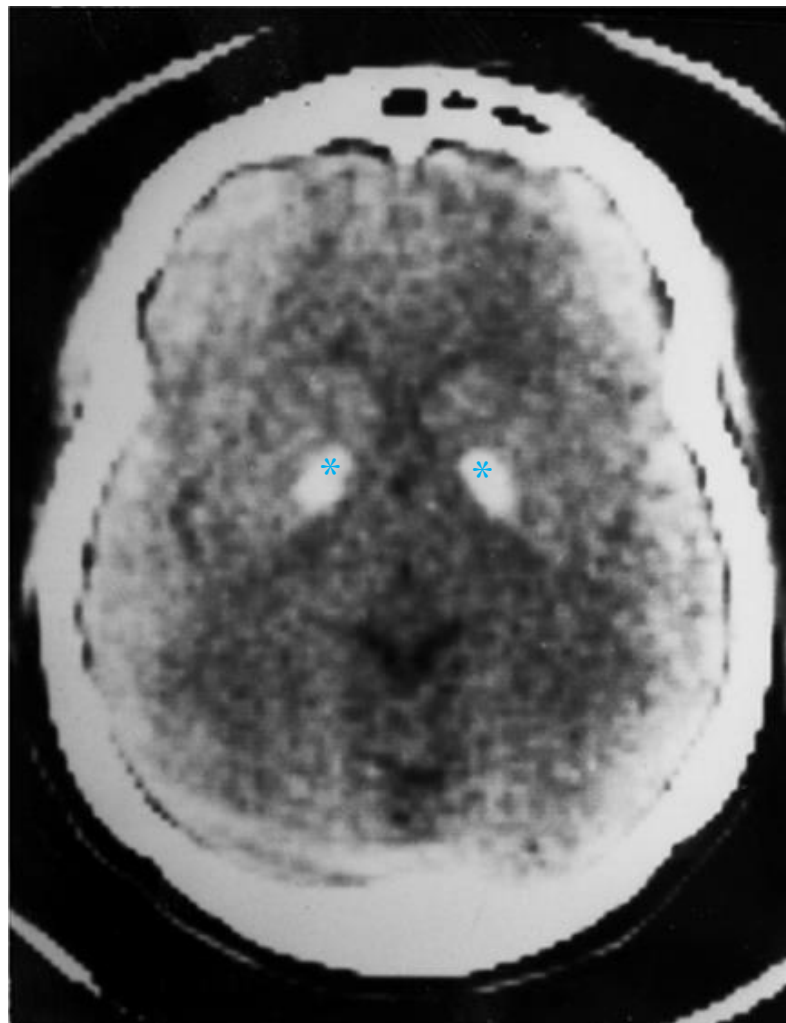
Source:  
Dr Yuranga  
Weerakkody and Dr  
Frank Gaillard.  
Radiopedia.org.

**Calcifications:**  
Basal Ganglia  
Pituitary Gland  
Coroidal Plexus

**C- Axial head CT**  
Senile Basal Ganglia Calcification



# Companion Patient #5: Schizophrenia - Axial Head CT



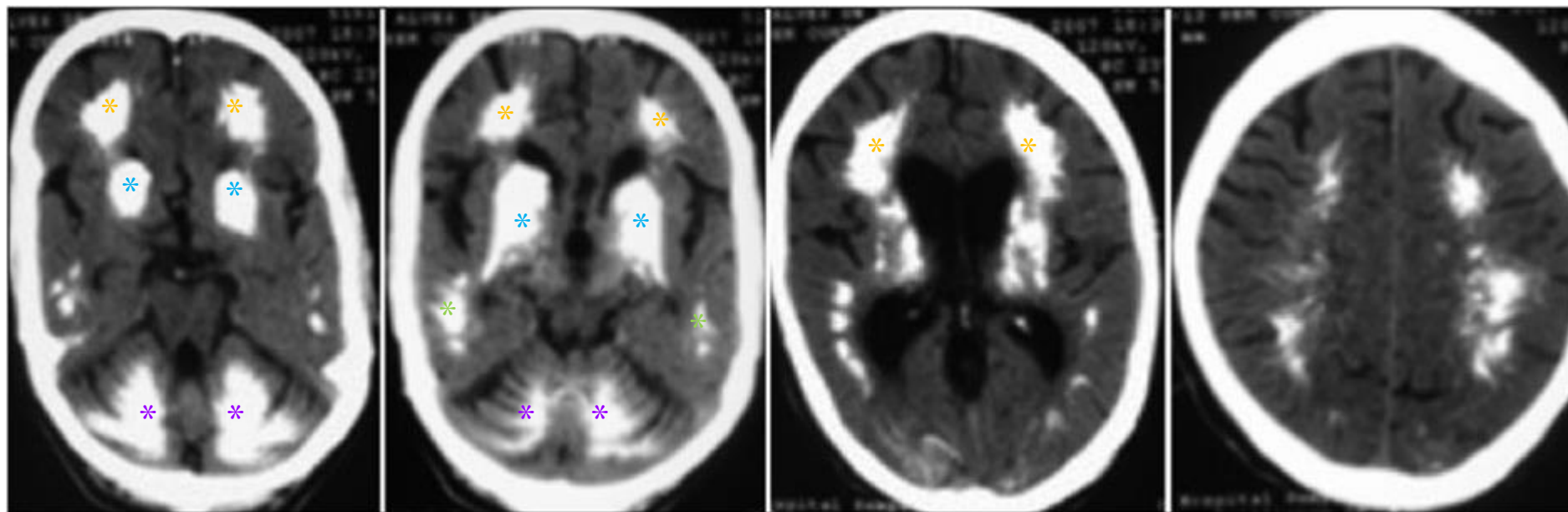
Source:  
*Psychiatry Research*  
121(2003)59-87.

**Calcifications:**  
Basal Ganglia

**C- Axial head CT**  
Basal Ganglia Calcification in patient with Schizophrenia.



# Companion Patient #6: Farh's Disease - Axial Head CT



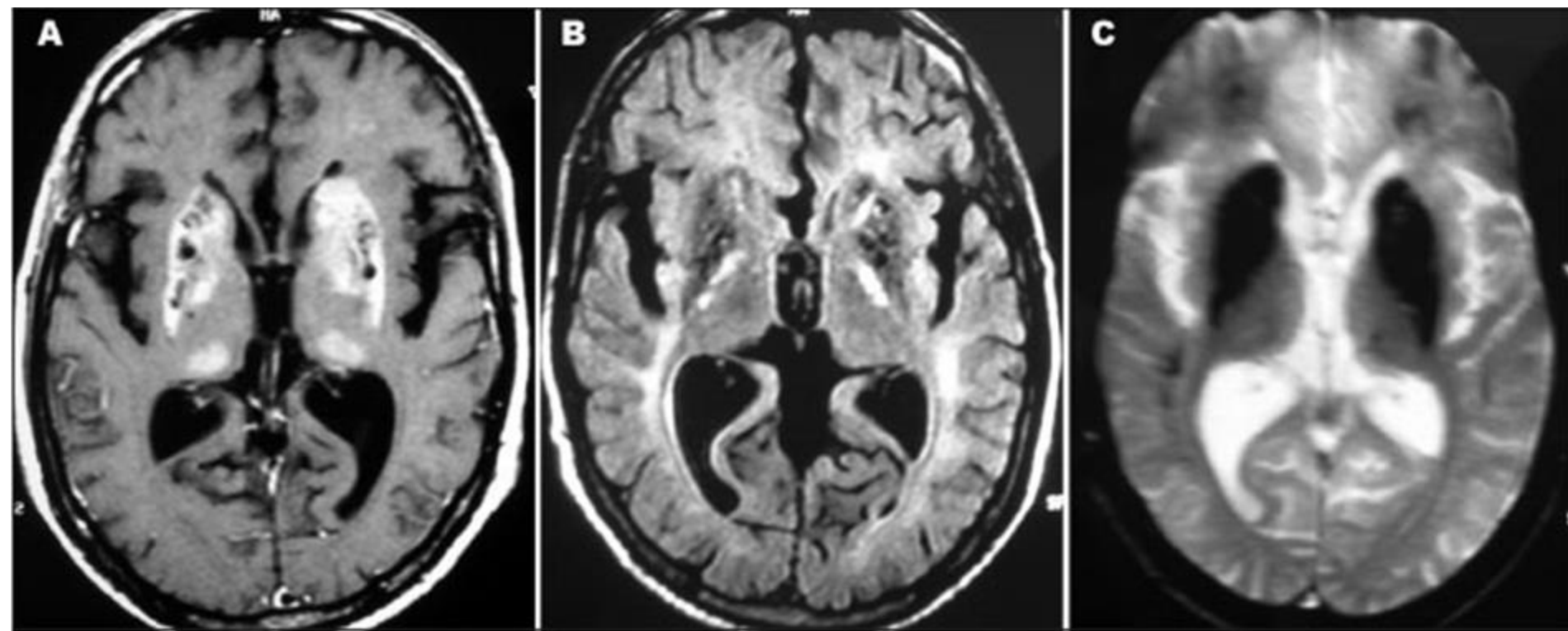
Source:  
*Arq. Neuro-Psiquiatr.* [online].  
2009, vol.67, n.2b, pp. 516-518.

## C- Axial head CT

**Calcifications:**  
Basal Ganglia  
Frontal Lobe  
Temporal lobe  
Cerebellum



# Companion Patient #6: Farh's Disease - Axial Head MRI



## Axial head MRI

- A. T1 weighted image after gadolinium injection with hyperintense signal
- B. FLAIR image with heterogeneous signal
- C. T2 weighted gradient echo-image with strongly hypointense signal

Source:

*Arq. Neuro-Psiquiatr.* [online].  
2009, vol.67, n.2b, pp. 516-518.



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# Take Home Points

- BGC have several causes, there is a big differential diagnosis for this radiological finding.
- If BGC is noted in a patient younger than 40 years, pathological causes should be definitely excluded.
- There are several modalities to assess BGC, but the preferred one is a head CT with no contrast.



# References

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