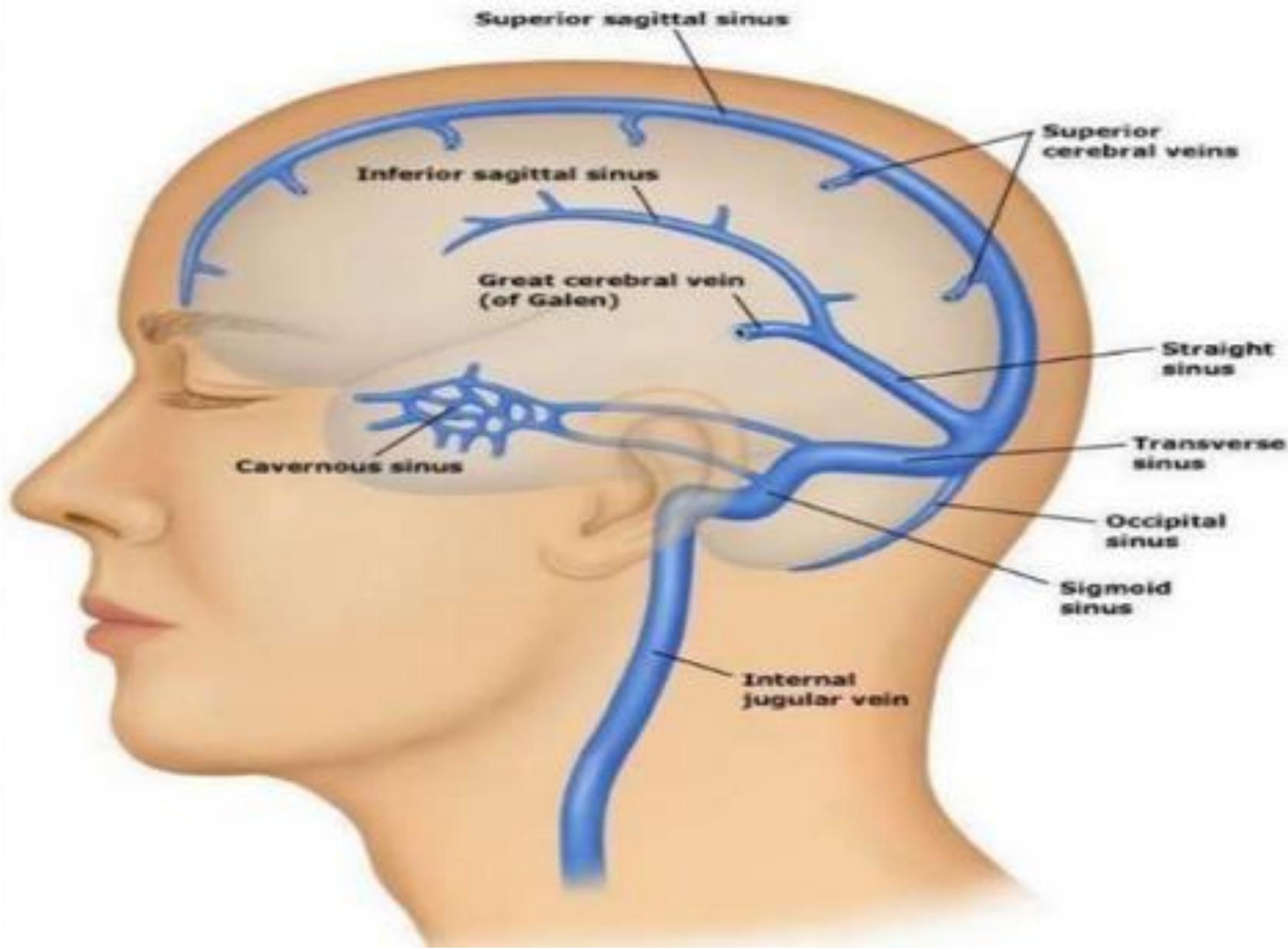


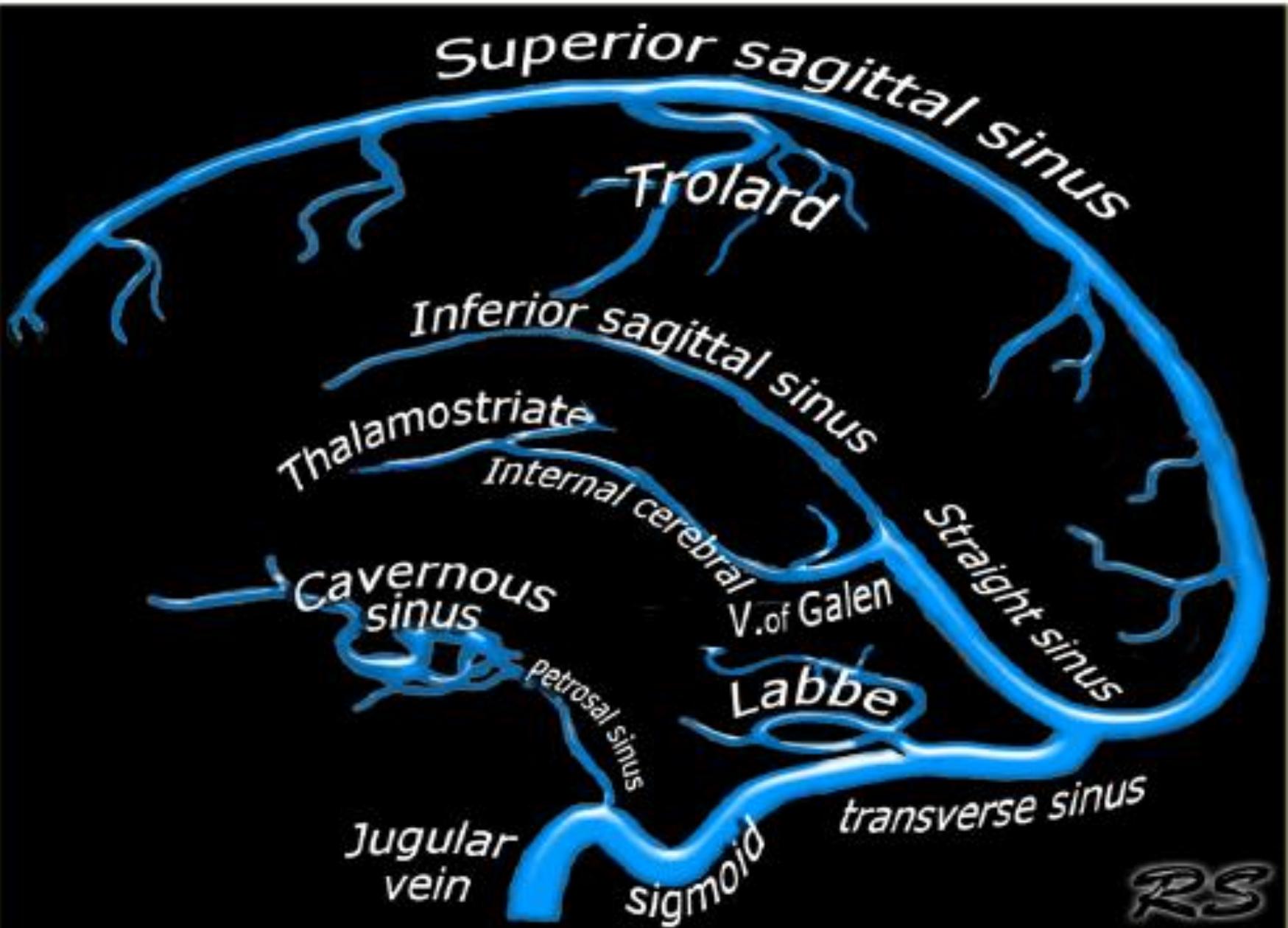
Hình ảnh huyết khối xoang và tĩnh mạch não

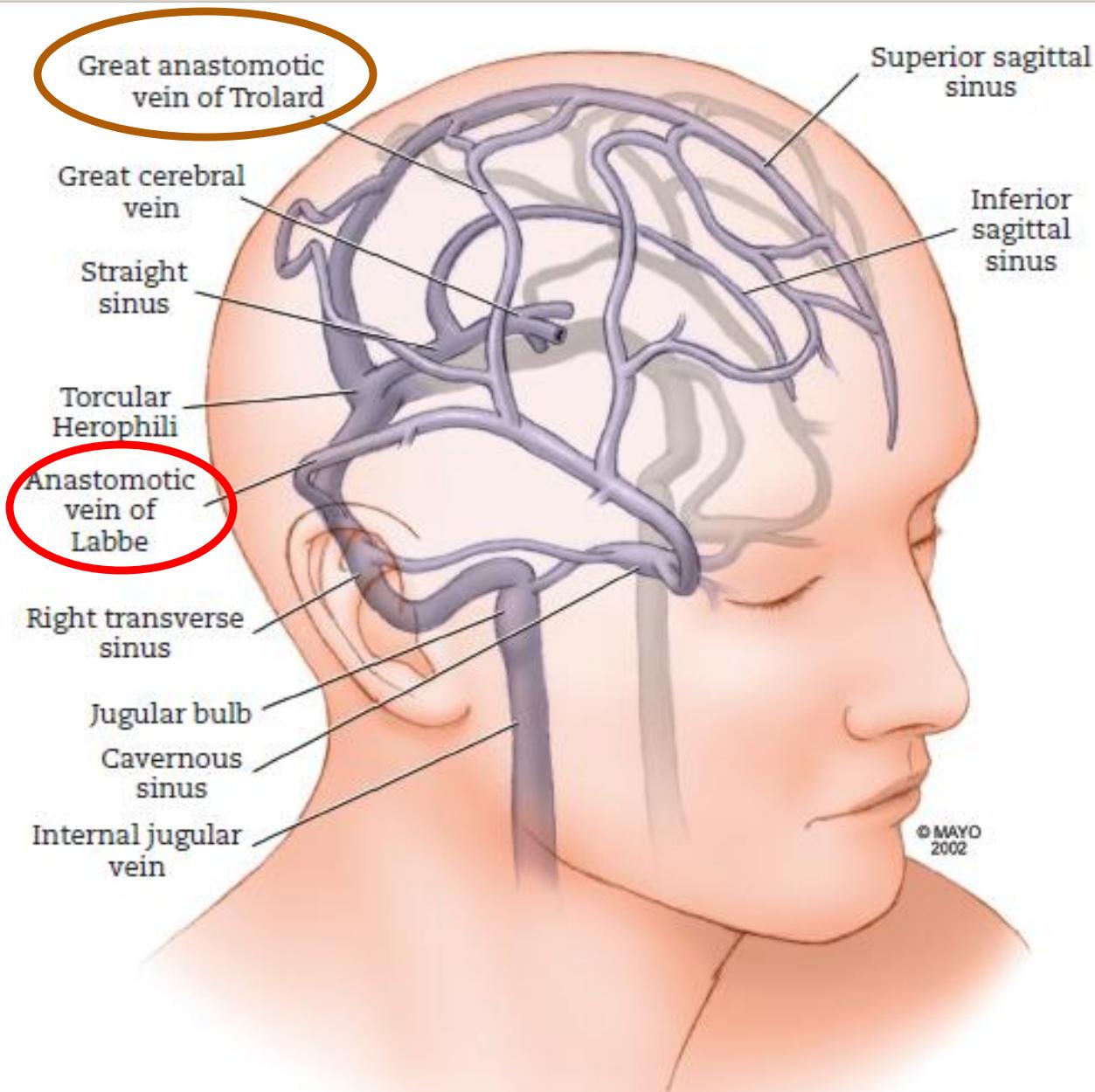
(Imaging of Cerebral Venous and Sinus Thrombosis (CVST))

PGS.TS Cao Phi Phong

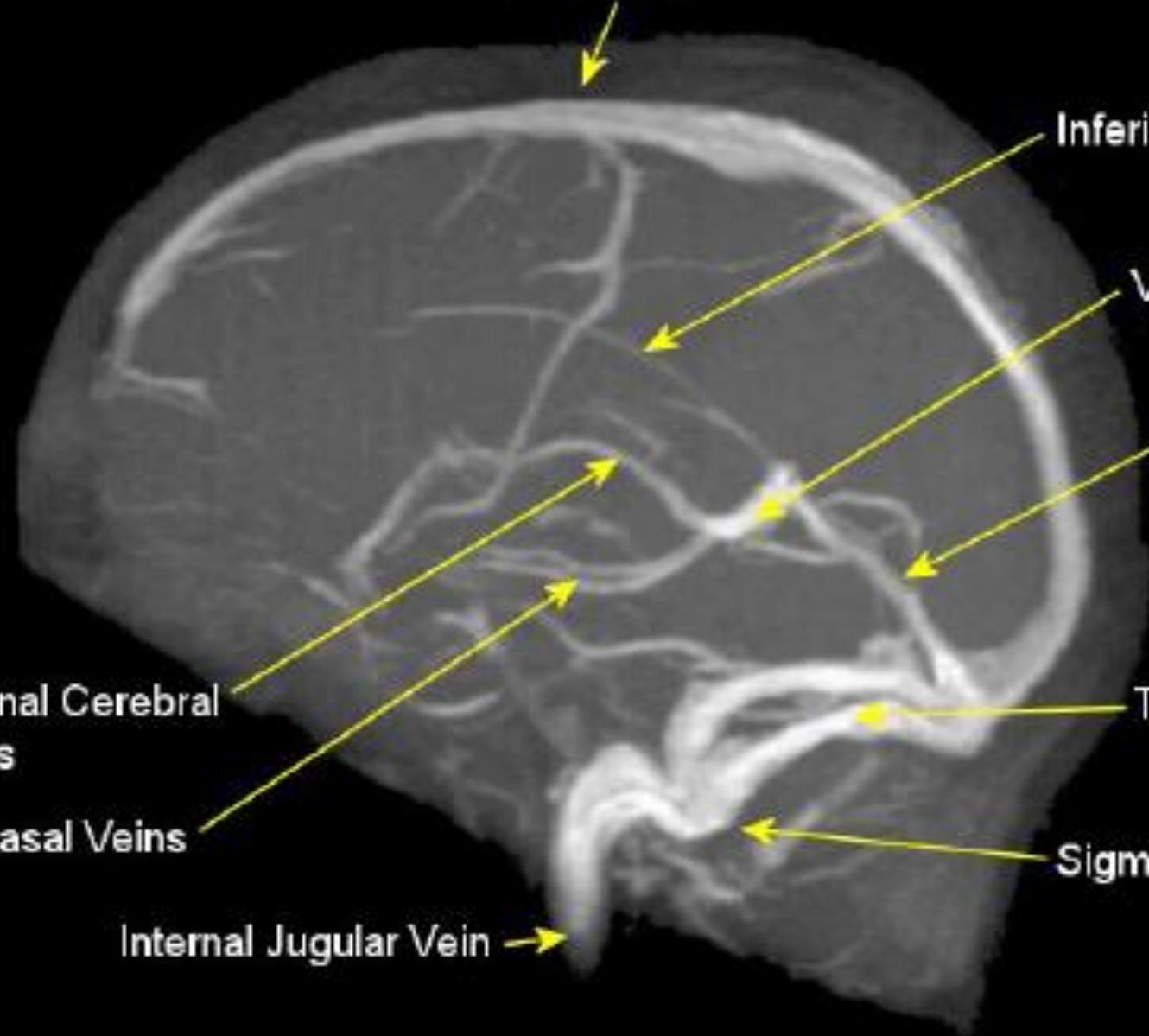
Hình ảnh xoang và tm não

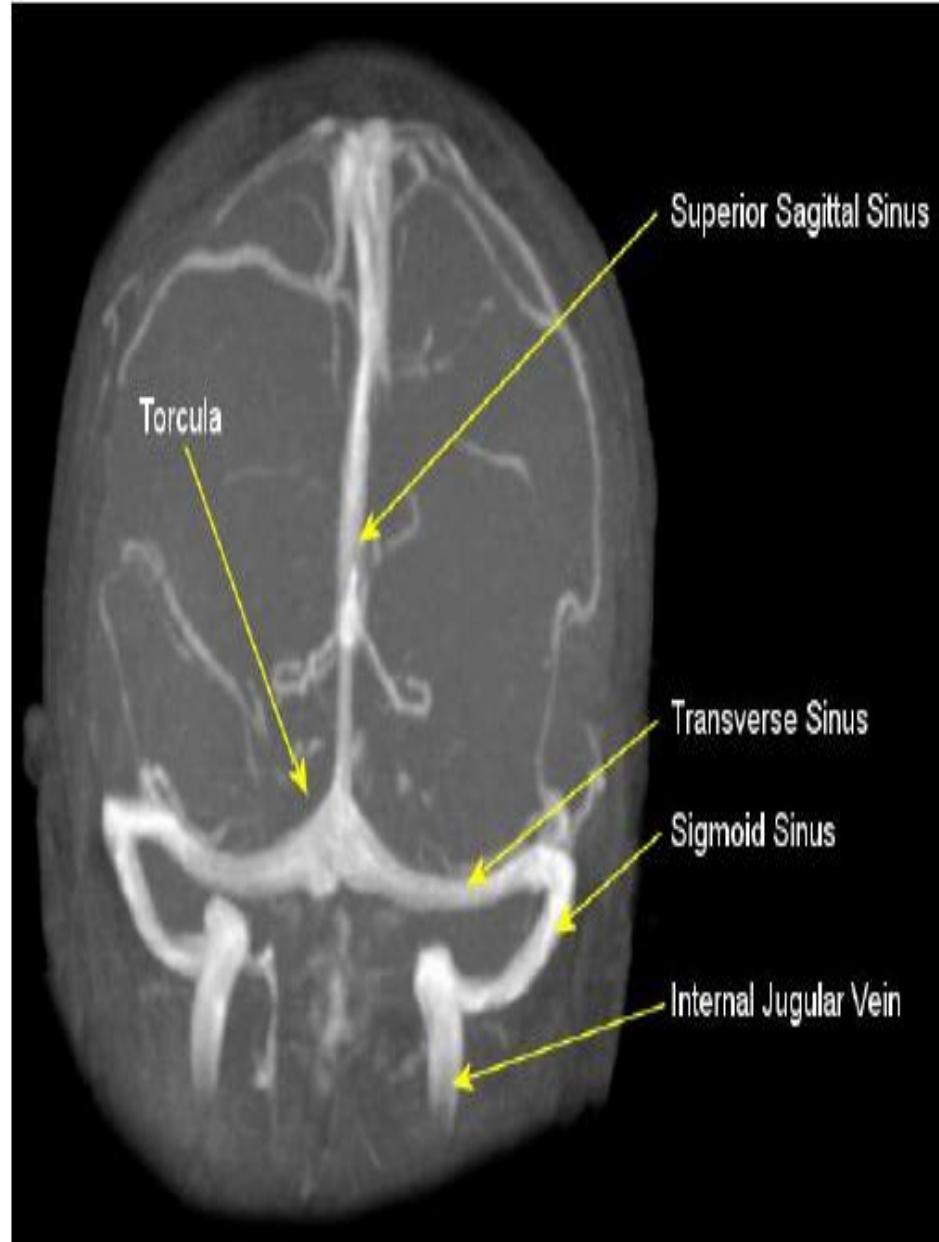
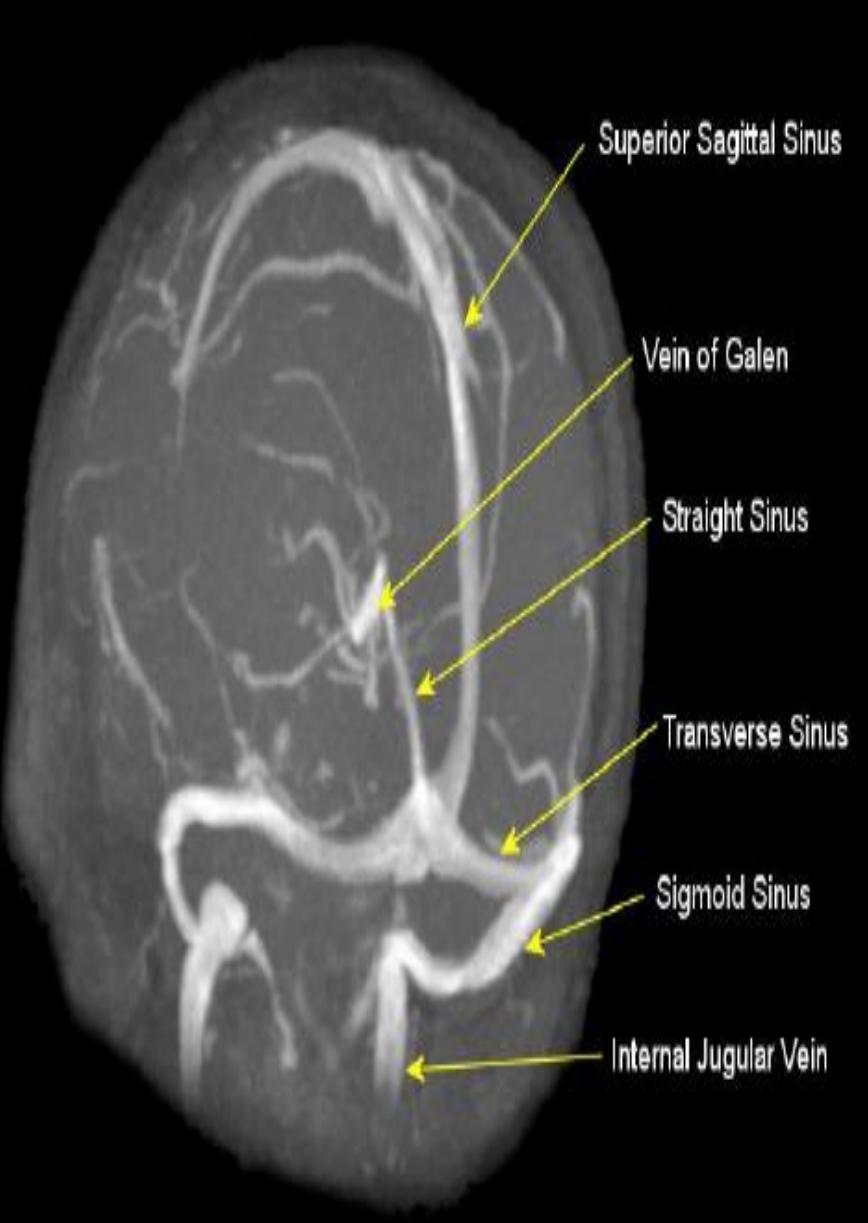


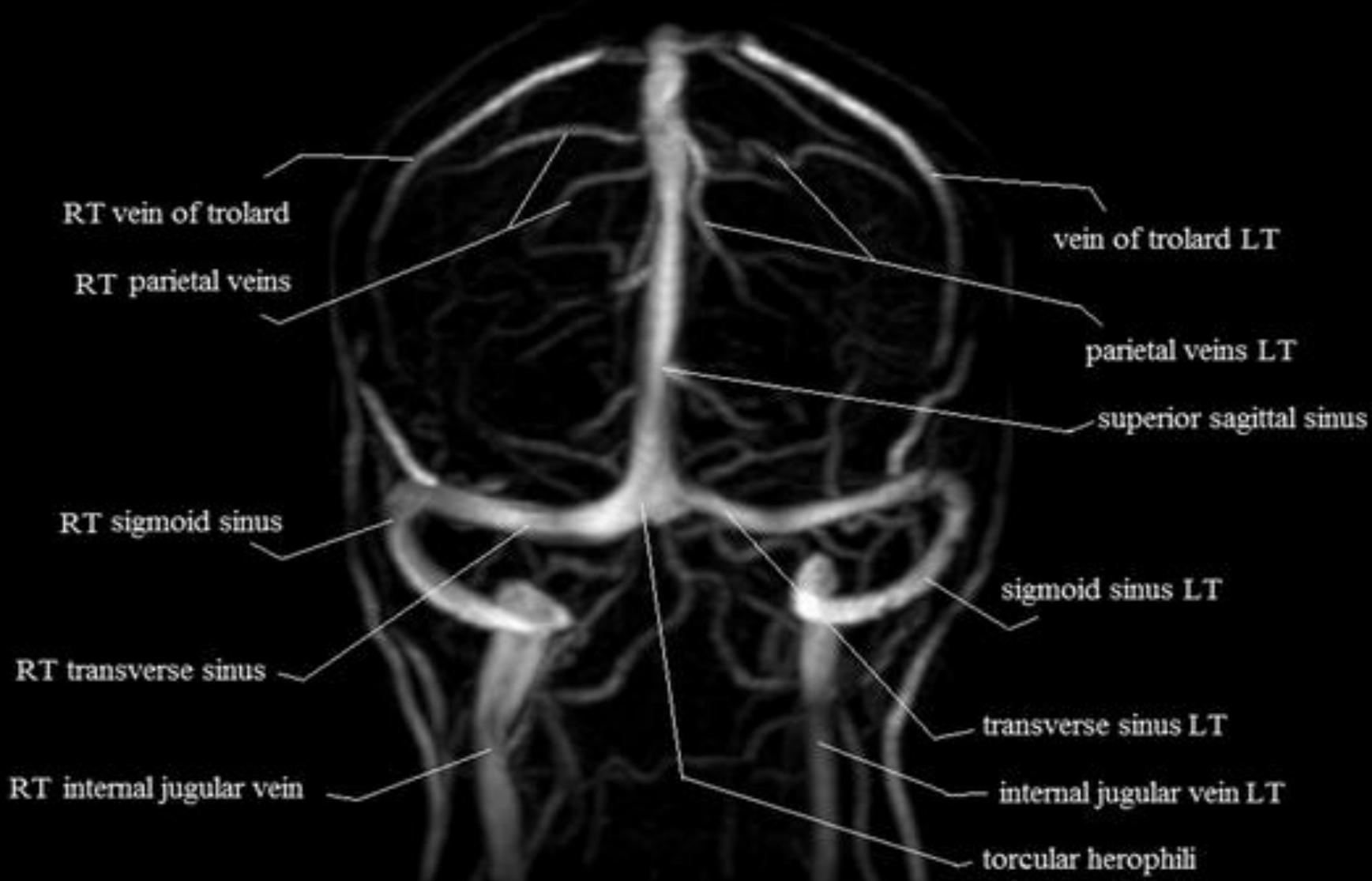


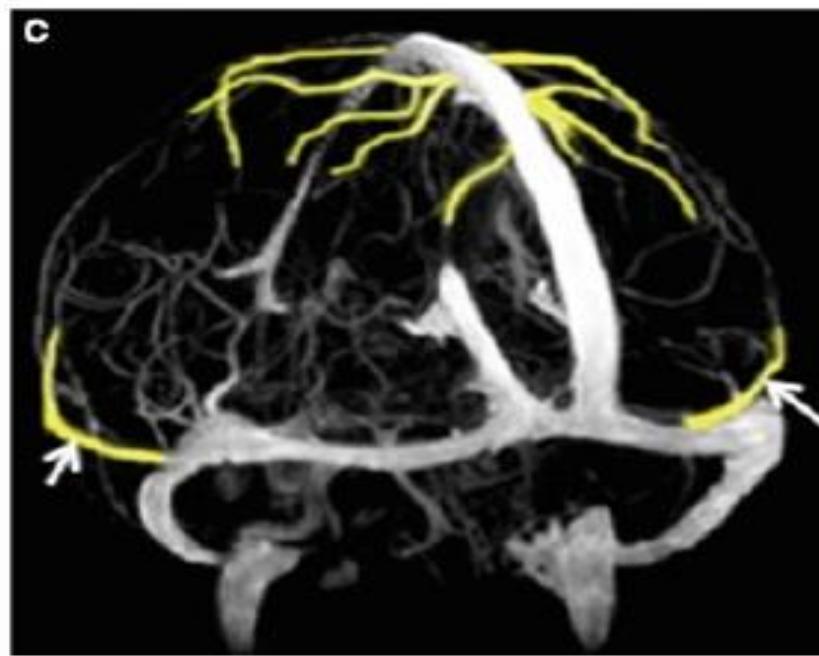
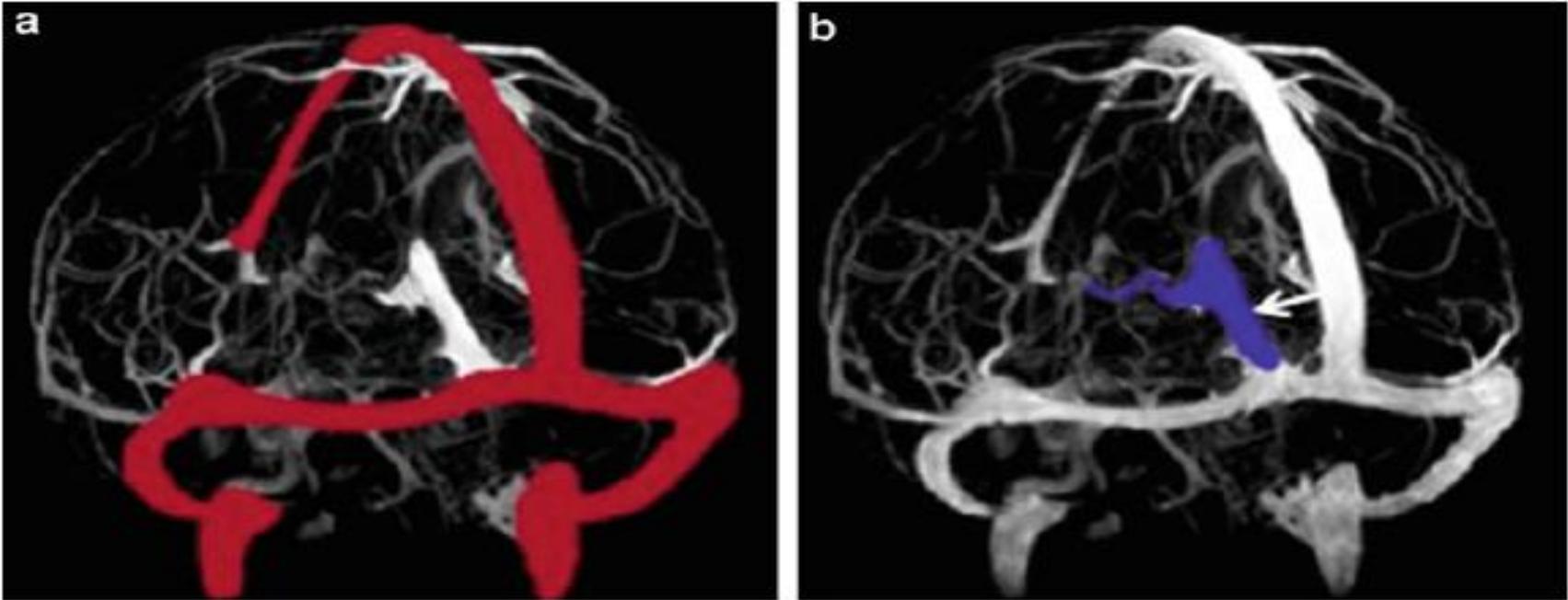


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Cerebral venous và sinus thrombosis (CVST) chia 3 nhóm.

1. **Dural sinus thrombosis(huyết khối xoang màng cứng)**
(thrombotic occlusion of one or more dural sinuses, red in a),
2. **Deep cerebral venous thrombosis (huyết khối tĩnh mạch não sâu)**
(thrombosis of the vein of Galen and its tributaries, blue in b),
3. **Cortical venous thrombosis(huyết khối tĩnh mạch vỏ)**
(thrombosis of the superficial cortical veins including the anastomotic vein of Labbé, yellow in c). The straight sinus (arrow in b) is included with the deep cerebral veins. Arrows in (c) indicate the anastomotic vein of Labbé)

□ Cerebral venous và sinus thrombosis (CVST)

- + ít gặp
- + nguyên nhân quan trọng của đột quy
- + tỉ lệ mắc bệnh hàng năm 3- 4 ca/ một triệu người lớn
- + khoảng 7 ca/ một triệu trẻ em

□ Thường gặp nhất young and middle-aged, CVST có thể xảy ra ở mọi lứa tuổi và cả 2 giới

Cortical veins 17%

Posterior frontal vein

Trolar vein

Anterior frontal vein

Superior sagittal sinus
62%

Deep venous system 11%

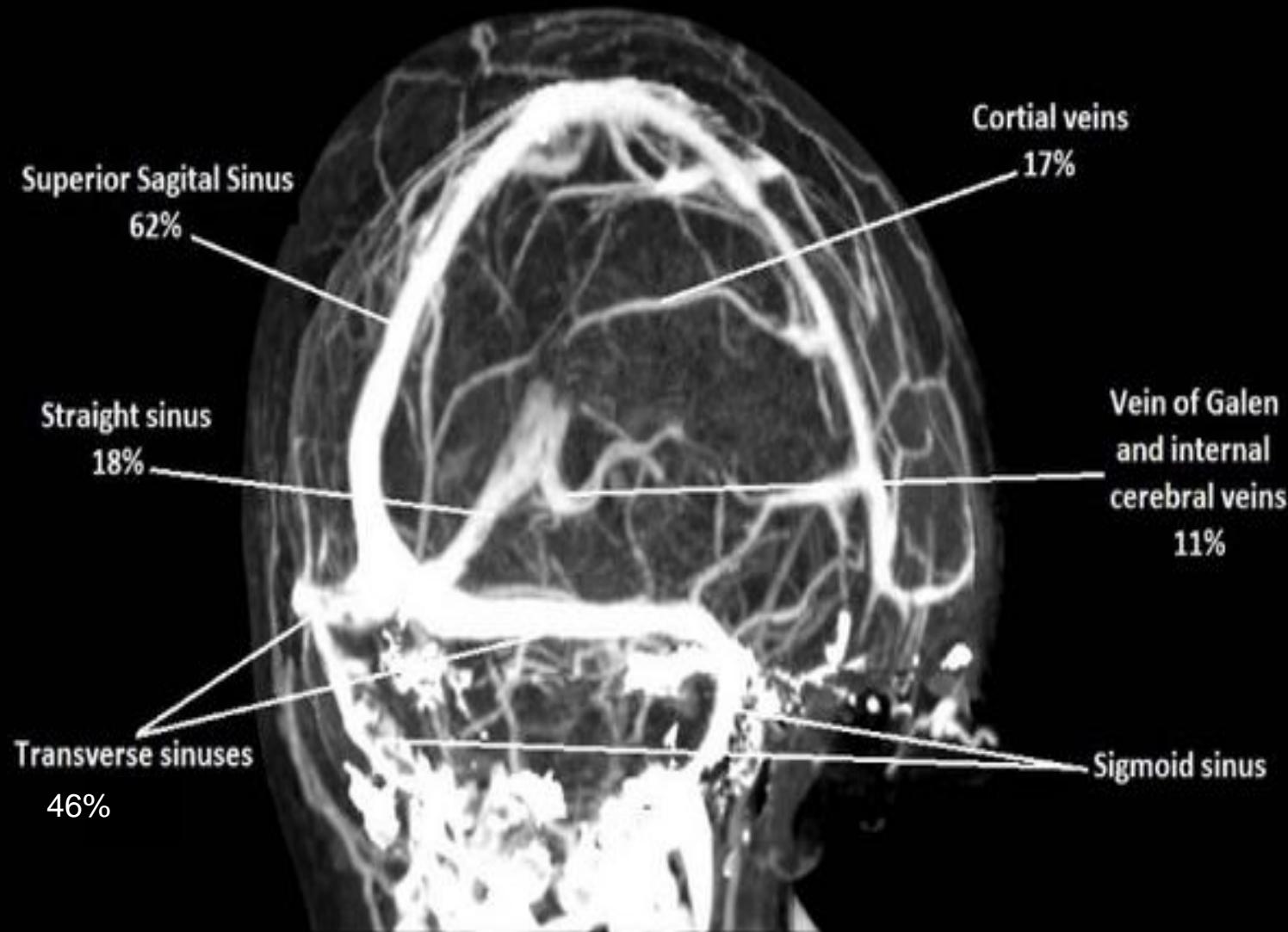
Straight sinus
18%

Transverse (lateral)
sinus 41-45%

Sigmoid sinus

Internal Jugular
12%





❑ Yếu tố ảnh hưởng quan trọng nhất và gây CVST:

- + *coagulation disorders (acquired or congenital),*
- + *intake of oral contraceptive drugs,*
- + *pregnancy, lactation,*
- + *ear, nose, and throat infections.*

❑ Trên 40 % BN có 2 hay nhiều yếu tố nguy cơ hiện diện, trong khi 15–20 % BN không xác định

Phân loại (Subtypes of CVST)

- Trên cơ sở vị trí huyết khối, phân chia 3 nhóm CVST
 - + *huyết khối xoang màng cứng*
 - + *huyết khối tĩnh mạch não sâu*
 - + *huyết khối tĩnh mạch vỏ não*
- **Dural sinus thrombosis** (sinus thrombosis, SVT), quan trọng nhất CVST,
 - + thrombotic occlusion một hay nhiều dural sinuses.
 - + superior sagittal sinus ảnh hưởng nhiều nhất, kế đến là transverse sinus .

Deep cerebral venous thrombosis (DVT) ảnh hưởng:

- + internal cerebral veins,
 - + vein of Galen,
 - + và /hay veins Rosenthal và phụ lưu.
-
- Straight sinus bao gồm deep cerebral veins.
 - Liên quan đến deep cerebral veins tương ứng 10 % bệnh nhân CVST và thường kết hợp sinus thrombosis.
 - Isolated thrombosis của deep cerebral veins ít gặp hơn

□ ***Cortical venous thrombosis*** (CVT) bao gồm:

- + thrombosis TM vỏ não nồng: anastomotic vein Labbé
- + CVT ảnh hưởng nhiều nhất frontal cortical veins, tiếp theo parietal veins.
- + isolated CVT ít gặp hơn
- + trong phần lớn ca, hiện diện đồng thời SVT, đặc biệt liên hệ superior sagittal sinus.
- + giả thuyết, CVT phát triển thứ phát sau superior sagittal sinus thrombosis do sự lan về phía sau (retrograde) của thrombotic material từ sinus vào
- + đánh giá cortical veins là một thách thức, không giống dural sinuses và deep cerebral veins,

Lâm sàng CVST

- CVST thường **subacute** hơn, triệu chứng không đặc hiệu và đa dạng
- đau đầu khởi phát thường gấp **75–90 % BN.**
- triệu chứng khác của tăng áp lực nội sọ: dizziness, nausea, visual disturbances.
- thêm vào triệu chứng CVST tùy thuộc vị trí huyết khối

- liên hệ deep cerebral veins thường gặp***
 - + altered level of consciousness(> 70 % of DVT cases) ,
- trong khi cortical venous thrombosis***
 - + focal or generalized seizures
 - + focal neurological deficits: e.g., hemiparesis, aphasia, hemianopsia.
- trong cases isolated thrombosis deep or cortical veins***, triệu chứng tăng áp lực nội sọ có thể không gặp
- yếu tố quan trọng khác xác định biểu hiện lâm sàng là:
 - + age,
 - + presence of concomitant parenchymal changes,
 - + interval from symptom onset to diagnosis

Cận lâm sàng

- mặc dù D-dimer bình thường có giá trị cao, kết quả falsenegative (*âm tính trong CVST*) có thể gặp đặc biệt trong BN isolated thrombosis deep cerebral veins.
- D-dimer levels có thể bình thường trên 25% cases, được cho là liên quan thể tích huyết khối nhỏ

Tiên lượng và kết cục (Prognosis and Outcome)

- kết cục CVST đã được cải thiện đáng kể trong thập kỷ gần đây do cải thiện neuroimaging, giúp chẩn đoán nhanh và điều trị intravenous or low-molecular weight heparin.
- đến nay, CVST tiên lượng rất tốt khi chẩn đoán sớm, hồi phục hoàn toàn đến 80% BN
- tuy nhiên thời gian trung bình từ khởi phát đến chẩn đoán vẫn còn là 7 ngày, chủ yếu do lâm sàng đa dạng, không đặc hiệu, khởi phát trì hoãn, bán cấp, một số nhỏ D-dimer bình thường

- trì hoãn chẩn đoán CVST kết cục xấu 10-15%
- BN deep cerebral venous thrombosis, males, và chỉ có increased intracranial pressure dễ bị trì hoãn chẩn đoán CVST
 - .
 - yếu tố nguy cơ khác phối hợp kết cục xấu :
 - + advanced age,
 - + secondary intracerebral hemorrhage do venous congestion,
 - + deep cerebral veins or right transverse sinus.
- thêm vào kết cục xấu ở BN
 - + central nervous system infection
 - + intracerebral tumor cause CVST.

CVST

KEY FACTS

IMAGING

- General features
 - "Empty delta" sign on CECT, T1WI C+ MR
- CT
 - Hyperdense sinus on NECT (usually > 70 HU)
 - ± hyperdense cortical veins ("cord" sign)
 - CTV: Filling defect (thrombus) in dural sinus
- MR
 - Hypointense thrombus "blooms" on T2* GRE
 - Absence of flow in occluded sinus on 2D TOF MRV
- Protocol recommendations
 - NECT, CECT scans ± CTV as initial screening
 - If CTs negative, MR + MRV (T2*, DWI, T1WI C+)
 - If MRV equivocal, DSA is gold standard

TOP DIFFERENTIAL DIAGNOSES

- Normal (arteries, veins normally slightly hyperdense)
- High hematocrit (newborns, polycythemia)

- Dural sinus hypoplasia/aplasia
 - No "blooming"; collaterals/venous infarcts absent
- "Giant" arachnoid granulations
 - Round/ovoid, not elongated like thrombus
- Acute subdural hematoma
 - Blood layered on tentorium can mimic transverse sinus (TS) thrombosis

DIAGNOSTIC CHECKLIST

- Review MRV source images
 - Exclude pseudoocclusions (e.g., hypoplastic TS)
- Review T1 images to exclude false-negative MRV
- Review NECT to exclude dense thrombus as false-negative CECT or CTV
- Brain looks normal
 - Does not exclude CVT
- DSA helpful if noninvasive imaging inconclusive
- Chronic thrombosis may enhance
 - Recanalization or granulation tissue enhances

HÌNH ẢNH

- **Hình ảnh tổng quát**
 - "Empty delta" sign on CECT, T1WI C+ MR
- **CT**
 - Hyperdense sinus on NECT (usually > 70 HU)
 - ± hyperdense cortical veins ("cord" sign)
 - CTV: Filling defect (thrombus) in dural sinus(khiếm khuyết đổ đầy)
- **MR**
 - Hypointense thrombus "blooms" on T2* GRE
 - Absence of flow in occluded sinus on 2D TOF MRV
- **Protocol khuyến cáo**
 - *NECT, CECT scans + CTV as initial screening*
 - *nếu CTs negative, MR + MRV (T2*, DWI, T1WI C+)*
 - *nếu MRV equivocal, DSA is gold standard*

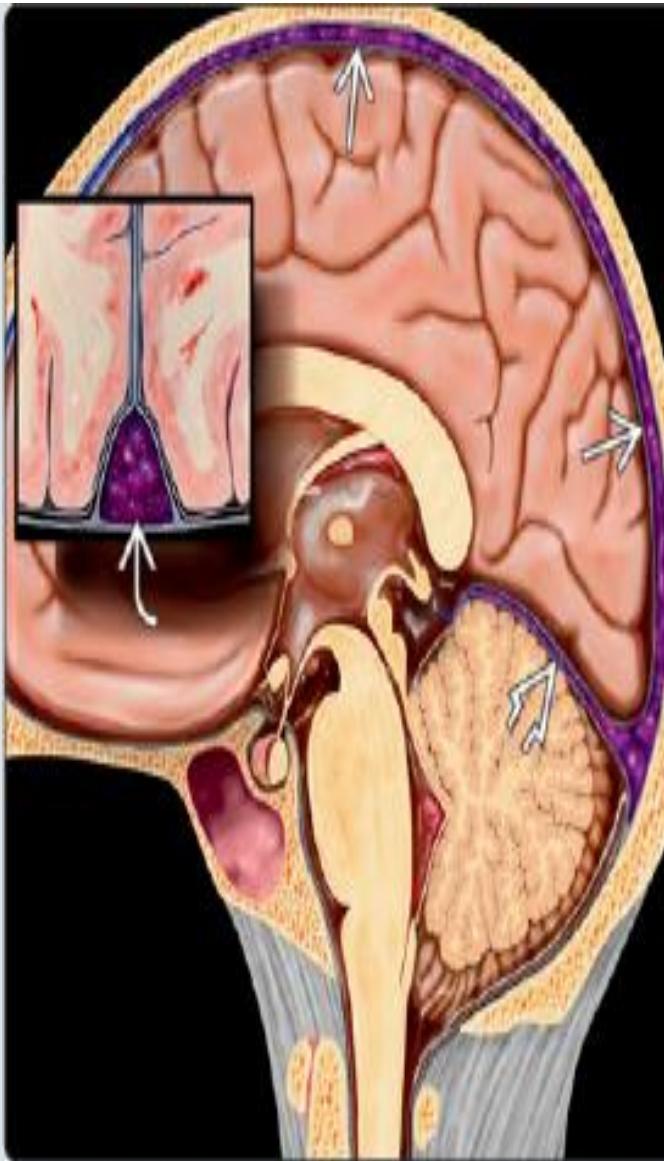
CHẨN ĐOÁN PHÂN BIỆT

- Normal (arteries, veins normally slightly hyperdense)
- High hematocrit (newborns, polycythemia)
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- "Giant" arachnoid granulations
 - Round/ovoid, not elongated like thrombus
- Acute subdural hematoma
 - Blood layered on tentorium can mimic transverse sinus (TS) thrombosis

DIAGNOSTIC CHECKLIST (những mục cần kiểm tra)

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(Left) Sagittal graphic shows thrombosis of the superior sagittal sinus → and straight sinus →. Inset in the upper left reveals a thrombus in the superior sagittal sinus in cross section ("empty delta" sign) → seen on contrast-enhanced imaging. (Right) NECT scan in a 25-year-old male with progressively increasing headaches shows hyperdensity in the right transverse → and straight sinuses →. Both internal cerebral veins are hyperdense → and the right thalamus → is hypodense and edematous.



Huyết khối: SSS, SS,
dấu delta trắng



NECT: tăng đậm độ: TS(p), SS, ICV
Đồi thi(p) giảm đậm độ + phù

(Left) Axial source image from a CTV in the same patient shows the dura around the superior axial sinus enhances ➤, but its clot-filled lumen ➡ does not ("empty delta" sign). (Right) Sagittal reformatted view of the CTV in the same patient shows extensive nonenhancing thrombus in the superior sagittal ➤ and straight ➡ sinuses. The internal cerebral veins ➤ are occluded and do not enhance. Findings indicate extensive dural sinus, deep vein thrombosis.



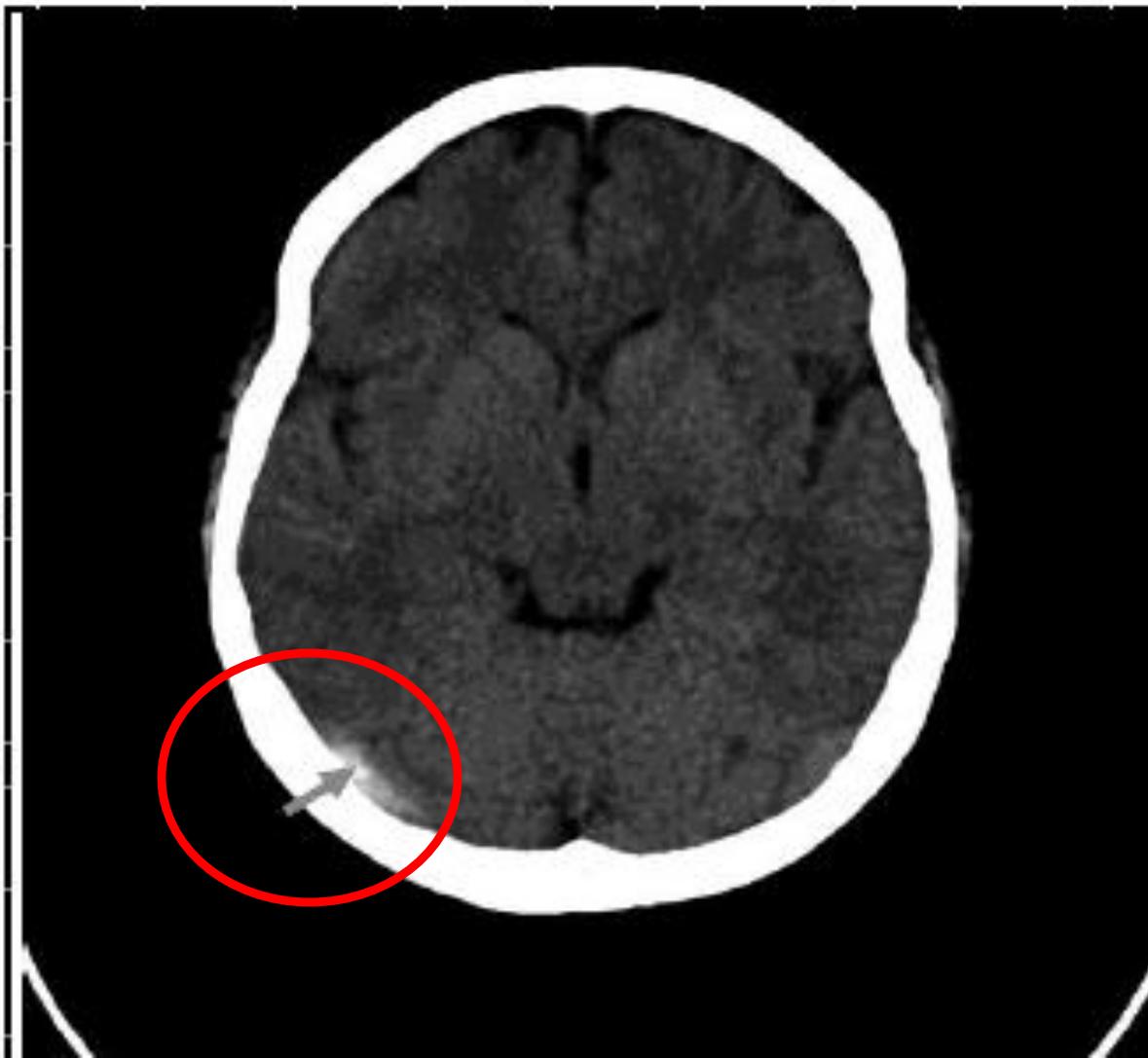
CTV: dấu delta trắng



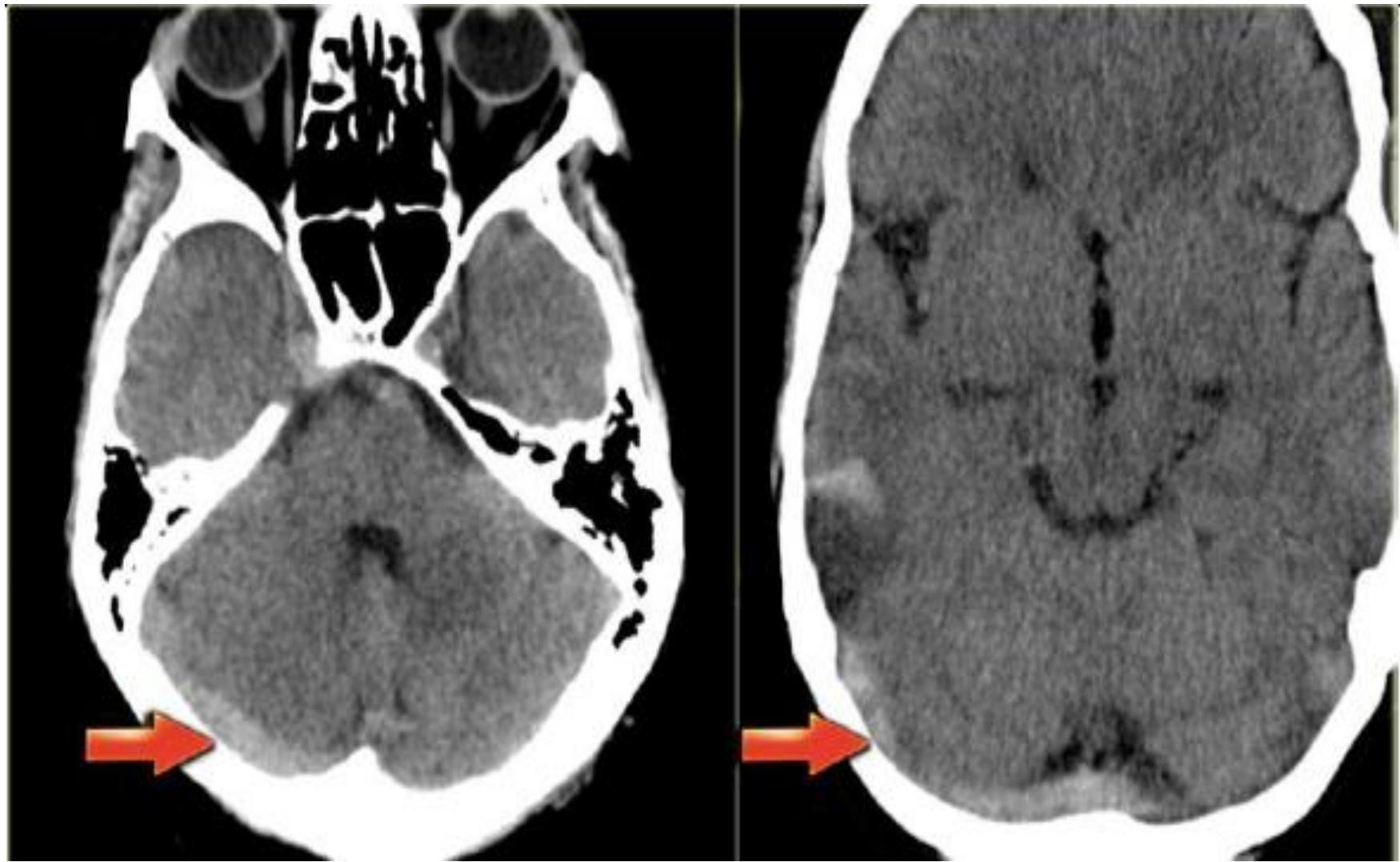
CTV: thrombus không tăng quang SSS, SS. ICV tắc và không tăng quang

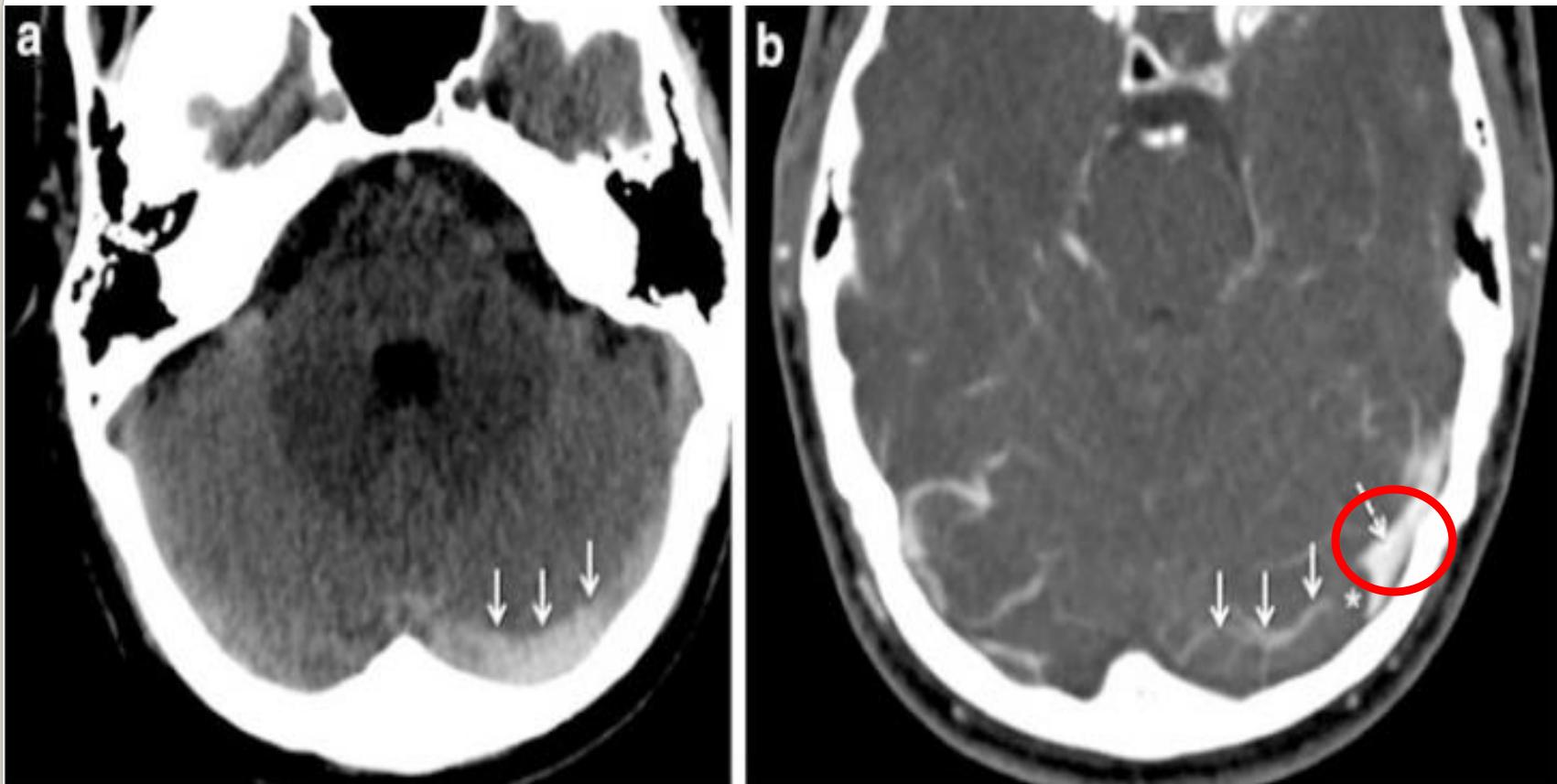
*NECT : Dấu tam giác đặc(Dense clot sign) huyết khối
tĩnh mạch dọc trên*



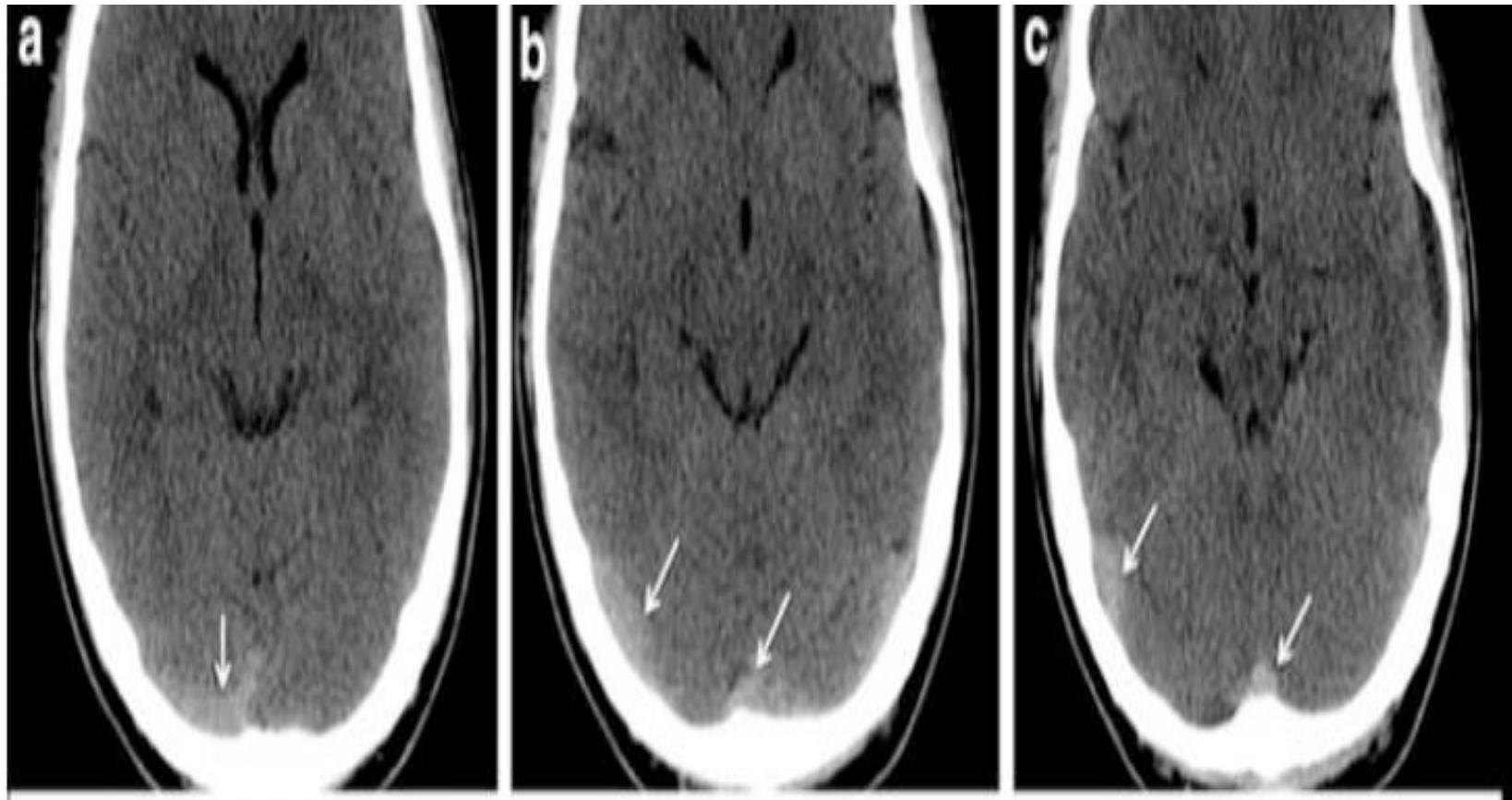


NECT: Tăng đậm độ vùng xoang ngang



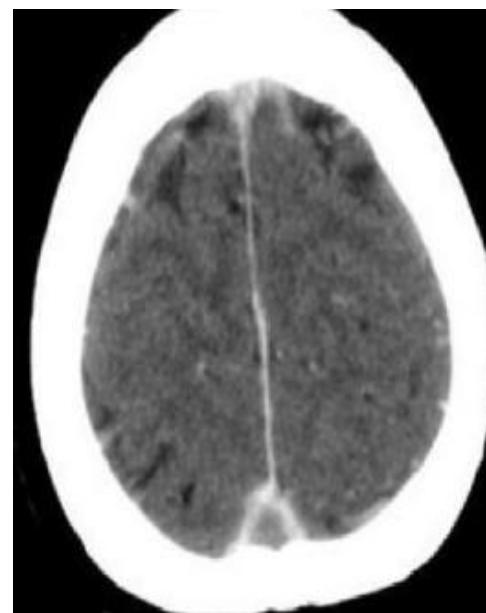
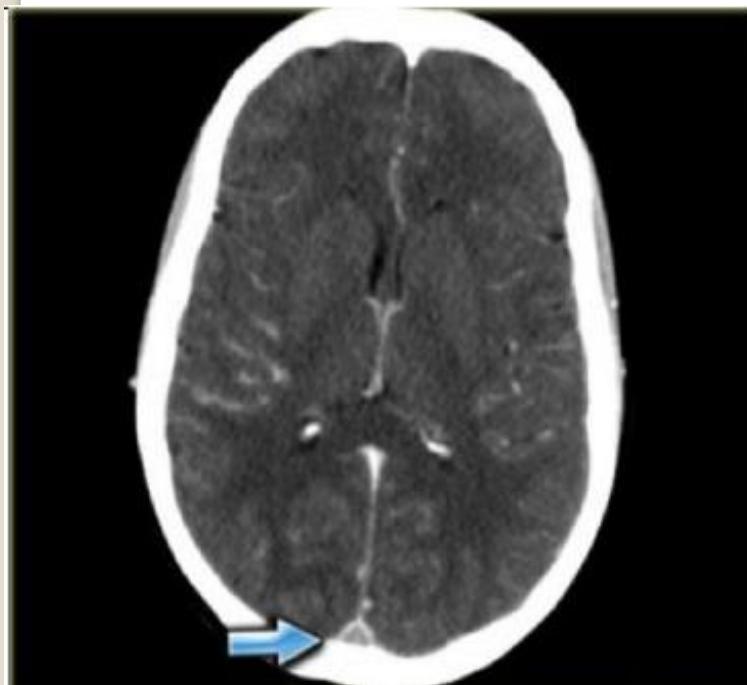


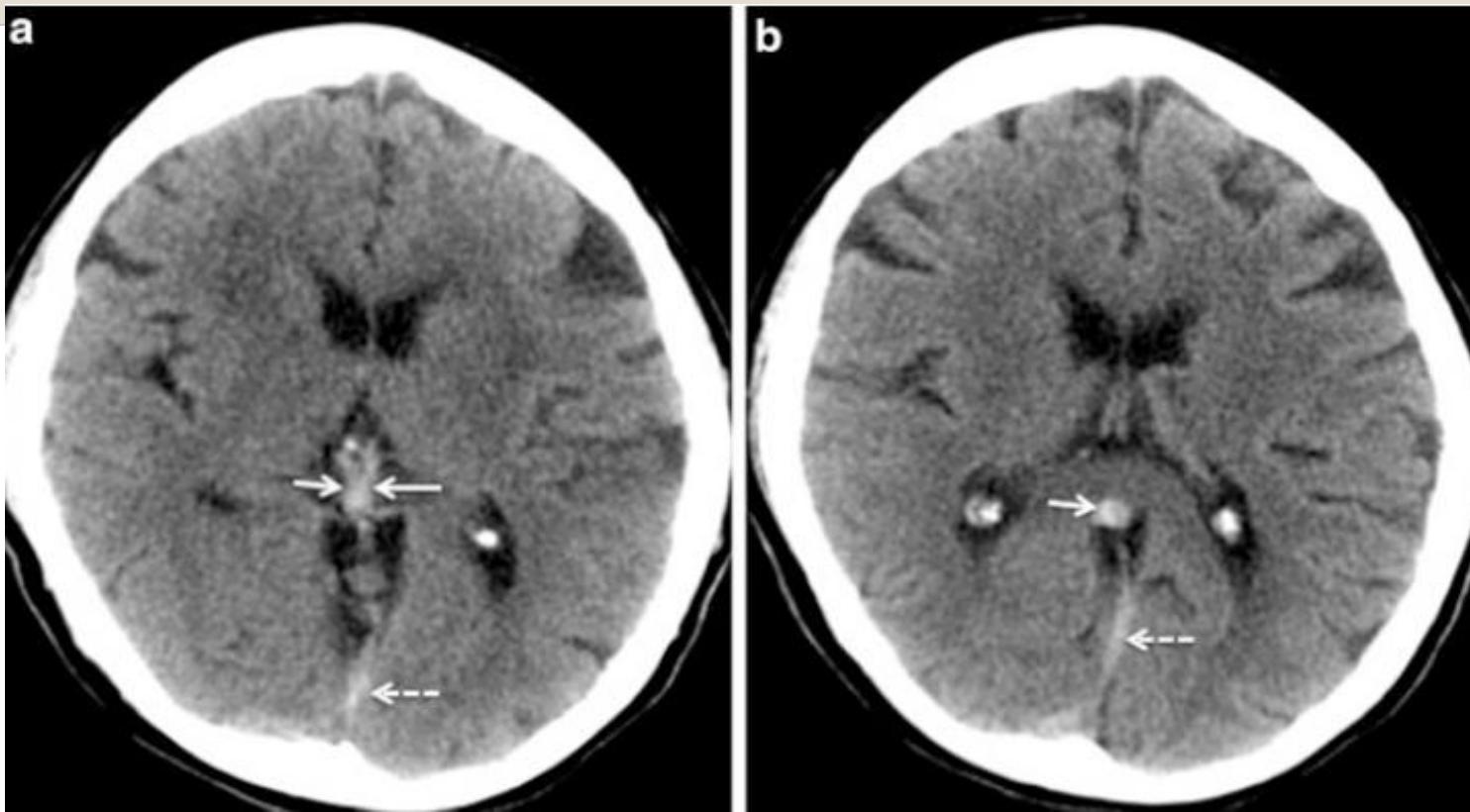
Cord sign on NECT, 34-year-old male patient with thrombosis of the proximal left transverse sinus. The venous clot delineated hyperdense on NECT (a), a direct sign of thrombosis, cord sign (arrows in a). The venous clot is visualized as a filling defect in the affected sinus on CT angiography (b, arrows)



False-positive cord sign on NECT. Patient with an elevated hematocrit resulting in a relative high density in the dural sinuses on NECT (a–c, e.g., arrows).

CECT: Dấu tam giác trống (empty delta sign) : huyết khối tĩnh mạch dọc trên – và hội lưu TM

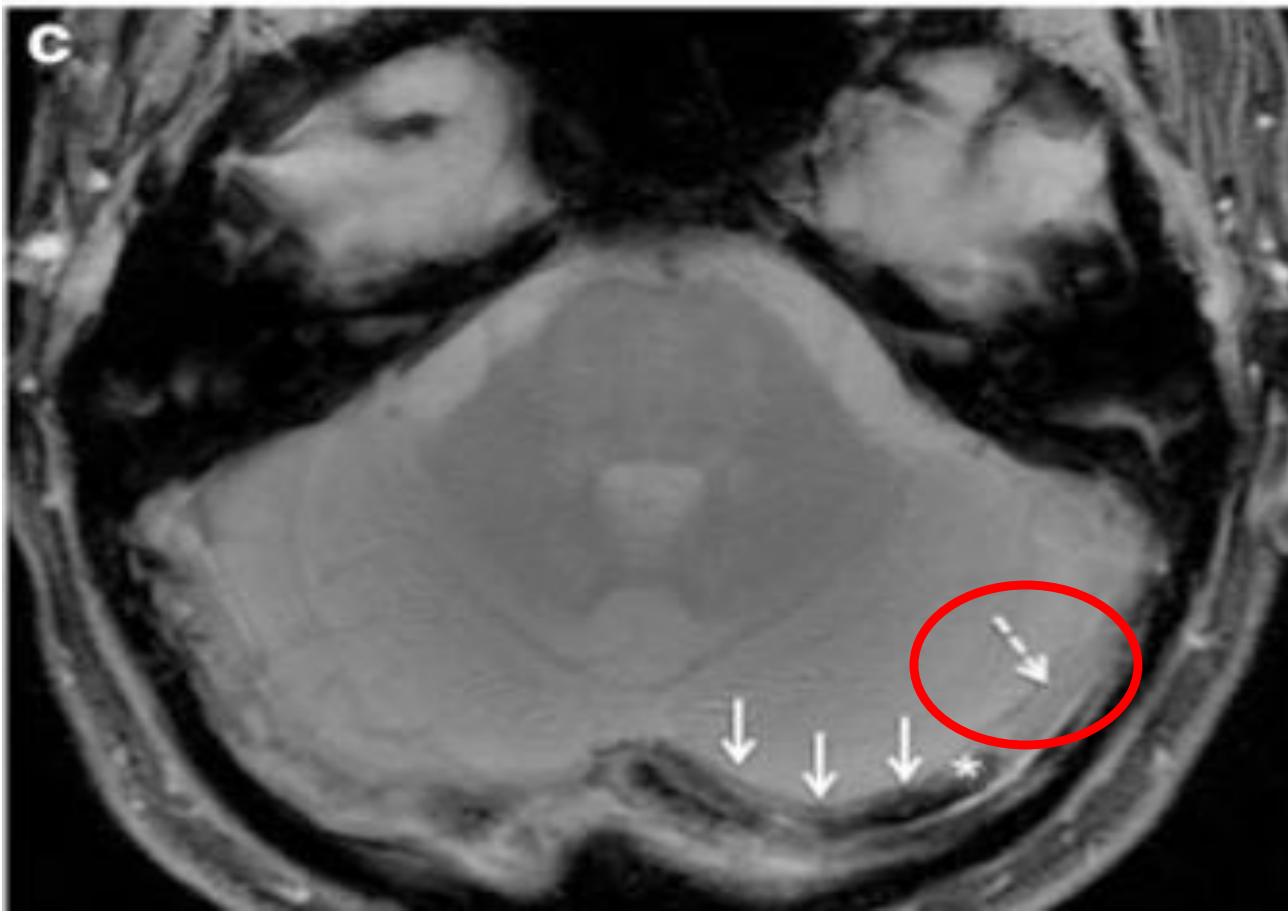




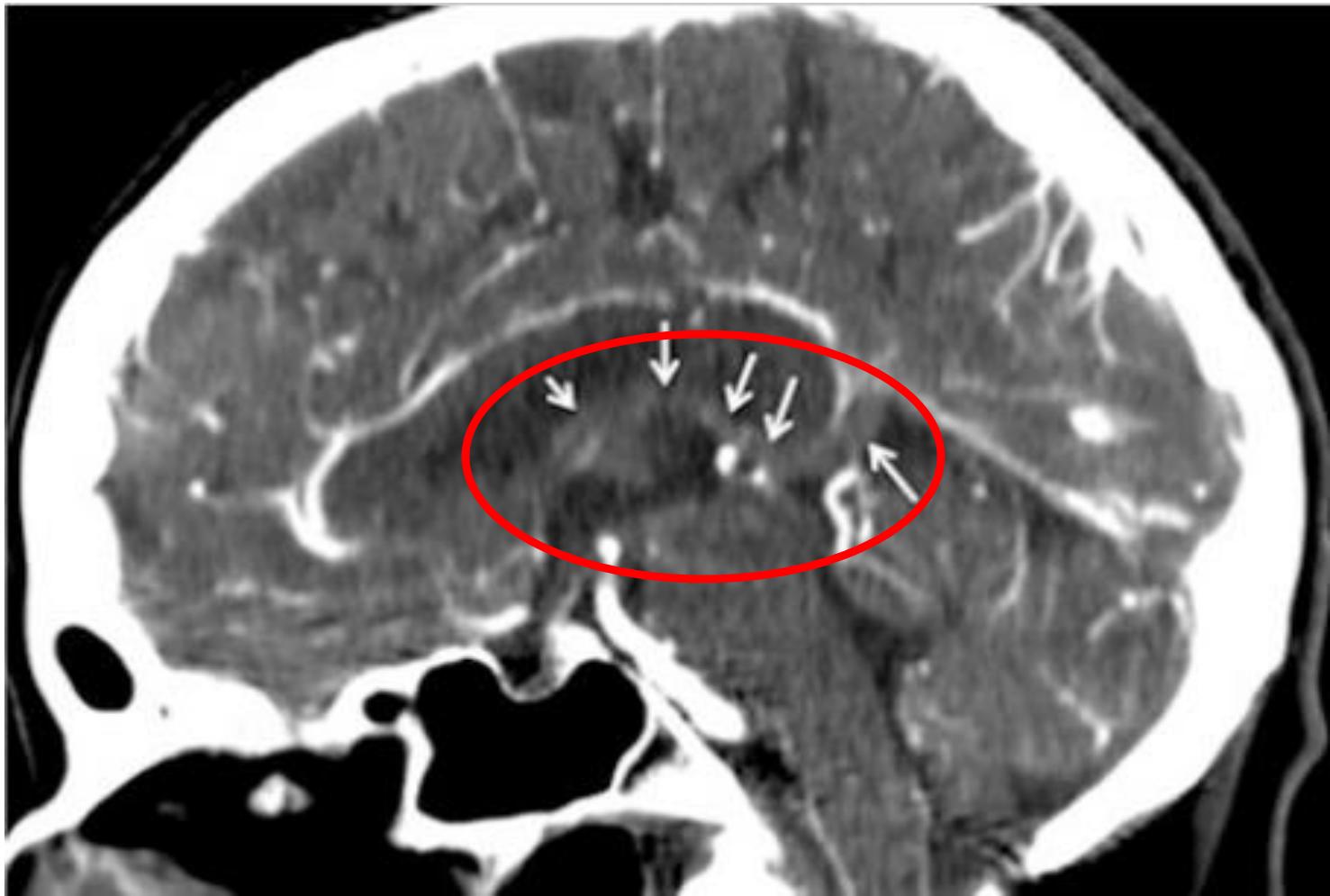
Dense vein sign on NECT.

Bn nữ 28 tuổi thrombosis of the internal cerebral veins.

On NECT (a, b) **the venous clot: hyperdense tubular structures** within the **internal cerebral veins** (normal arrows in a), **the vein of Galen** (normal arrow in b), **and the straight sinus** (dotted arrows in a and b). This direct sign of venous thrombosis on NECT is referred to as “dense vein sign.”



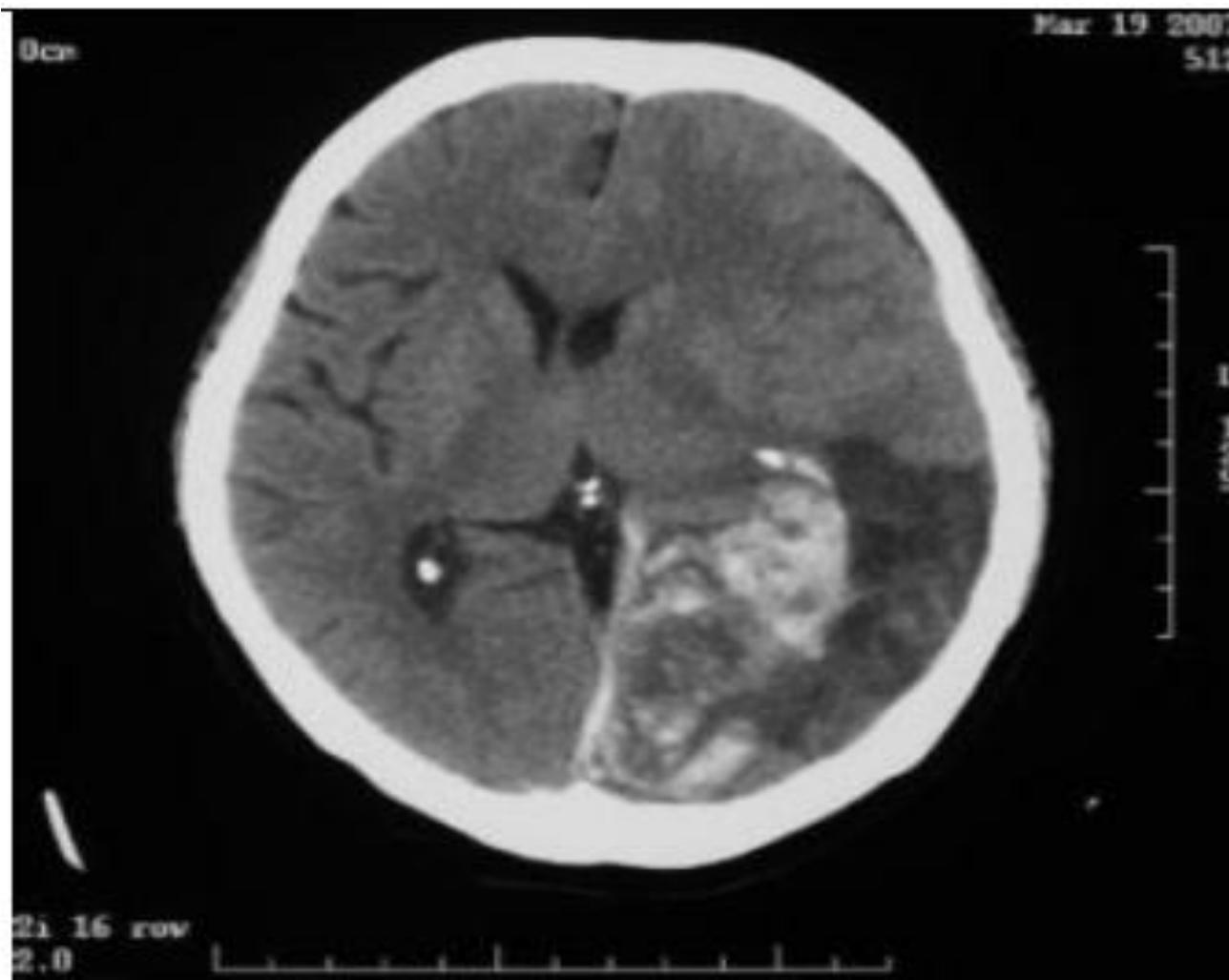
profound hypointense structure on **T2*WI images** (c, arrows). Note the sharp margin of the thrombus: *huyết khối bờ sắc nét* (asterisks in b and c). There is regular flow in the distal part of the sinus: *dòng chảy đều phần xa xoang* (dotted arrows in b and c)



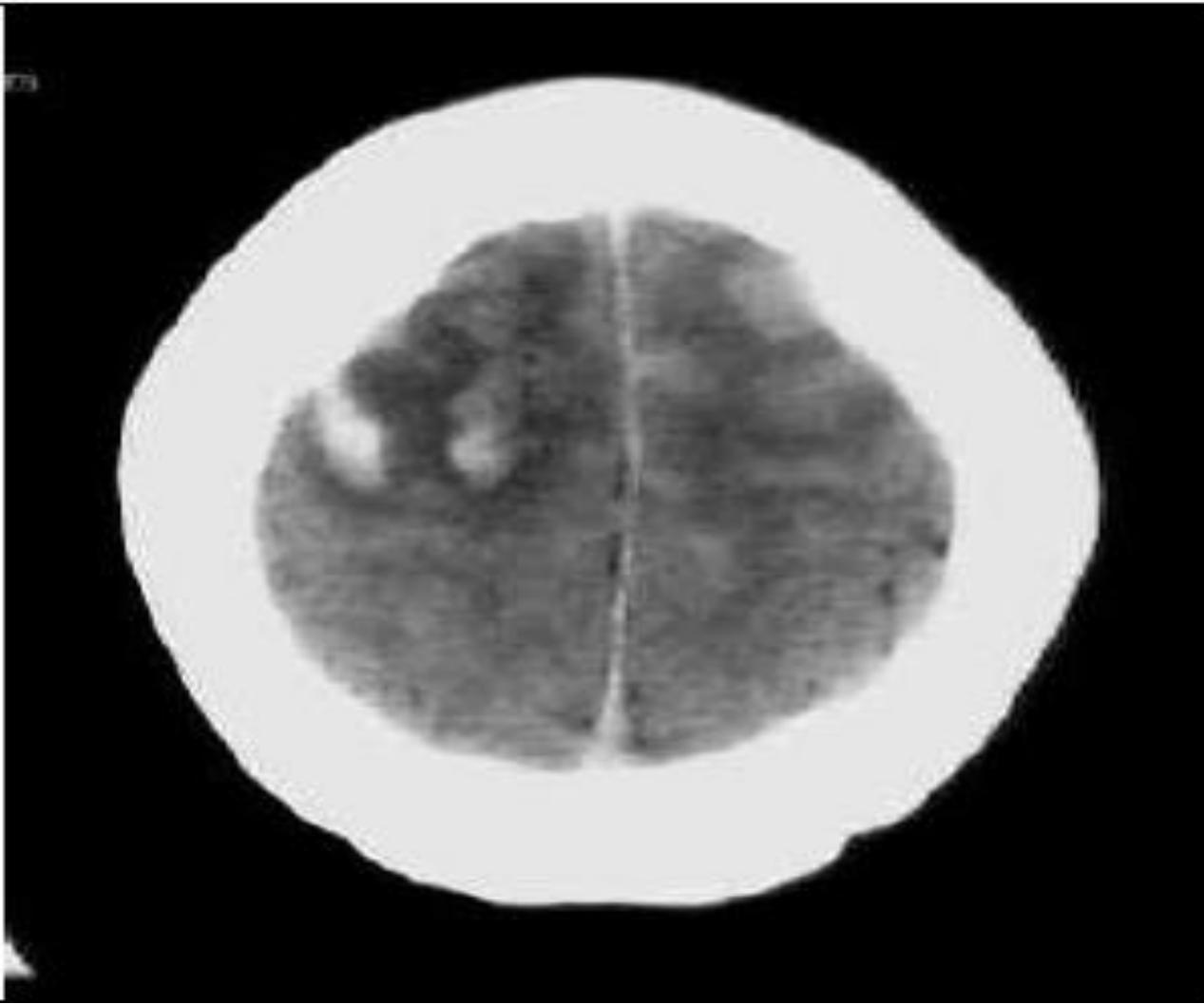
On sagittal reconstructions of the CT angiography), the **venous clot** is visualized as a **filling defect** in the affected veins (arrows)

Dấu hiệu gián tiếp:

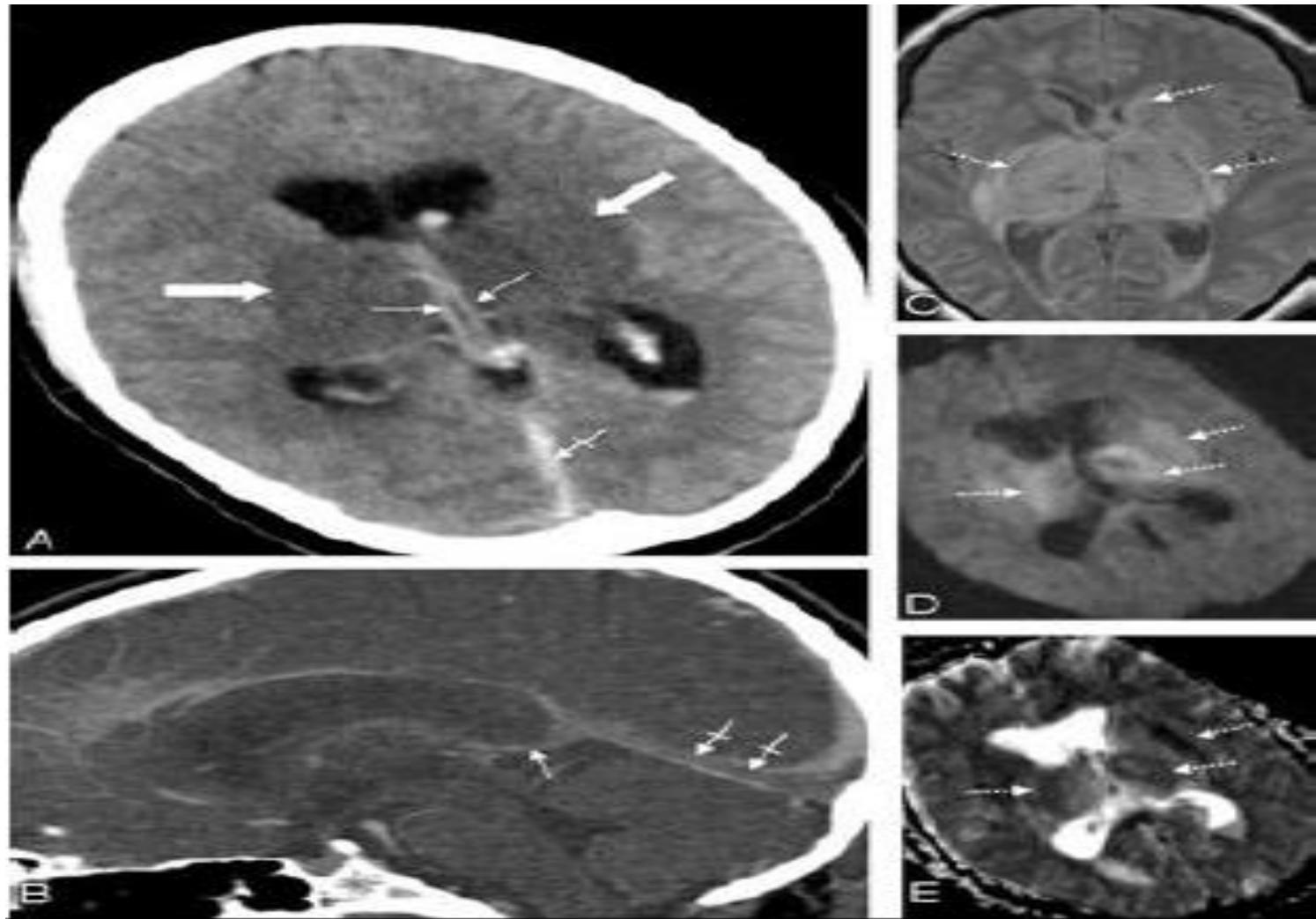
- ❑ Bắt cản quang rất mạnh ở lều tiểu não và liềm não, phù não lan tỏa, giảm đậm độ chất trắng không bắt thuốc cản quang, hình ảnh não thất nhỏ.
- ❑ Có hình ảnh tăng đậm độ tự phát do nhồi máu xuất huyết,
(không theo sự phân bố của động mạch, thường có kết hợp giữa hình ảnh giảm đậm độ khu trú với vùng tăng đậm độ lan tỏa, một bên hoặc hai bên, một ổ hay nhiều ổ)



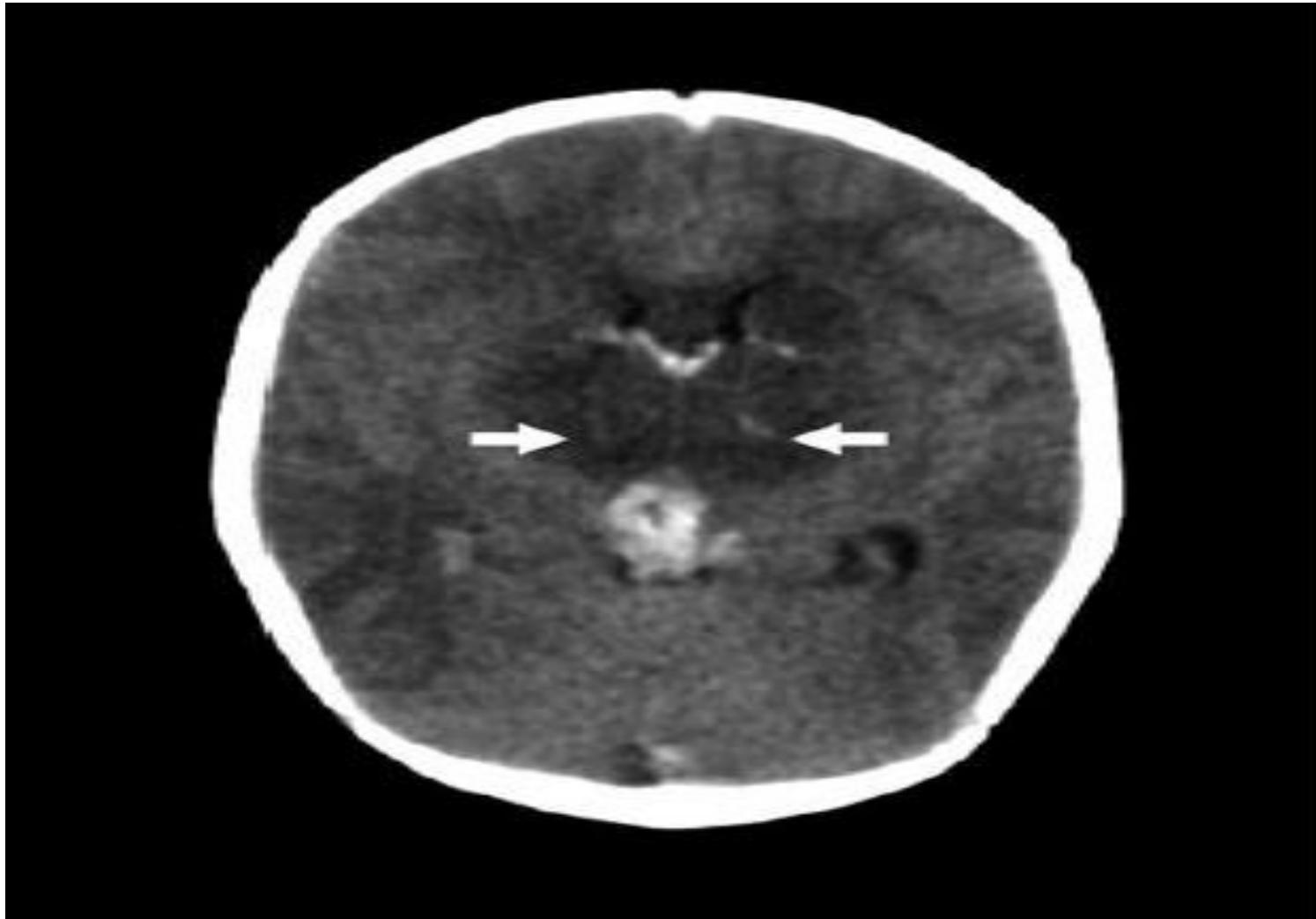
Nhồi máu xuất huyết, không theo sự phân bố của động mạch



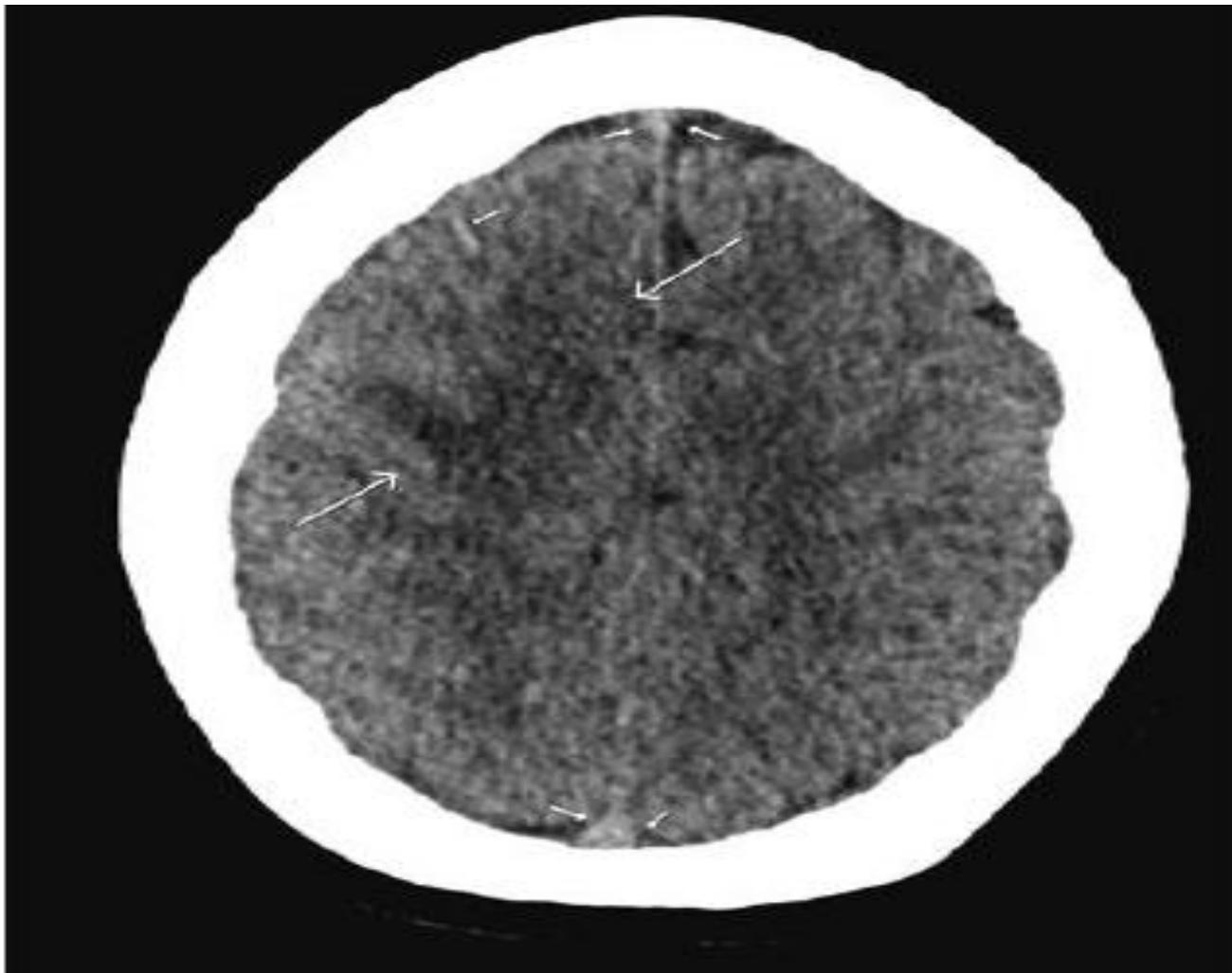
Tổn thương xuất huyết trong vùng nhồi máu 2 bên



Phù đồi thị và nhân bèo 2 bên do huyết khối TM não sâu (ICVs) và xoang tm thẳng (SS)



Nhồi máu đồi thị 2 bên do huyết khối tĩnh mạch não sâu
ở BN mới sinh (deep CVT)



Tổn thương giảm đậm độ thùy trán P do HKTM dọc trên và TM
vỏ não trán P

Huyết khối xoang màng cứng

(Dural Sinus Thrombosis)

IMAGING

- General features
 - "Empty delta" sign on CECT, T1WI C+ MR
- CT
 - Hyperdense sinus on NECT (usually > 70 HU)
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THUẬT NGỮ(TERMINOLOGY)

Viết tắt

- *Dural sinus thrombosis (DST)*
 - *Chronic dural sinus thrombosis (cDST)*
- *Cerebral vein thrombosis (CVT)*

Định nghĩa

- *Thrombotic occlusion of intracranial dural sinuses*

HÌNH ẢNH(IMAGING)

Hình ảnh tổng quát

- gợi ý chẩn đoán tốt nhất
 - Hyperdense (65-70 HU) on NECT
 - "Empty delta" sign on CECT, T1WI C+ MR
- vị trí
 - Thrombus in dural sinus — adjacent cortical vein(s)

HÌNH ẢNH CT

- **NECT**

- Hình ảnh sớm thường không rõ ràng
- **Hyperdense sinus** (so với carotid arteries)
 - Usually $> 65 \text{ HU}$ ($74 \pm 9 \text{ HU}$ vs. 53 ± 7 in normal)
 - Distinguish thrombus vs. hyperdense sinus from high hematocrit (HCT)
 - $\text{HU:HCT ratio in thrombus } 1.9 \pm 0.32 \text{ vs. } 1.33 \pm 0.12 \text{ nonthrombus}$
- \pm **Hyperdense cortical veins ("cord" sign)**
- \pm **Venous infarct** (50%)
 - Cortical/subcortical petechial hemorrhages, edema
 - Straight sinus (SS) \pm internal cerebral veins (ICV) occlusion
 - *Thalami/basal ganglia hypodense, swollen*

- CECT

- "Empty delta" sign (25-30%)
 - Enhancing dura surrounds nonenhancing thrombus
- "Shaggy," enlarged/irregular veins (collateral channels):
TM “xù xì” dẫn ra/ không đều(bàng hệ)

- CTA/CTV

- Filling defect (thrombus) in dural sinus(thiếu hụt làm đầy)
 - Caution: Acute clot can be hyperdense, obscured on CECT/CTV (*cục máu đông cấp có thể tăng đậm độ hay lờ mờ trên CECT*)
 - Luôn luôn có NECT để so sánh

HÌNH ẢNH TRÊN MR

MRI sequence	Signal intensity	Acute stage (0–5 days) ^a	Subacute stage (6–15 days) ^a	Chronic stage (>15 days) ^a
T1w	Hyperintense	30 %	71 %	39 %
	Isointense	68 %	29 %	54 %
	Hypointense	2 %	0 %	7 %
T2w, PDw, FLAIR	Hyperintense	25 %	52 %	43 %
	Isointense	10 %	32 %	45 %
	Hypointense	65 %	16 %	12 %

Numbers printed in bold letters indicate the most common clot signal intensity in the respective stage

T1w T1-weighted spin-echo sequence

T2w T2-weighted spin-echo sequence

PDw proton-density-weighted spin-echo sequence

FLAIR fluid-attenuated inversion recovery-weighted sequence

^aIndicates days after symptom onset

Stage- and sequence-dependent variability of clot signal characteristics (Modified from Linn and Bruckmann)

- T1WI

- Acute thrombus: Isointense with brain
- Subacute thrombus: Hyperintense
- Chronic thrombus: Isointense
- Normal variations in dural sinus flow may mimic thrombosis; vascular exam (CTV or MRV) more reliable to confirm suspected DST

(thay đổi bình thường dòng chảy trong dural sinus có thể giống huyết khối, CTV, MRV nếu nghi ngờ DST)

- T2WI

- Acute thrombus: Hypointense
 - Caution: Hypointense thrombus can mimic normal sinus "flow void"
(giảm tín hiệu của huyết khối có thể giống dòng chảy trong xoang)
- Subacute thrombus: Hyperintense
- Chronic thrombus: Hyperintense
 - Longstanding thrombosed sinus eventually appears isointense
- **Venous infarct:** Mass effect with mixed hypo-/hyperintense signal in adjacent parenchyma

- **PD/intermediate**

- Loss of normal flow voids (*mất dòng chảy trống bình thường*)
- More sensitive than T2WI

- **FLAIR**

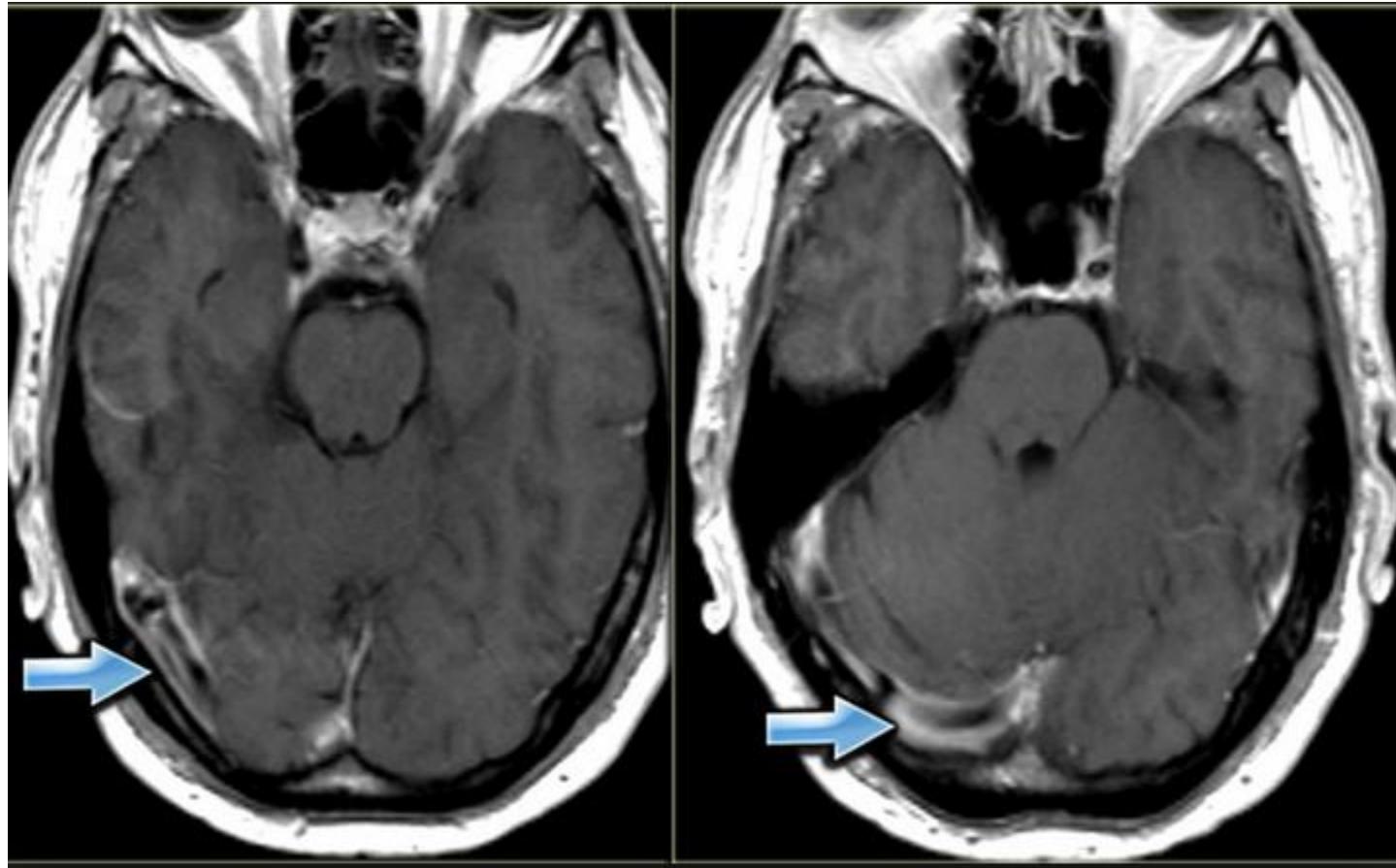
- Clot signal varies
- Venous ischemia/infarcts hyperintense

- **T2* GRE**

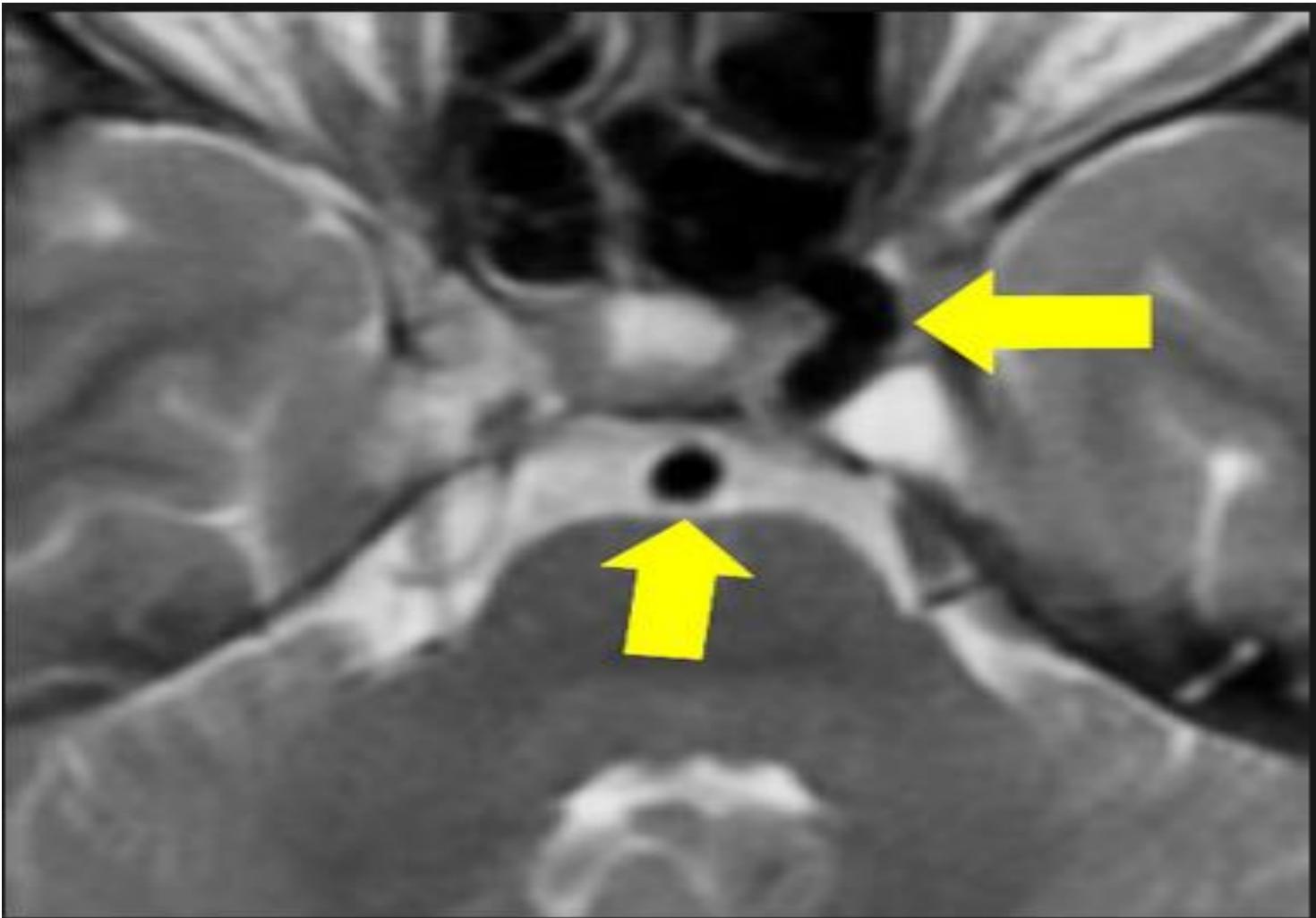
- Hypointense thrombus usually "**blooms**" (thường thành thổi)
- ± hypointense petechial hemorrhages

- ❑ **Flow voids** refer to a signal loss occurring with blood and other fluids, like CSF or urine, moving at sufficient velocity relative to the MRI apparatus.
- ❑ flow void is synonymous with vascular patency(*thông mạch máu*), representing a normal flow-related signal loss in vessels that contain vigorously flowing blood
- ❑ sequences with long TE (such as T2 and PD) have most prominent flow voids; when vascular thrombosis is identified on a T1-weighted sequence (short TE), it should be confirmed by the corresponding T2 or PD sequences, as these are less sensitive to slow flow voids and more specific to the diagnosis of thrombosis

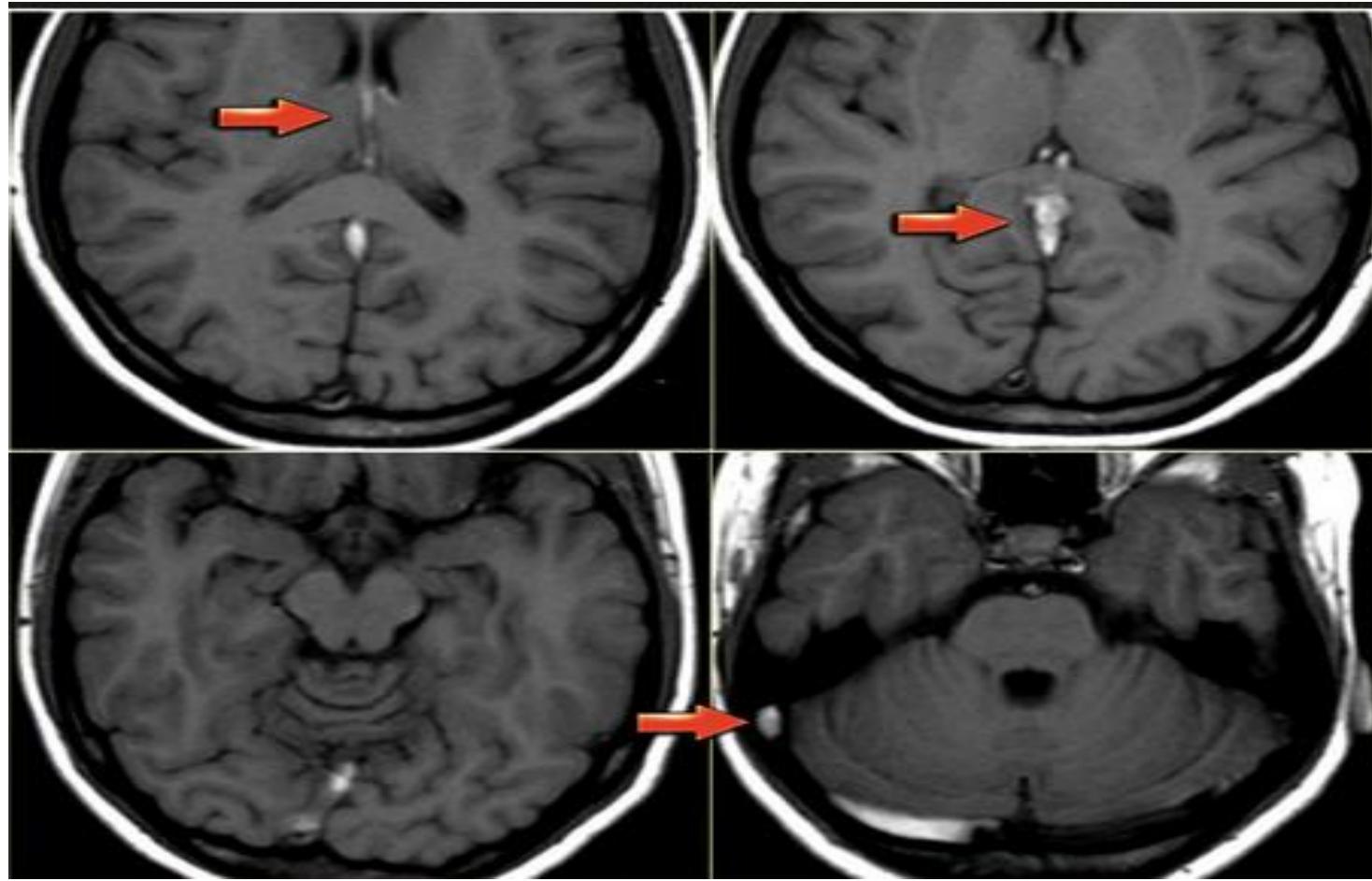
- “Flow void” refers to loss of signal in a widely patent vessel due to time-of-flight or spin-phase effects



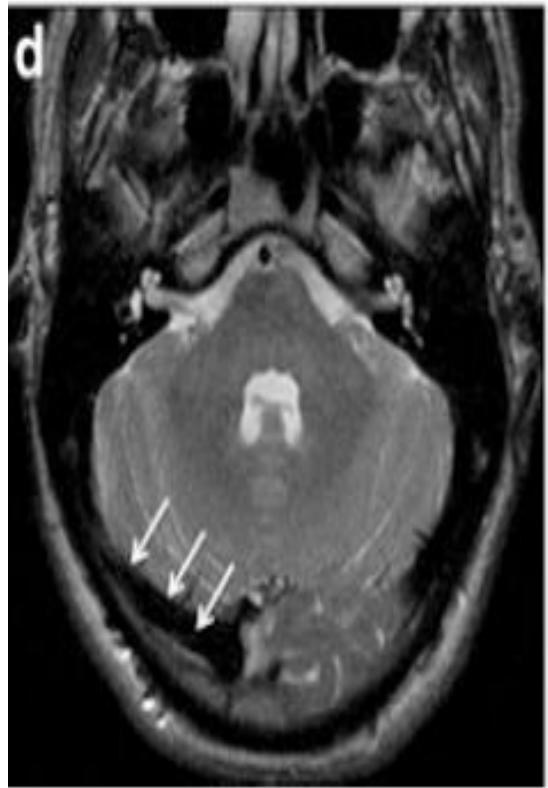
Flow void on contrast-enhanced MR



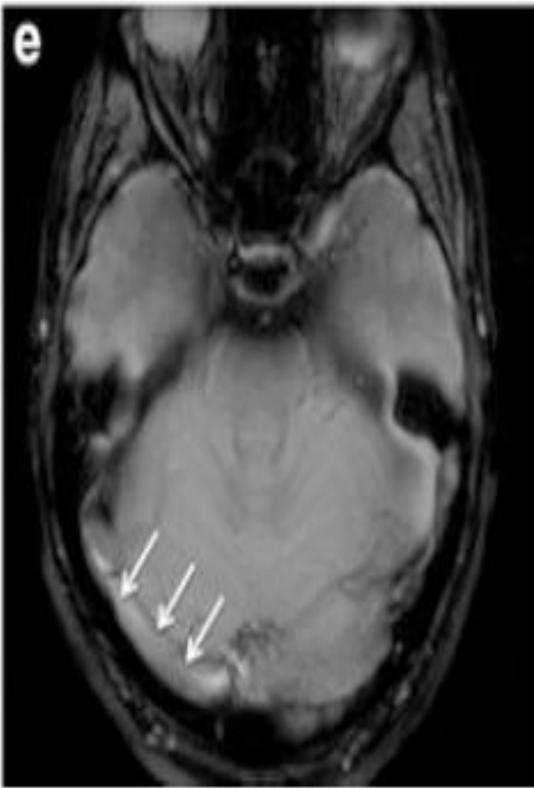
flow void



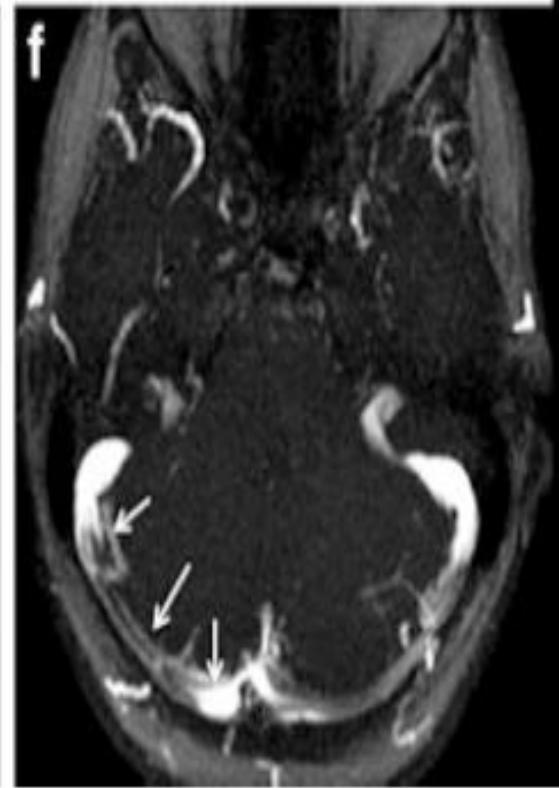
Venous thrombosis with absence of normal flow void on T1-weighted image.



T2-WI



T2*WI sequence



Venous MR

Normal flow void on the T2-WI image (d, arrows), no signal abnormalities indicative of venous clot on T2*WI sequences (e, arrows). Venous MR angiography (f) confirms regular venous flow in the transverse and superior sagittal sinuses (e.g., arrows in f)

- DWI

- 40% have **hyperintense clot** in occluded vessel
- DWI/ADC findings in parenchyma variable, heterogeneous
 - Mixture of vasogenic, cytotoxic edema
 - Cytotoxic edema may precede vasogenic edema
 - Parenchymal abnormalities may be reversible

- T1WI C+

- Acute, subacute DST: Dura enhances, clot doesn't ("**empty delta**" sign)
- cDST: longstanding clot can enhance
 - Organized fibrous tissue —

- **MRV**

- 2D TOF hay contrast MRV
- **Absence of flow** in occluded sinus on 2D TOF MRV
 - Frayed or shaggy appearance of venous sinus (cực kỳ xù xì, lộn xộn)
 - Abnormal collateral channels (e.g., enlarged medullary veins)
- Contrast-enhanced MRV (CE-MRV) shows thrombus, small vein detail, collaterals much better than 2D TOF
- Phase contrast MRV not limited by T1 hyperintense thrombus
- T1 hyperintense (subacute) clot can masquerade as flow on MRV; evaluate standard sequences, source images to exclude artifacts
 - Potential cause of false-negative MRV
(tăng tín hiệu cục máu đông T1(bán cấp) có thể giả dạng như dòng chảy trong MRV)

Angiographic Findings (tìm kiếm trên mạch máu)

- Occlusion of involved sinus (*tắc xoang liên hê*)
- Slow flow in adjacent patent cortical veins (*dòng chảy chậm tĩnh mạch vỏ liên thông kế cận*)
- Collateral venous drainage develops (*phát triển tĩnh mạch bàng hệ dẫn lưu*)

Khuyến cáo hình ảnh

- **Công cụ hình ảnh tốt nhất**
 - NECT, CECT scans — CTV : initial screening
 - MR, MRV (bao gồm T2*, DWI, T1WI C+)
- **Protocol khuyến cáo**
 - nếu CT/CECT/CTV negative, MR với MRV
 - nếu MRV không rõ ràng, cerebral angiography

Chẩn đoán phân biệt

Normal

- Arteries, veins normally slightly hyperdense on NECT

High Hematocrit

- Common in newborns (low density brain, physiologic polycythemia)
- Polycythemia vera (both arteries, veins equally hyperdense)

Dural Sinus Hypoplasia-Aplasia

- Congenital hypoplastic/aplastic transverse sinus
 - Transverse sinus flow gaps (31%); nondominant sinus
 - Right transverse sinus dominant (59%), left dominant (25%), codominant (16%)
- "High-splitting" tentorium (sự phân cắt)

"Giant" Arachnoid Granulations

- Round/ovoid filling defect (clot typically long, linear)
- Cerebrospinal fluid (CSF) density/signal intensity
- Normal in 24% of CECT, 13% of MR
 - Transverse sinus most common location by imaging, left > right
 - Superior sagittal sinus most common location for arachnoid granulations on histopathology (lateral lacunae, not well seen by imaging)

Acute Subdural Hematoma

- Layered blood on tentorium cerebelli may mimic transverse sinus thrombosis

Bệnh học

- **Căn nguyên**

- *Nhiều nguyên nhân ảnh hưởng đến*

- Trauma, infection, inflammation
 - Pregnancy, oral contraceptives
 - Metabolic (dehydration, thyrotoxicosis, cirrhosis)
 - Hematological (coagulopathy)
 - Collagen-vascular disorders (APLA syndrome)
 - Vasculitis (Behcet)

- *Kiểu thường gặp nhất*

- Thrombus forms in dural sinus
- Clot propagates into cortical veins
- Venous drainage obstructed, venous pressure elevated
- Blood-brain barrier breakdown with vasogenic edema, hemorrhage
- Venous infarct with cytotoxic edema

- ***Di truyền***

- Resistance to activated protein C (*typically due to factor 5 Leiden mutation*): nguyên nhân thường nhất CVT rải rác
- Protein S deficiency
- Prothrombin (factor II) gene mutation

- ***Liên quan bất thường***

- Dural AV fistula; venous occlusive disease may be underlying etiologic factor

Lâm sàng

Triệu chứng

- *Triệu chứng thường gặp nhất*
 - Chẩn đoán lâm sàng thường khó tìm thấy
 - thường gặp nhất = headache
 - triệu chứng khác = nausea, vomiting, neurologic deficit

Nhân trắc học

- Age
 - bất cứ tuổi nào cũng bị ảnh hưởng
- Gender
 - F > M
- Dịch tễ học (Epidemiology)
 - Venous accounts for 1% of acute strokes

Diễn tiến và dự hậu (Natural History & Prognosis)

- Extremely variable: Asymptomatic to coma, death
 - Up to 50% of cases progress to venous infarction
 - Can be fatal if severe brain swelling, herniation

Treatment

- In-patient heparin followed by out-patient warfarin (Coumadin)
- In more severe cases, endovascular mechanical thrombectomy — local heparin infusion



Giai đoạn sớm không bất thường
SSS: 60 HU

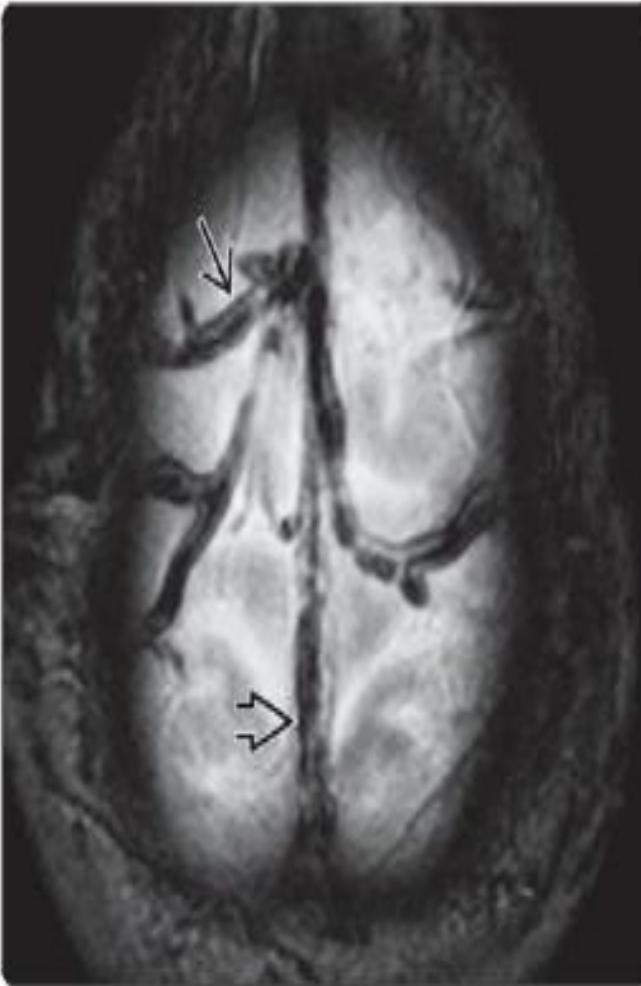


CTV: cục huyết khối không tăng quang toàn bộ SSS, thành màng cứng tăng quang

(Left) NECT scan in a 68-year-old male with a 2-day history of headache and confusion shows no definite abnormality. The superior sagittal sinus → measured 60 HU. (Right) Axial CT venogram in the same patient shows nonenhancing thrombus → filling the entire SSS. The dural walls of the SSS enhance ▷.



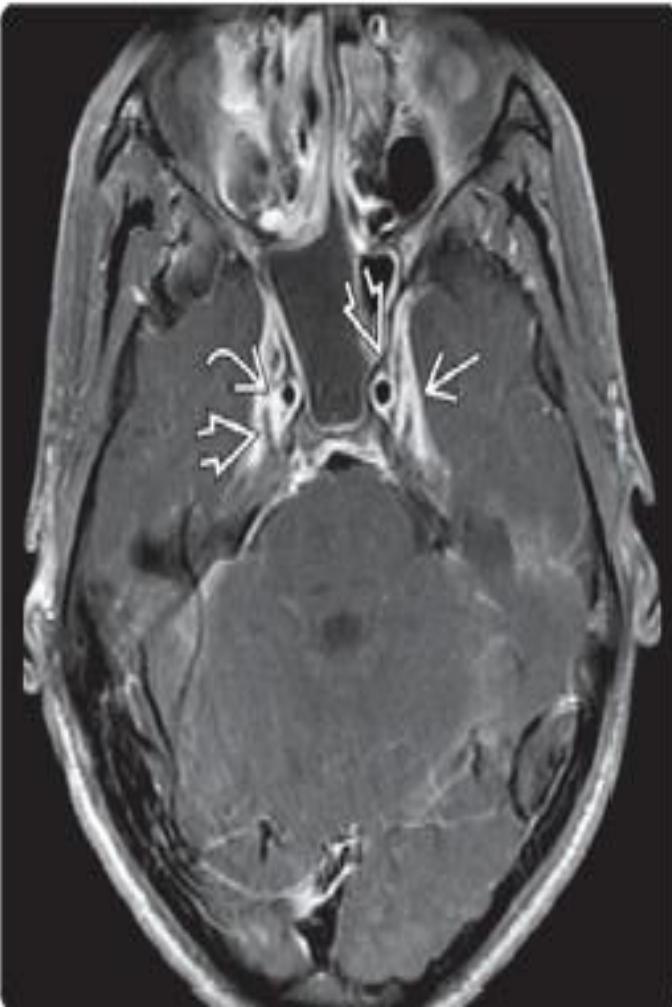
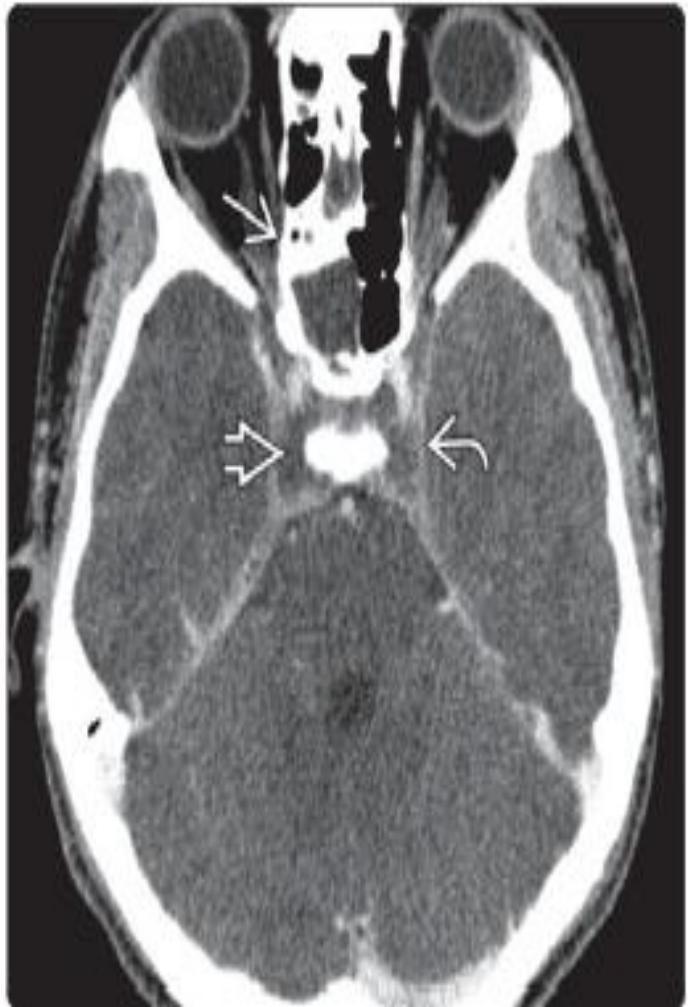
T2WI: giảm tín hiệu SSS, TM
vỏ giống “normal flow void”



T2 GRE: **blooming thrombus** giống
“normal flow void” trên T2WI

(Left) T2WI in the same patient shows hypointensity in the SSS → and cortical veins → mimicking normal “flow voids.” (Right) T2* GRE in the same patient shows “blooming” thrombus in the SSS → and cortical veins → Acute thrombus can mimic normal “flow voids” on T2WI, but susceptibility-weighted scans (GRE or SWI) easily depict the intraluminal clots.

Độ cảm từ, mô tả



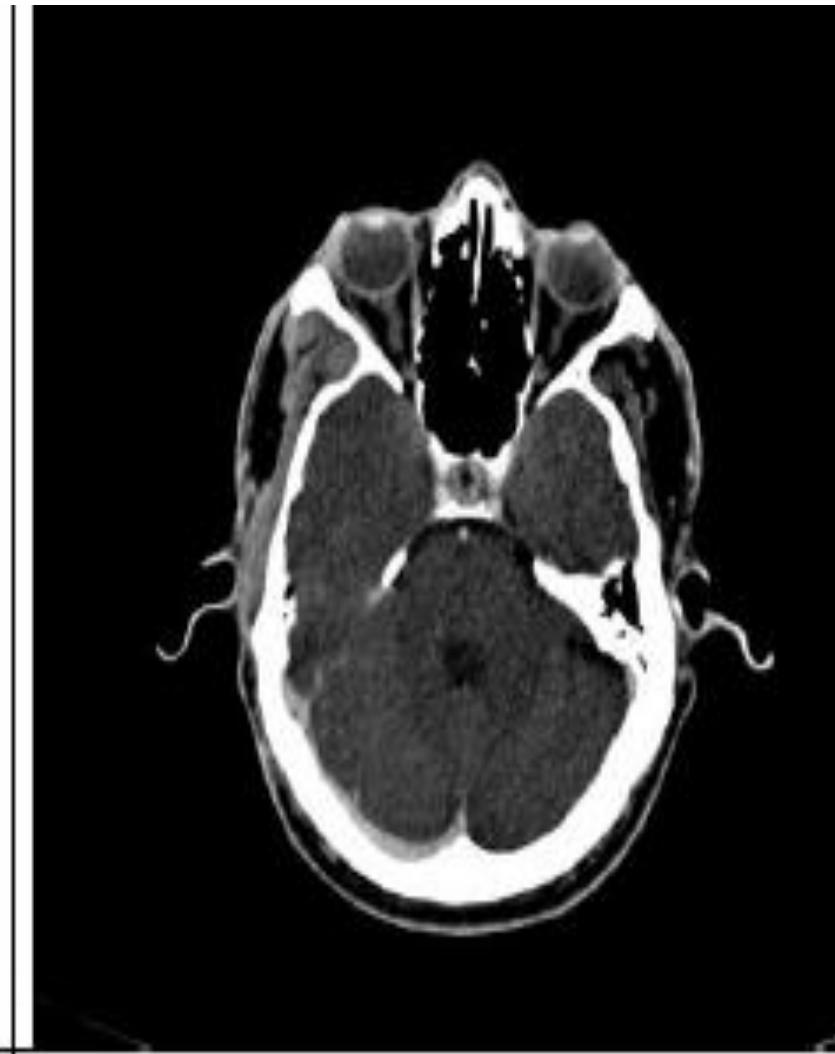
(Left) Cavernous sinus thrombosis can be difficult to diagnose. Most cases occurs as complications from severe sphenoid sinusitis ➡ and are seen as nonenhancing clot ➡ contained by the enhancing dural walls ➡. (Right) Axial T1C+FS MR in the same patient shows the nonenhancing clot ➡ in the enhancing dural walls ➡ and internal septae ➡ of the CS. Patients with CS thrombophlebitis almost always have headache, cranial nerve palsies, and sphenoid sinusitis.

Huyết khối xoang hang, viêm xoang bướm,, cục máu đông không tăng quang trong thành màng cứng tăng quang

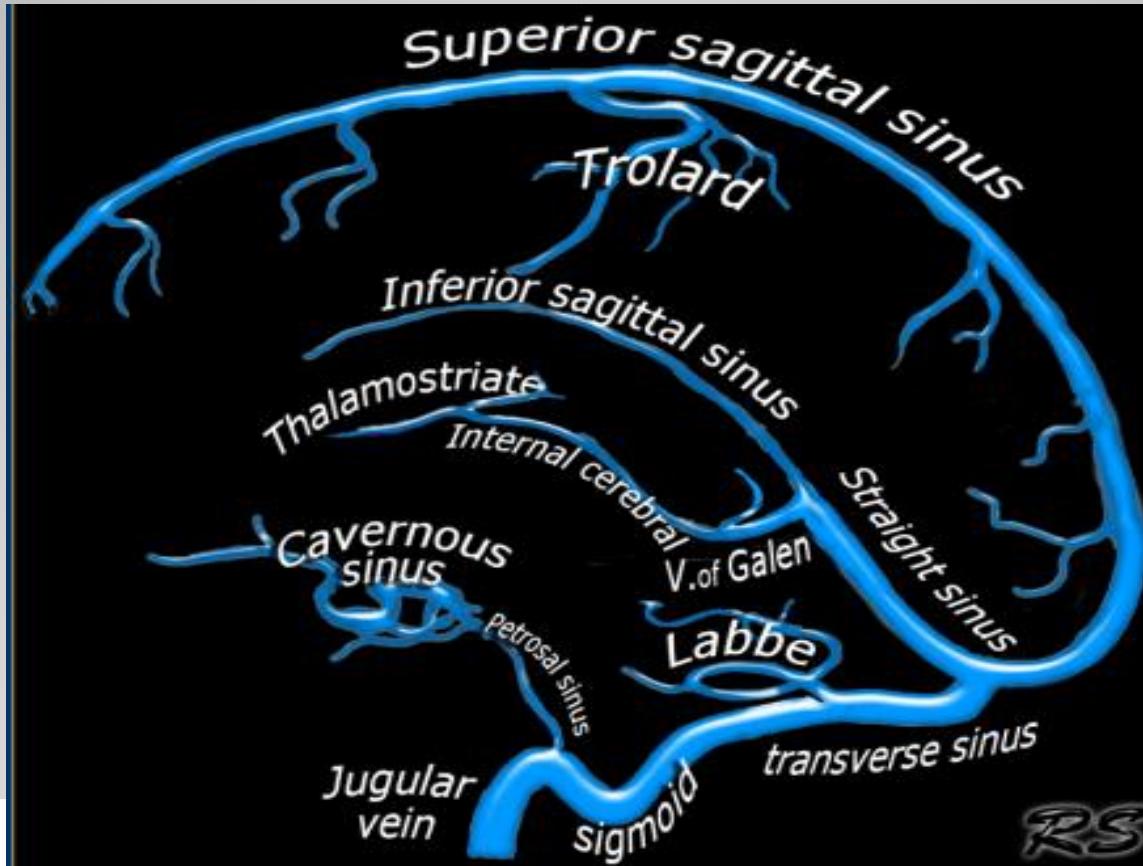
MR, T1 có gado: huyết khối không tăng quang trong thành màng cứng tăng quang

Mất đồ dày xoang ngang T





Cortical Venous Thrombosis



KEY FACTS

TERMINOLOGY

- Cortical/cerebral venous thrombosis (CVT)
- Dural sinus thrombosis (DST)
- CVT with DST > isolated CVT without DST

IMAGING

- NECT
 - "Cord" sign (hyperdense vein)
 - Involved veins usually enlarged (distended with clot), irregular
 - ± petechial parenchymal hemorrhage, edema
- CECT
 - If DST, "empty delta" sign (25-30% of cases)
 - CVT: Thrombi may be seen as filling defects
- MR
 - Acute thrombus isointense on T1WI
 - Hypointense on T2WI (can mimic flow void)
 - T2* GRE best (clot usually blooms)
- 2D time of flight (TOF) MRV

- Thrombus seen as sinus discontinuity, loss of vascular flow signal
- Subacute thrombus T1 hyperintense (mimics patent flow on MIP)
- Imaging recommendations
 - NECT, CECT scans ± CTV
 - If CT negative → MR/MRV with T1WI C+, GRE
 - If MR is equivocal → DSA (gold standard)

TOP DIFFERENTIAL DIAGNOSES

- Normal (circulating blood slightly hyperdense)
- Anatomic variant (hypoplastic segment can mimic DST)

CLINICAL ISSUES

- Most common symptom is headache

DIAGNOSTIC CHECKLIST

- If "convexal" subarachnoid hemorrhage is seen, consider CVT

THUẬT NGỮ

- Cortical/cerebral venous thrombosis (CVT)
- Dural sinus thrombosis (DST)
- CVT with DST > isolated CVT without DST

Hình ảnh tổng quát

- đầu mối chẩn đoán tốt nhất
 - "Cord" sign on NECT, T2* GRE
- vị trí
 - Cortical veins (unnamed)
 - Anastomotic vein of Labbe
 - Anastomotic vein of Trolard
 - Can be solitary, multiple
- hình thái học (Morphology)
 - Veins usually enlarged (distended with clot), irregular
 - Linear, cigar-shaped thrombus

CT

- **NECT**

- Hyperdense cortical vein ("cord" sign) — DST
- Parenchymal abnormalities common
 - Petechial hemorrhage, edema
 - Hypodensity in affected vascular distribution
- Need NECT to exclude false-negative CTV
 - Thrombus dense, can mimic enhancement

- **CECT**

- nếu có DST
 - "Empty delta" sign (25-30% of cases)
 - "Shaggy," irregular enhancing veins (collateral channels)

- CTV

- Thrombus seen as **filling defect** in cortical veins (*khièm khuyết làm dày*)
- Abnormal collateral channels (e.g., enlarged medullary veins)
- Negative CTV does not exclude CVT
 - Limited value for chronic CVT
 - Organizing thrombosis also enhances
 - Limited value for nonocclusive thrombus
 - Optimize technique using thin slice (0.6 mm) MDCT with venous phase enhancement and dedicated sagittal and coronal MPR (1-2 mm)
 - Thick slice (3-5 mm) sliding or overlapping MIPs in sagittal and coronal planes
 - Concurrent NECT important to exclude false-negative CTV due to intrinsically dense thrombus (*đậm độ huyết khối bên trong*)
 - Subacute and chronic thromboses can enhance: Potential false-negative

MR

- **MR**
 - Acute thrombus isointense on T1WI
 - Hypointense on T2WI (can mimic flow void)
 - T2* GRE best (clot usually blooms)
- 2D time of flight (TOF) MRV
 - Thrombus seen as sinus discontinuity, loss of vascular flow signal
 - Subacute thrombus T1 hyperintense (mimics patent flow on MIP)

- **T1WI**

- Thrombus is isointense early, hyperintense later
- ± venous infarct
 - Gyral swelling, edema hypointense
 - Iso- to slightly hyperintense foci if hemorrhagic

- **T2WI**

- Thrombus hypointense acutely, hyperintense much later
 - Acute clot can mimic flow void
- Venous infarct
 - Gyral swelling, edema hyperintense
 - Hypointense foci if hemorrhagic

- ***FLAIR***
 - Thrombus usually hyperintense
 - Parenchymal edema hyperintense
- ***T2* GRE***
 - GRE most sensitive sequence for thrombus
 - Hypointense ("black"), cord-like
 - SWI not as helpful due to intrinsic hypointensity of normal veins

susceptibility-weighted scans (SWI)

- **DWI**

- DWI/ADC varies with ischemia, type of edema, hemorrhage
 - Distinguishes cytotoxic from vasogenic edema

- **T1WI C+**

- Thin (1 mm) 3D volume acquisition (*thể tích đạt được*)
- Acute/early subacute clot: Peripheral enhancement outlines clot (*tăng quang chu vi cục máu đông*)
- Late clot: Thrombus, fibrous tissue often enhances
- Venous infarct: Patchy enhancement (*tăng quang lõm đốm*)

- **MRV**

- 2D time of flight (TOF) MRV depicts thrombus as sinus discontinuity, loss of vascular flow signal (*mô tả được thrombus khi sinus không liên tục , mất tín hiệu dòng chảy mạch máu*)
 - May see abnormal collateral channels (e.g., enlarged medullary veins)
 - Occluded veins at time of diagnosis may predict low rate of vessel recanalization 2 or 3 months later

- Contrast-enhanced MRV (CE-MRV)
 - Faster; better depicts nonenhancing thrombus and small veins than TOF
- TOF limitations
 - T1 hyperintense thrombus (subacute) may mimic patent flow on MIP (false-negative MRV)
 - Must evaluate source images and conventional MR sequences to exclude potential false-negatives
- Phase contrast MRV: T1 hyperintense thrombus not misrepresented as flow

Maximum Intensity *Projection (MIP)*

Siêu âm (Ultrasonographic)

- *Transcranial Doppler (TCD) ultrasound*
 - Monitor venous flow velocities at ICU bedside
 - Follow therapy as decreasing velocities
 - Caveat(cảnh báo) : Normal venous velocities in serial measurements do not exclude diagnosis of CVT

Chụp mạch máu (Angiographic)

- *Conventional DSA, venous phase*
 - More accurate than MR, particularly for isolated cortical vein thrombosis
 - Considered gold standard
 - Chronic thromboses challenging due to enhancement from recanalization/organizing thrombus
- *Interventional:*
Treatment with thrombolytics &/or mechanical declotting

Khuyến cáo hình ảnh

- Best imaging tool
 - NECT, CECT — CTV
 - MR with T1WI C+, GRE if CTV negative but high suspicion
 - DSA is gold standard
- Protocol advice
 - If CT negative → MR with T1WI C+, GRE, MRV
 - If MR, MRV equivocal → DSA

Chẩn đoán phân biệt

- Normal (circulating blood slightly hyperdense)
- Anatomic variant (hypoplastic segment can mimic DST)

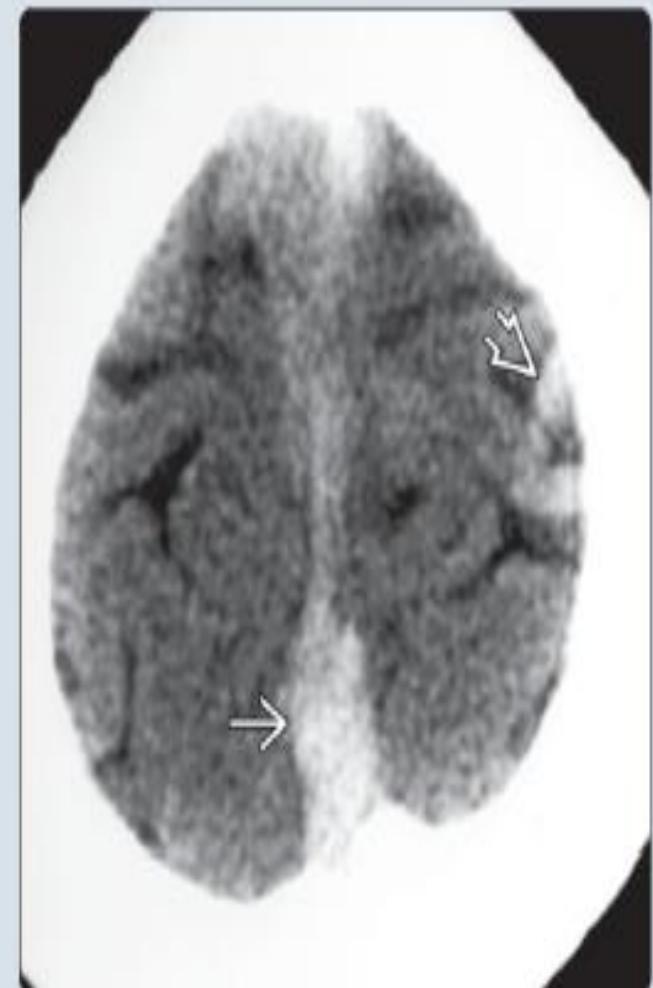
Lâm sàng

- Most common symptom is headache

Những mục cần kiểm tra (DIAGNOSTIC CHECKLIST)

- If "convexal" subarachnoid hemorrhage is seen, consider CVT

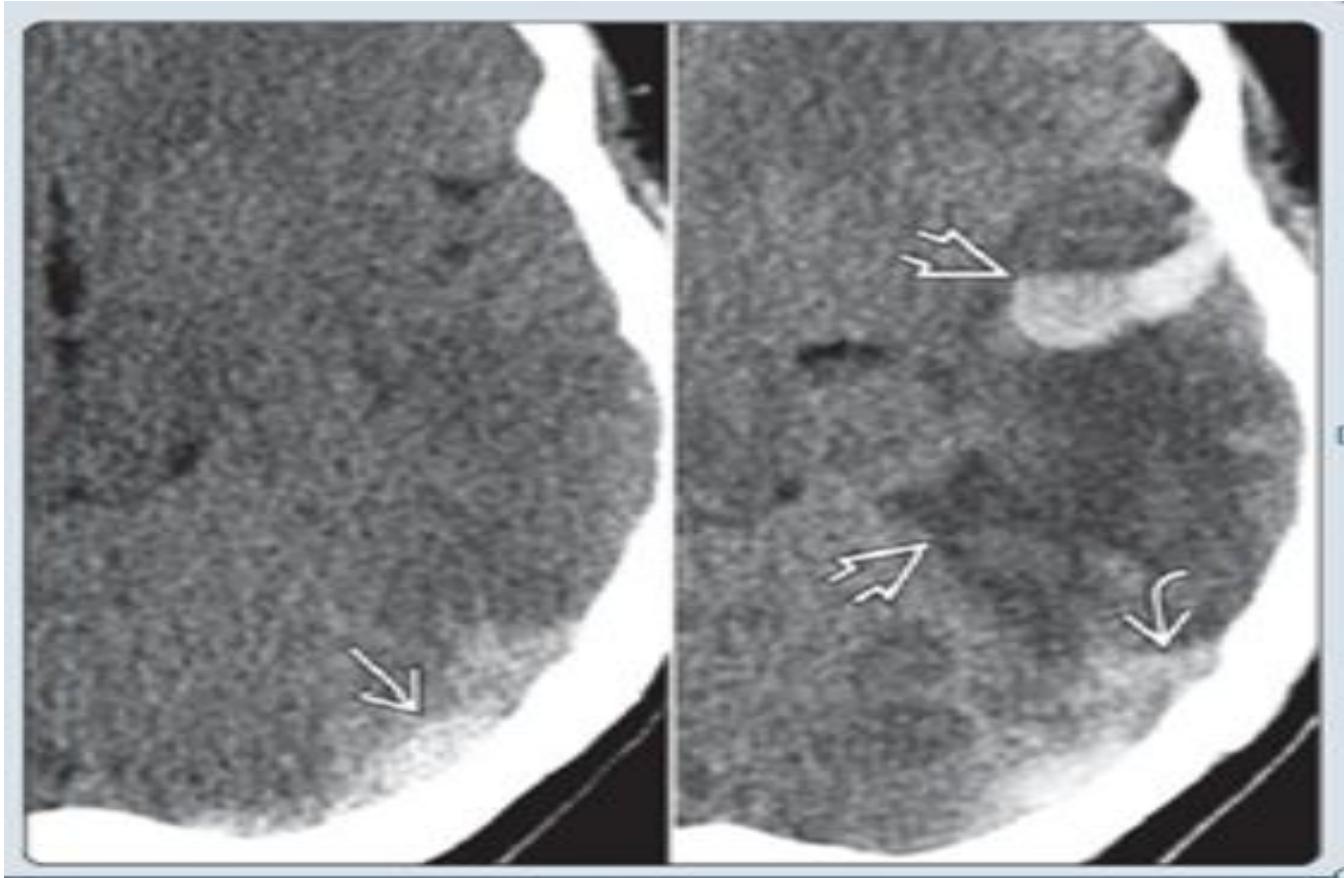
(Left) Autopsy case shows thrombus in several cortical veins →, the pathologic basis for the "cord" sign. (Courtesy E.T. Hedley-Whyte, MD.)
(Right) Axial NECT scan in a patient with thrombosis of the superior sagittal sinus shows dense clot □ filling and expanding the SSS. Thrombus is seen in a vein □ over the cerebral convexity. Most (but not all) cortical vein thrombi occur as extension from clot in an adjacent dural venous sinus.



Tử thiết nhiều tm vở bi huyết khối “cord sign”

NECT: huyết khối SSS: Dense clot, huyết khối trong tm trên lồi não, huyết khối tm vở dãn rộng từ cục máu đông trong xoang màng cứng kế cận)

23-year-old woman presented in the ER with "migraine headache." Initial NECT scan (left) was called normal. Note the hyperdense thrombus in left TS. CT 1 day later (right) shows vein of Labbé thrombosis and a large left temporal lobe hemorrhagic venous infarct.



Phụ nữ 23 tuổi, đau đầu migraine: TS trái hyperdense thrombus, một ngày sau
cho thấy huyết khối TM Labbe và xuất huyết trên nền nhồi máu thùy thái dương

Chẩn đoán phân biệt

Normal

- Circulating blood normally mildly hyperdense on NECT

Anatomic Variant

- Congenital hypoplasia can mimic DST
- Vein of Trolard, Labbe, superficial middle cerebral vein (SMCV) have reciprocal size relationship
 - If 2 are prominent, 3rd usually hypoplastic

"Giant" Arachnoid Granulation

- Can mimic DST
- Round/ovoid filling defect (clot is long, linear)
- CSF density, signal intensity

Cerebral Hemorrhage

- Mimics venous infarct
- Amyloid
- Cerebral contusion
- Hypertensive

Bệnh học

- *Căn nguyên*

- No cause identified in 20-25% of cases (không xác định 20-25%)
- Wide spectrum of predisposing causes(nhiều nguyên nhân ảnh hưởng)
 - Trauma, infection, inflammation, malignancy
 - Pregnancy, oral contraceptives
 - Metabolic (dehydration, thyrotoxicosis, cirrhosis, hyperhomocysteinemia, etc.)
 - Hematological (coagulopathy)
 - Collagen-vascular disorders (e.g., APLA syndrome)
 - Vasculitis (e.g., Behcet)
 - Drugs (androgens, MDMA "ecstasy")

- Most common pattern (kiểu thông thường nhất)
 - Thrombus initially forms in dural sinus
 - Clot propagates into cortical veins
 - Venous drainage obstructed → ↑ venous pressure
 - Blood-brain barrier breakdown with vasogenic edema, hemorrhage
 - Venous infarct with cytotoxic edema ensues
- Isolated CVT without DST occurs but is uncommon

Hình ảnh bệnh lý

- Sinus occluded, distended by acute clot
(xoang bị tắc nghẽn và sưng phồng do cục máu đông)
- Thrombus in adjacent cortical veins
(huyết khối TM vỏ kế cận)
- Adjacent cortex edematous, usually with petechial hemorrhage
(vùng vỏ kế cận phù, thường xuất huyết dạng chấm)

Lâm sàng

- ***Triệu chứng thường gặp nhất***

- Clinical diagnosis often difficult, elusive(khó khăn và thoái thác)
 - Headache (95%)
 - Seizure (47%), paresis (43%), papilledema (41%)
 - Altered consciousness (39%), comatose (15%)
 - Isolated intracranial hypertension (20%)
- Focal neurologic deficits variable (depends on location)

Nhân trắc học (Demographics)

- Age
 - Any
- Gender
 - M < F
- Epidemiology
 - 1% of acute strokes

Diễn tiến và dự hậu

- Extremely variable outcome; asymptomatic to death
 - **Good outcome** associated with isolated intracranial hypertension presentation, "delta" sign on CT (leading to earlier diagnosis)
 - **Poor outcome** associated with papilledema, altered consciousness, coma, age > 33 years, diagnostic delay > 10 days, intracerebral hemorrhage, involvement of straight sinus
- Up to 50% of cases progress to venous infarction
 - Overall mortality = 10%; recurrence as high as 12%

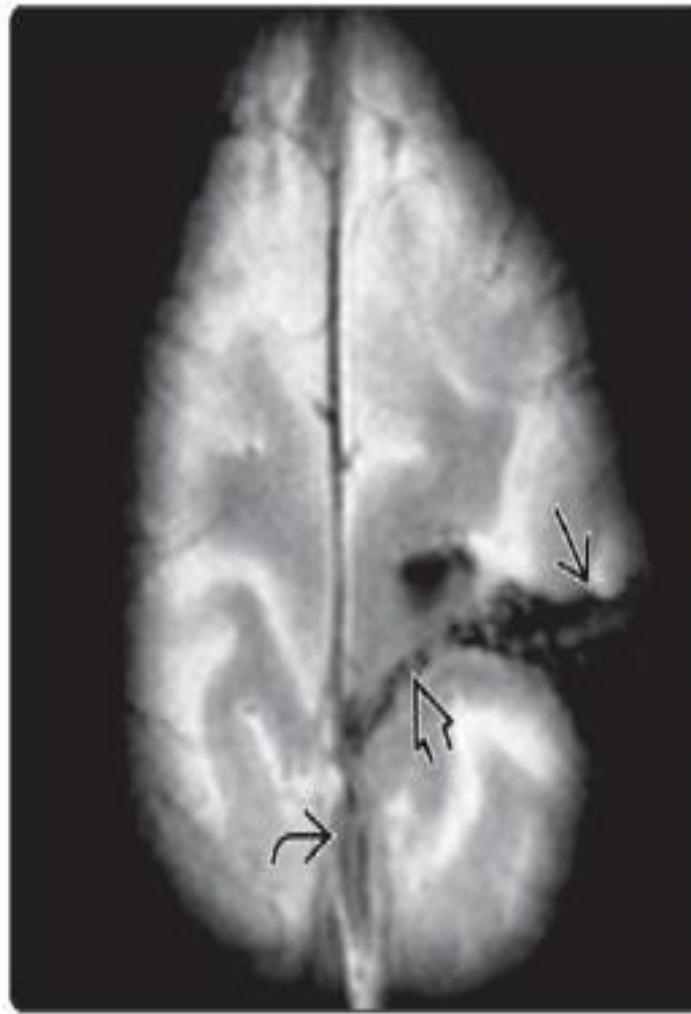
Những mục cần kiểm tra (diagnostic checklist)

Xem xét

- If "convexal" subarachnoid hemorrhage is seen, consider CVT

Tinh hoa giải thích hình ảnh (Image Interpretation Pearls)

- Include T2* GRE sequence on MR/MRV



(Left) FLAIR scan in a patient in the ER with headaches and convexal SAH on NECT (not shown) discloses hyperintense signal in the left central sulcus →. (Right) T2* scan in the same patient shows the source of the convexal subarachnoid hemorrhage (SAH) → is a thrombosed a cortical vein →. Note that the superior sagittal sinus → demonstrates no corresponding "blooming," suggesting that the thrombosed vein occurred in isolation, without involvement of other venous structures.

Bn cấp cứu, đau đầu, XHDN vùng đỉnh. FLAIR xuất huyết dưới nhện
Hyperdense signal rãnh trung tâm trái

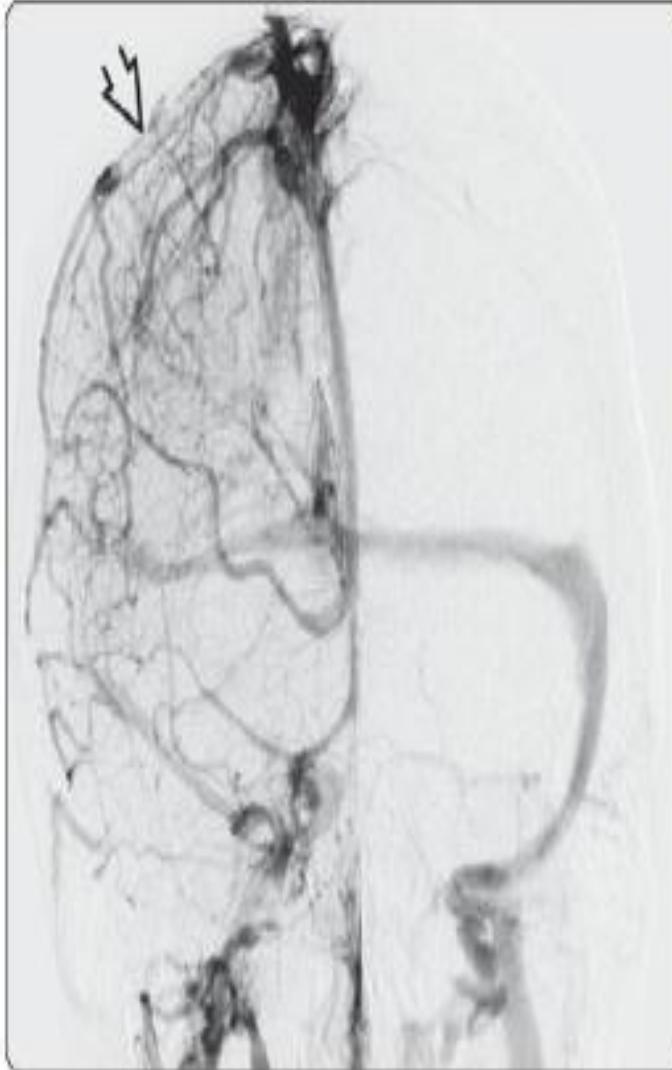
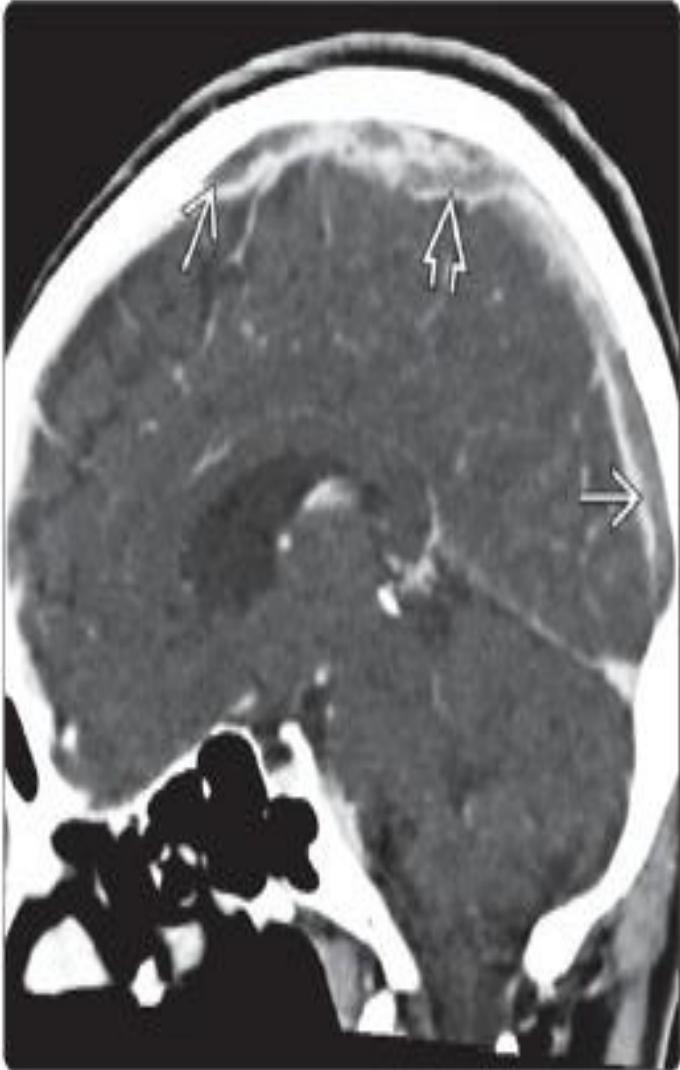
T2* cho thấy nguồn XHDN là huyết khối TM vỏ. SSS cho thấy không tương ứng "blooming". Huyết khối tm xảy ra đơn độc



(Left) NECT scan in a 62-year-old female with headache and left-sided weakness shows a hyperdense superior sagittal sinus (measured 72 HU) ➡. A hyperdense cortical vein is also present ("cord sign") ➡. (Right) CTV in the same patient shows nonenhancing thrombus in the SSS ("empty delta sign") ➡ as well as the cortical vein ➡.

Bn nữ 62 tuổi, đau đầu và yếu ½ trái.
NECT hyperdense SSS 72 HU và TM
vỏ (cord sign)

CTV: emty delta sign SSS
cũng như cortical vein



CTV huyết khối không bắt cản quang, tắc 1 phần SSS và tm vỏ kẽ cận

DSA ĐM cảnh trong phải thì tm, huyết khối không bắt cản quang tm Trolard

(Left) Sagittal CTV shows nonenhancing thrombus → in the partially occluded SSS as well as in the adjacent cortical vein ↗. (Right) Right internal carotid DSA, venous phase, AP view, confirms nonenhancing thrombus ↗ in a prominent vein of Trolard.

Deep Cerebral Venous Thrombosis

KEY FACTS

TERMINOLOGY

- Thrombotic occlusion of deep cerebral veins
 - Usually affects both ICVs ± vein of Galen (VOG), straight sinus (SS)
 - Often occurs with more widespread deep sinus thrombosis

IMAGING

- NECT
 - Hyperdense ICV ± VOG, SS
 - Hypodense thalam/basal ganglia (BG), loss of gray-white matter interfaces
 - Variable loss of deep gray-white interfaces
 - Thalam seem to "disappear" into background WM hypodensity
 - ± petechial hemorrhages
- CECT
 - Loss of ICV enhancement, presence of enlarged collateral channels

- "Shaggy," irregular veins (collateral channels) in deep WM, around tentorium
- MR
 - Acute dots hypointense on T2WI, "bloom" on T2*
 - Deep (medullary) WM veins prominent, tortuous on SWI
- Protocol advice
 - If CT/CECT/CTV scans negative → MR with MRV
 - If MRV equivocal → DSA

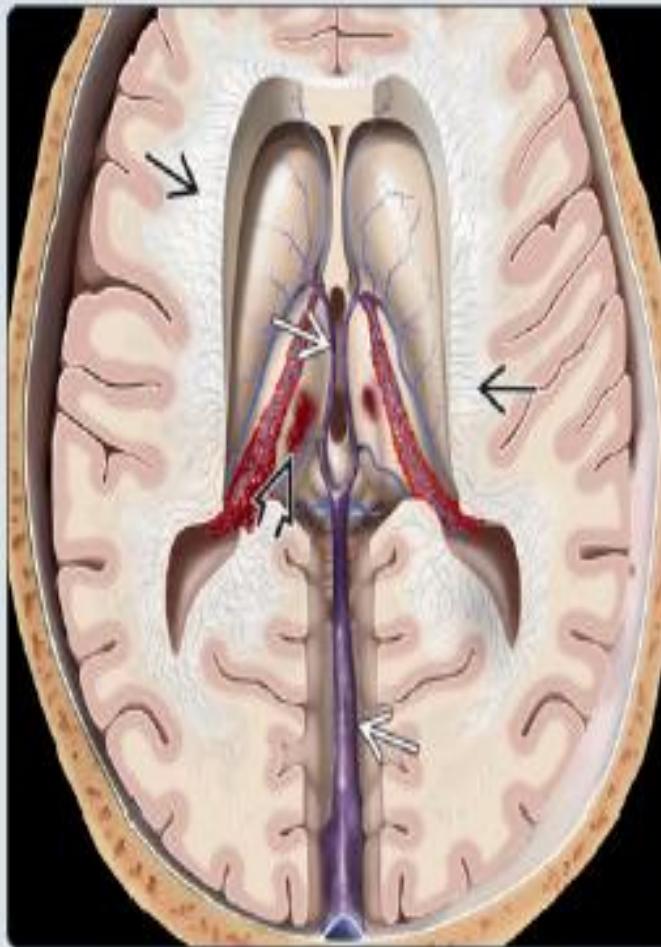
TOP DIFFERENTIAL DIAGNOSES

- Other bithalamic/basal ganglia lesions
 - Neoplasm (e.g., bithalamic astrocytoma)
 - Nonvenous ischemia (e.g., artery of Percheron infarct)
 - Toxic/metabolic disorders (e.g., carbon monoxide poisoning)

CLINICAL ISSUES

- Venous thrombosis = 1-2% of strokes
- ICV thrombosis = 10% of venous "strokes"

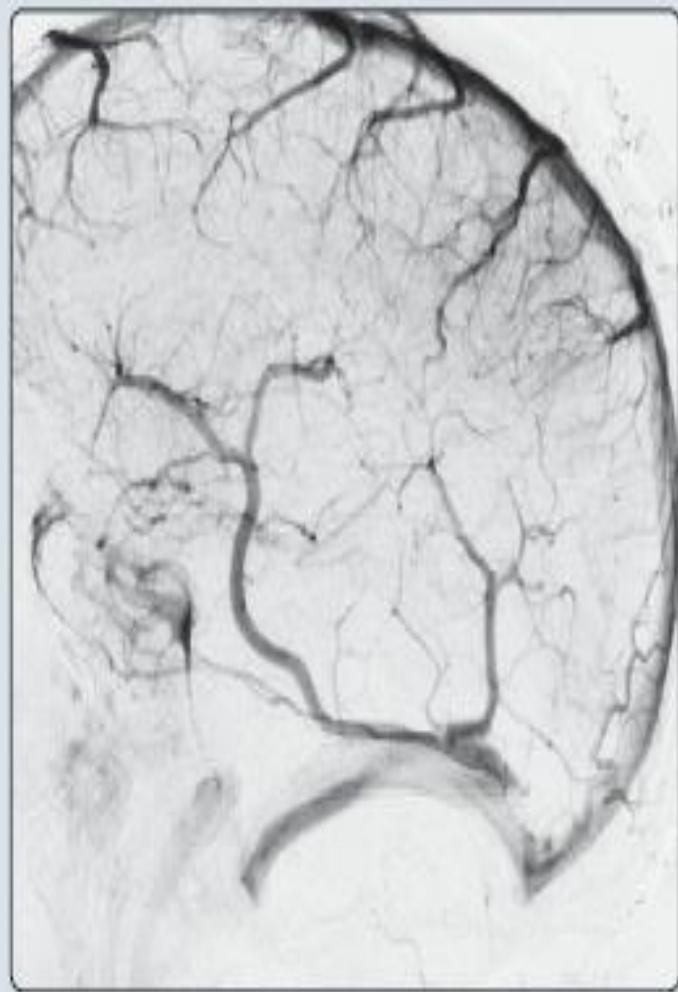
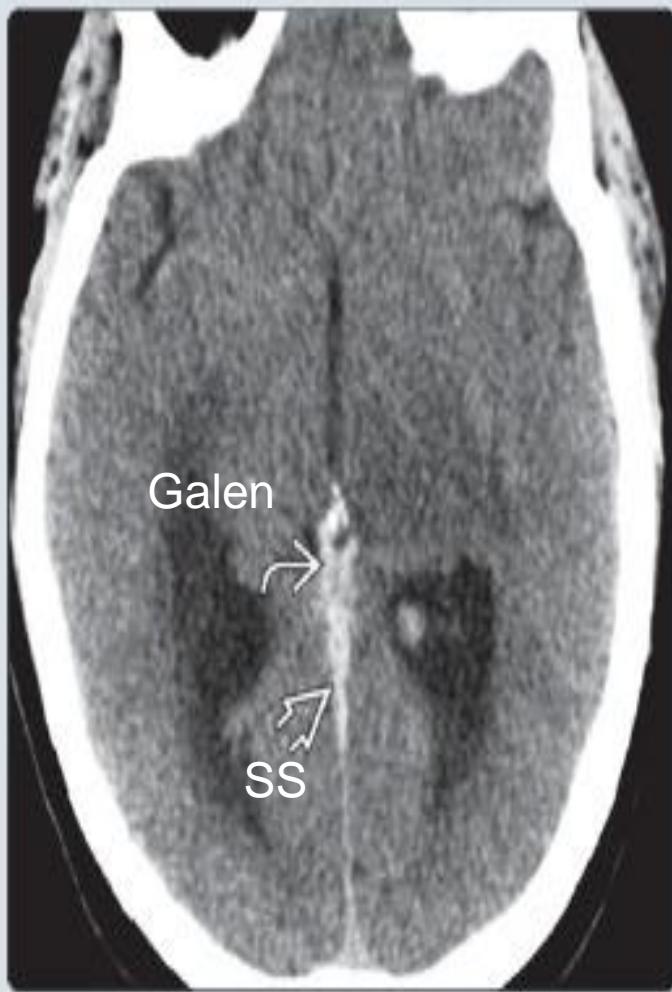
(Left) Axial graphic depicts thrombosis of both ICVs and SS → with secondary hemorrhage in the choroid plexus and thalami ↗ Edema in the thalamus, basal ganglia, and deep cerebral white matter are common findings. Linear WM medullary veins ↗ may become engorged and enhance. (Right) NECT in a 32-year-old female with severe headache shows hyperdense internal cerebral veins (ICVs) →. Both thalami are edematous, symmetrically isodense (normally hyperdense) compared to the surrounding white matter.



Huyết khối cả ICV và SS và xuất huyết thứ phát trong plexus choroid và thalami, phù thalami, hạch nền, chất trắng sâu vỏ não

NECT BN 32 tuổi nữ đau đầu nặng hyperdense ICVs, phù 2 bên thalami

(Left) More inferior NECT in the same patient shows the vein of Galen → and straight sinus ↗ are also thrombosed and hyperdense (measured 70 HU). (Right) Lateral DSA, venous phase, in the same patient shows normal opacification of the superior sagittal sinus and transverse sinus. The ICVs, vein of Galen, and straight sinus are thrombosed and do not fill with contrast. Deep (Galenic system) venous occlusion.



NECT cho thấy tm galen và SS có huyết khối và hyperdense(70HU)

DSA pha TM, SSS, TS bình thường, SS, TM Galen, ICVs huyết khối và không đổ đầy

Thuật ngữ

Abbreviations

- Deep cerebral venous thrombosis (DCVT)
- Internal cerebral vein (ICV) thrombosis

Definitions

- Thrombotic occlusion of deep cerebral veins
 - Usually affects both ICVs — vein of Galen (VOG), straight sinus (SS)
 - Often with widespread dural sinus thrombosis (DST)

Hình ảnh

Hình ảnh tổng quát

- *bằng chứng chẩn đoán tốt nhất*
 - Hyperdense ICV — VOG, SS → bithalamic hypodensity
 - Loss of deep gray-white matter interfaces
 - Thalami seem to "disappear" into background WH hypodensity
- *vị trí*
 - ICV → VOG, SS, basal veins of Rosenthal
 - Bilateral ICV thrombosis >> unilateral
 - Edema (venous congestion)
 - Deep gray nuclei, internal capsule, medullary white matter (WM)
 - Variable involvement of midbrain, upper cerebellum

CT

- **NECT**

- Hyperdense ICVs — SS, DST
- Variable parenchymal abnormalities
 - Hypodense thalami/basal ganglia (BG), loss of gray white matter interfaces
 - ± petechial hemorrhages

- **CECT**

- "Empty delta" sign (if DST)
- "Shaggy," irregular veins (collateral channels) in deep WM, around tentorium

- **CTV**

- Loss of ICV enhancement, presence of enlarged collateral channels
- Limited value in chronic cases as organizing thrombosis also enhances

MR

- **T1WI**

- Clot: Early T1 isointense, later hyperintense
- Venous hypertension: Hypointense swelling of thalami, basal ganglia
- Venous infarct: Hypointense edema, may be Hemorrhagic

- **T2WI**

- Acute thrombus hypointense, mimics flow voids
- Hyperintense swelling of thalami, basal ganglia common
 - Corresponds to vasogenic — cytotoxic edema
- Venous infarct: Parenchymal swelling, hyperintense edema, may be hemorrhagic

- **FLAIR**

- High signal in occluded veins
- Best demonstrates hyperintense BG edema

- ***T2* GRE***

- Thrombus is hypointense, "blooms"
- SWI shows engorged, prominent deep WM (medullary) veins
- Variable petechial hemorrhages

- ***DWI***

- Variable findings
- BG/thalamus may restrict early, normalize later
- Thrombus, hemorrhages may restrict

- ***T1WI C+***

- Acute/early subacute clot: Peripheral enhancement outlines clot
- Late clot: Thrombus, fibrous tissue often enhances
- Venous stasis in deep WM (medullary) veins seen as linear enhancing foci radiating outward from ventricles
- Venous edema/hypertension: No enhancement
- Parenchymal venous infarct: Patchy enhancement

- **MRV**

- 2D time of flight (TOF) MRV shows "missing" ICVs, variably absent signal in VOG, SS
 - May see abnormal collateral channels
- Contrast-enhanced MRV (CE-MRV)
 - Faster; better depicts nonenhancing thrombus and small veins than TOF
- TOF limitations
 - T1 hyperintense thrombus falsely appears as patent flow on MIP
 - Always evaluate source images and conventional MR sequences
- Phase contrast MRV: T1 hyperintense thrombus not misrepresented as flow

Angiographic Findings

- ***Conventional***

- DSA more accurate than MR
- Normal deep cerebral veins are always present on angiography
 - In DCVT, occluded ICVs do not opacify ("absent")
 - Collateral venous channels (e.g., medullary veins) enlarge

- ***Interventional:*** Treatment with thrombolytics &/or mechanical declotting

Khuyến cáo hình ảnh

- Best imaging tool
 - NECT, CECT — CTV venogram
 - Conventional DSA if intervention planned
- Protocol advice
 - If CT/CECT/CTV scans negative → MR with MRV
 - If MRV equivocal → DSA

Chẩn đoán phân biệt

Nonvenous Ischemic Injury

- Arterial occlusion
 - Artery of Percheron cerebral ischemia
 - Top of basilar cerebral infarction
- Global hypoxia

Primary CNS Lymphoma

- T2 hyperintense, enhancing mass(es)
- Along ependymal surfaces (thalami > basal ganglia)
- Normal venous system

Bithalamic Astrocytoma

- T2 hyperintense mass in deep gray nuclei
- Normal venous system
- Elevated choline, decreased NAA
- Vasogenic not cytotoxic edema

Carbon Monoxide Poisoning

- T2 hyperintense deep gray nuclei, often globus pallidus
- Normal venous system
- Positive carboxyhemoglobin
- Classic cherry red skin is rare

Bệnh học

- **Căn nguyên**

- No cause identified in 20-25% of cases
- Wide spectrum of causes (> 100 identified)
 - Trauma, infection, inflammation
 - Pregnancy, peripartum period
 - Metabolic (dehydration, thyrotoxicosis, cirrhosis, etc.)
 - Hematological (coagulopathy)
 - Collagen-vascular disorders (e.g., APLA syndrome)
 - Vasculitis (e.g., Behcet)
 - Drugs (oral contraceptives, androgens, ecstasy)
 - Ulcerative colitis

- Most common sequence
 - Thrombus initially forms in dural sinus
 - Clot propagates into cortical veins
 - Venous drainage obstructed, venous pressure elevated
 - Blood-brain barrier breakdown with vasogenic edema, hemorrhage
 - Venous infarct with cytotoxic edema ensues
- ***Di truyền (Genetics)***
 - Factor 5 Leiden mutation is most common cause of sporadic CVT

Staging, Grading, & Classification

- ***Venous ischemia***
 - Type 1: No abnormality
 - Type 2: High signal on T2WI/FLAIR; no enhancement
 - Type 3: High signal on T2WI/FLAIR; enhancement present
 - Type 4: Hemorrhage or venous infarction

Gross Pathologic & Surgical Features

- ICVs occluded, distended by acute clot
- Venous hypertension ensues
- Adjacent thalami edematous with variable hemorrhage

Microscopic Features

- Thrombus in occluded vessels

Lâm sàng

Triệu chứng

- Most common signs/symptoms
 - Headache, nausea, vomiting
 - ± neurologic deficit, seizure

Nhân trắc học

- Age
 - Any age
 - Especially elderly, debilitated patients (bệnh nhân yếu sức)
 - Pregnant, peripartum women, women on BCPs
- Gender
 - F > M
- Epidemiology
 - Venous thrombosis causes 1-2% of strokes
 - ICV thrombosis = 10% of venous "strokes"

Diễn tiến và dự hậu

- Clinical diagnosis of CVT often elusive
- Outcome of CVT extremely variable, from asymptomatic to death
 - Majority have no residual deficits at 16 months
 - Subgroup (13%) have poor outcome
 - Predictors of death/dependence
 - Hemorrhage on admission CT
 - DWI demonstration of cytotoxic edema (infarction)

Treatment

- Heparin — rTPA
- Endovascular thrombolysis

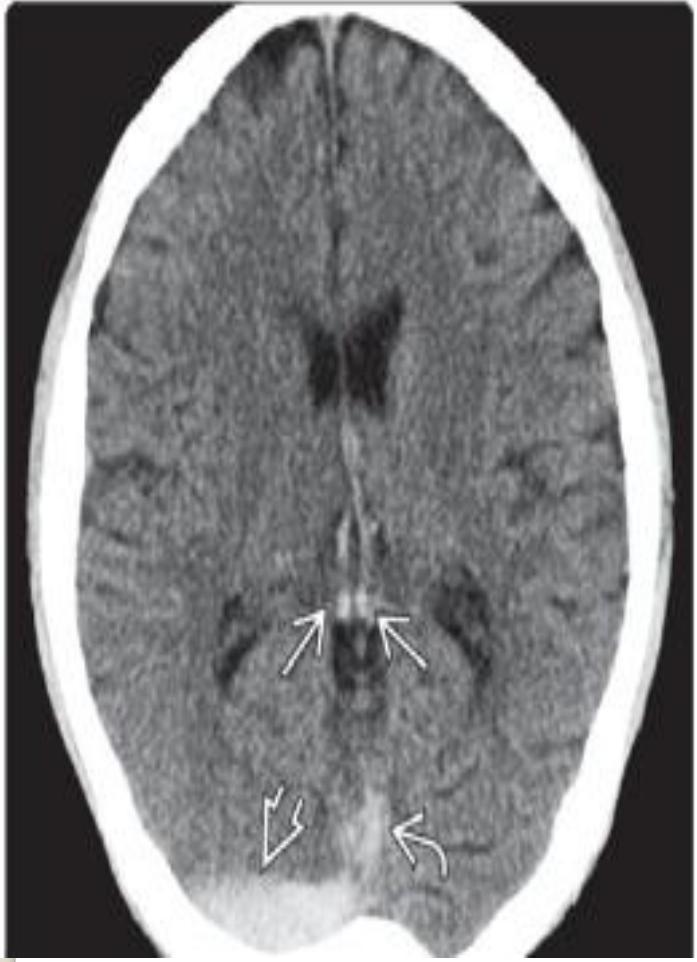
DIAGNOSTIC CHECKLIST

Consider

- DSA in equivocal cases and for intervention

Image Interpretation Pearls

- Early imaging findings subtle, often overlooked
- Obtain NECT concurrently with CTV
- "Flow voids" on T2 do not rule out DCVT
- 2D TOF MRV should not be interpreted without benefit of standard imaging sequences
- Nonvisualization of deep venous system on CTA/MRA/DSA always abnormal



NECT BN nam 25 tuổi đau đầu và lờ
mơ: IVCs, SS và TS hyperdense.
Thalamus isodense



CTV: thrombus trong IVCs,
SS và torcular

(Left) NECT in a 25-year-old male with headache and drowsiness shows hyperdense ICVs → and straight → and transverse → sinuses. The thalami have "faded" into the background and are isodense with surrounding white matter. (Right) CTV in the same patient shows nonenhancing thrombus in the ICVs →, straight sinus →, and torcular →.

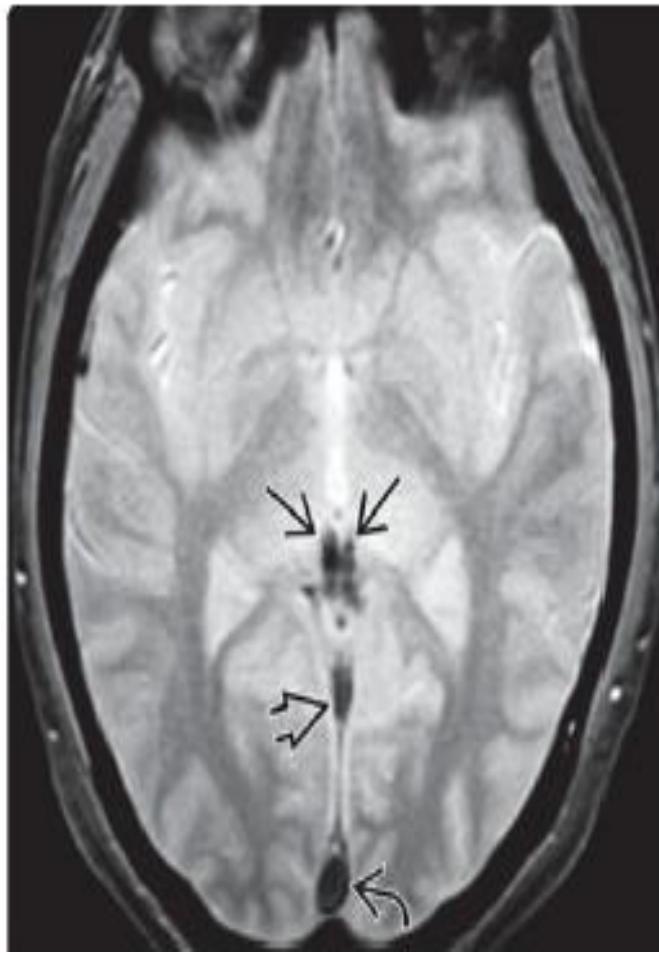
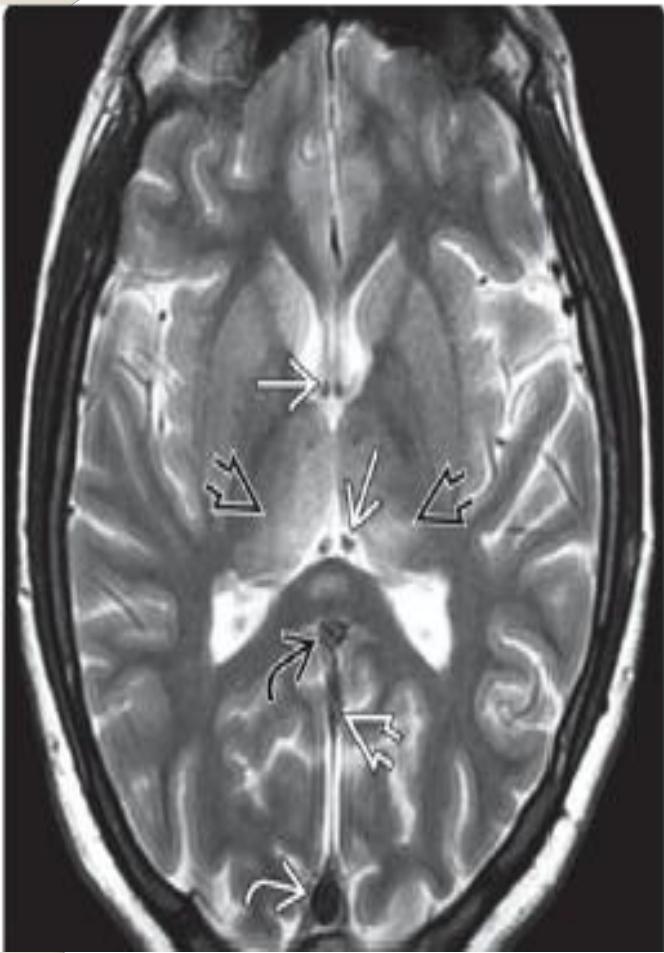


Sagital scan: Thrombus
không bắt cản quang trong
IVCs, vein Galen, SS,
torcular và SSS



Coronal CTV: thrombus trên
SSS, torcular và TS phải

(Left) Sagittal scan in the same patient reformatted from the axial source data shows extensive nonenhancing thrombus in the ICVs →, as well as the vein of Galen □, straight sinus □, torcular □, and superior sagittal sinus □.
(Right) Coronal CTV shows thrombus in the SSS →, torcular □, and right transverse sinus □.



(Left) Axial T2WI in the same patient shows bithalamic edema →. Acute thrombus in the ICVs →, vein of Galen →, straight sinus →, and torcular → is hypointense, mimicking "flow voids." (Right) T2* GRE scan in the same patient shows "blooming" acute thrombus in the ICVs →, straight sinus →, and torcular →

T2WI: phù thalamic 2 bên,
thrombus cấp ICVs, Galen,
SS và torcular hypodens
giống “flow voids”

T2*GRE
Blooming acute thrombus
trong ICVs, SS và torcular



Cảm ơn