“They may be ever seeing but never perceiving”

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3 cases with
overtly abnormal imagings
but……

First case

M/59

- CSCD, Tin Shui Wai Resident
- ADL-I
- PMH:
  - DM/HT
  - ischemic stroke 2005: Rt sided weakness
  - CTB: tiny hypodense area in Rt midbrain
  - Private MRI brain: old lacunar infarct at bilateral thalamus, chronic white matter ischemic changes in both cerebrum
- On aspirin/metformin/norvasc/acertil

Attended AED on 20/6/13

- c/o: fever/decreased GC, accidental fall with HI and scalp laceration
- E4V5M6
- BP 146/85 P92 Temp 38.6 SpO2 99% RA
- P/E: Chest LLZ crep +, Abd soft
- Hstix 11.2 Haemocue 14.2
- CXR: clear
- Skull XR: no fracture
- Dx: fever for Ix/ ?chest infection, to medical ward

In medical ward on 21/6

- E1V1M4
- CTB: small vessel disease, bilateral old infarcts
- LP
  - OP 11.5 cmH2O
  - protein 0.75
  - Glucose 6.4 (plasma 10)
  - WCC 232 PMN 74% LYM 26%
  - GS negative
- Impression: bacterial CNS infection
- Treatment: Rocephin

Progress

- Consult ICU for Intubation to protect airway
- Transferred to ICU, Keep Rocephin, + acyclovir
- On and off fever but downtrend, BP stable
- Obey command next day, on low PSV
- Weak limb power Rt 1-2/5, Lt 3/5

1st LP: bacterial Ag neg, cryptococcal Ag neg, neg growth

2nd LP 23/6 : Pr 0.75→1.04 Glu 5 (Serum 8.8) WCC + RC 3+

Repeat CTB 24/6 (with reporting): similar

Progress

- Fever down, E4VTM6, still weak limb power

  3rd LP 26/6: RC 600 WCC 11 PMN 11% LYM 89% Pr 0.57 glucose 5.4 GS neg

  Pending MRI brain

- 27/6: RUL 0/5 RLL 3/5 Left 4/5, Rt VII palsy, nil triggering of ventilator

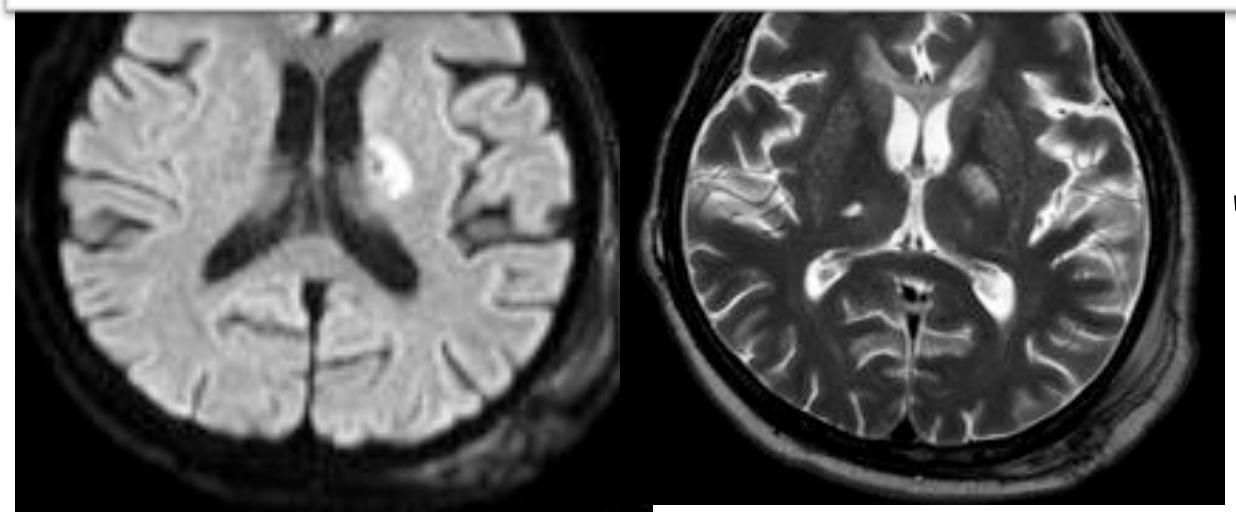
EEG on 21/6

- Mildly asymmetrical and slowing background with no epileptiform discharge detected

A T1-hypointense T2-hyperintense lesion measuring 1.3cmx1cm (APxW) in size i present at the posterior limb of left internal capsule. Its periphery demonstrates vaguely restricted diffusion on DWI study and no increased enhancement is noted on post-contrast study. Features are suggestive of late subacute infarction.
Another tiny T1-hypointense T2-hyperintense focus with no evidence of restricted diffusion on DWI study is found at the right thalamus. Features are suggestive of chronic lacunar infarct.
T2-hyperintense changes are noted at the white matter subjacent to the ventricular trigones, can be chronic ischemic changes due to small vessel disease of brain.
Ventricular system and sulcal spaces are unremarkable. There is no extraaxial collection.
There is no abnormal leptomeningeal enhancement.

OPINIONS :
1) Late subacute infarct at the posterior limb of left internal capsule.
2) Chronic lacunar infarct at the right thalamus.
3) Nonspecific T2-hyperintense changes at periventricular white matter, can be caused by small vessel disease of brain.

DWI



T2W

Progress

- NPS 20/6 grew coxsackie virus group B type 5 present
- CSF: RT-PCR for enterovirus NEG
- CSF: viral culture: No virus isolated
- Anti-HIV neg
- ENT: no ENT source of infection

Culture negative meningitis
Recovering alertness
Persistent Right sided weakness and apnea

- ? CVA complicated meningitis
- Put on aspirin
- Tracheostomy 3/7/2013

Is that CVA?

Neurologist

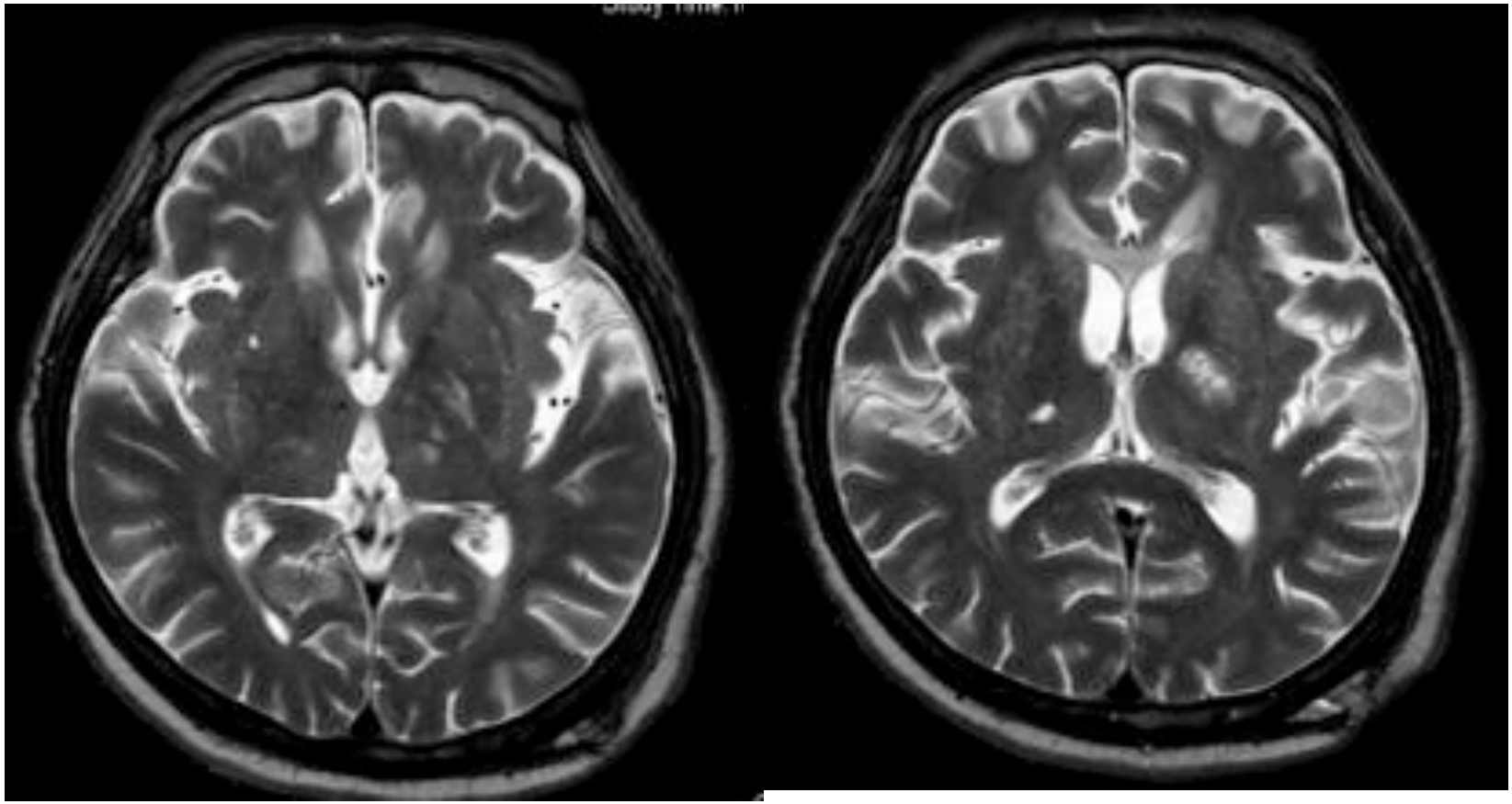
Presentation:

C/W encephalitis

Review MRI brain:

To rule out Jap B encephalitis

Repeat MRI brain 9/7/2014



FINDINGS :
Comparison is made with MRI 27/6/2013.

Faint restricted diffusion is seen at peripheray of previously noted left internal capsule infarction. No contrast enhancement is seen. A few tiny restricted foci are seen over right lentiform nucleus se601 im112 and left thalamus. se601 im104. They are suggestive of tiny subacute infarctions.

A few more old infarctions are seen in bilateral thalami, right internal capsule, pons. They are similar to last study.

T2-hyperintense over bilateral periventricular region shows no significant change, can be chronic ischemic changes due to small vessel disease of brain.

Ventricular system and sulcal spaces are unremarkable. There is no extraaxial collection. There is no abnormal leptomeningeal enhancement. No thalamic hemorrhage is seen.

Small residual left parietal scalp hematoma is seen.

OPINIONS :
Overall no significant change.
Subacute infarction at bilateral basal ganglia and left thalamus.
Not typical of encephalitis.

ADVERSE REACTION :
Nil reported.

Anatomical site and etiology based on MRI

Bilateral BG and left thalamus infarct

✓Contralateral limb weakness

? Persistent Apnoea with full GCS/ abnormal CSF/sepsis on admission

M/59

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Antibody Titre - Serum

Lab No	V13-2115240	V13-2115737
Date	28/06/2013	05/07/2013
Japanese encephalitis virus HAI	40	80

Lab No	V13-2115240	V13-2115737
Date	28/06/2013	05/07/2013
Japanese encephalitis virus IgM EIA	Positive	Positive

2014年6月24日

衞生防護中心就一宗日本腦炎確診個案提供調查進展

衞生署衞生防護中心今日（六月二十四日）就一宗本地日本腦炎確診個案提供調查進展，中心並呼籲市民預防經由蚊子傳播的疾病。

衞生防護中心公共衞生化驗服務處於六月十七日確診該宗個案後，中心透過抽驗血液的積極調查，於六月十七日至二十日期間，為在附近居住的人士共抽取九個血液樣本進行化驗。經公共衞生化驗服務處化驗後，一名五十五歲女子的血液樣本今日證實對日本腦炎抗體呈陽性反應。

初步調查顯示，該名女子居於天水圍天悅邨，她一直沒有出現病徵。她的家居接觸者至今亦沒有出現病徵。她並非該宗本地個案的緊密接觸者。調查仍在繼續。

衞生防護中心人員已向該名女子住所附近的人士進行問卷調查，以找出有否未獲診斷的個案。衞生防護中心已於六月十七日設立熱線（2125 1122），熱線由星期一至五上午九時至下午六時接受市民查詢。

衞生防護中心已於上星期舉行四場健康講座，今晚亦已於天水圍天晴社區會堂舉行另一場健康講座，向居民講解健康建議。元朗區居民（包括天水圍居民）若出現日本腦炎相關病徵，亦應盡快求醫。

至於今年首宗呈報衞生防護中心的日本腦炎個案，該名二十六歲女病人已於六月十九日出院。

由於該名五十五歲女子一直沒有出現病徵，故此宗不屬確診個案。今年呈報衞生防護中心日本腦炎個案仍為一宗。二○一三年有六宗呈報個案（兩宗本地、三宗外地傳入及一宗未能確定），二○一二年則有三宗個案（一宗本地及兩宗外地傳入）。

Japanese B Encephalitis

Japanese B Encephalitis

- Most common arbovirus infection worldwide
- Endemic in SE Asia, Japan, China, Philippines, Borneo, and large parts of Indian sub-continent
- age: < 15 yrs and elderly predominantly
- mosquito-borne
- incubation 1-2 weeks followed by abrupt onset of encephalitis often with myalgia

Pathology

- Thalamus shows most florid involvement with inflammation, necrosis and rarefaction
- Spinal cord and cerebellum also heavily involved

Diagnosis

- Depends on clinical,
- imaging abnormalities and
- serological evidence of IgM or at least four-fold rise of antibody titer.

Lab No	V13-2115240	V13-2116422
Date	28/06/2013	12/07/2013
Japanese encephalitis virus HAI	40	160

Clinical

- Characteristic neurologic findings during acute stage
  - Extrapyramidal signs such as tremor, dystonia, rigidity → Parkinsonism
  - Seizures more common in children
- acute psychosis
- Poliomyelitis-like acute flaccid paralysis due to anterior horn cell damage, without alteration in consciousness (subsequent encephalitis in 30%)

Laboratory findings

- Modest increase in peripheral WCC
- Hyponatremia due to SIADH
- CSF
  - mild to moderate pleocytosis with lypmhocytic predominance
  - Slightly elevated protein
  - Normal CSF to plasma glucose ratio
  - Maybe no pleocytosis or neutrophil predominant in early stage

Serology

- Confirmed by detection of JEV-specific IgM Ab in CSF or serum by ELISA or 4-fold rise of Ab
- CSF Ab detectable in 70-90% on admission
  - JEV IgM most detectable in CSF collected 5-8 days after symptoms onset
- Serum Ab detectable in 60-70% on admission
  - positive in nearly all serum collected at least 9 days after symptom onset
- If JE suspected and acute sample negative →convalescent serum sample

Role of EEG

- Often diffuse, continuous delta slowing; diffuse delta pattern with spikes; theta waves; and burst suppression.
- Do not correlate with the severity of Japanese encephalitis or its outcome

focal encephalitis eg HSV may have characteristic 2-3Hz periodic lateralised epileptiform discharges originating from the temporal lobes

Radiological finding

- Cortex and the deeper gray matter such as, thalamus, basal ganglia and brainstem nuclei including anterior horn cells of cervical cord are affected.
- Common CT finding
  - bilateral hypodensity in the thalamus and basal ganglia with occasional hemorrhage, though bilateral hemorrhage is rare.

MRI picture

- Bilateral (most asymmetric) thalamic and basal ganglia hypointensity in T1-weighted images, hyper-intense in T2.
- Thalamic lesions on CT/MRI
  - Se 23%, Sp 100%, PPV 100%, NPV 42.1%

An evaluation of the usefulness of neuroimaging for the diagnosis of JE
N M Dung, J Neurol 2009

Use of MRI in encephalitis

- In a patient with febrile encephalopathy, thalamic and basal ganglia involvement suggest JE and frontotemporal involvement suggest HSE
- MRI brain is usually abnormal in JE (91%) and HSE (100%) whereas it is usu normal in dengue (22%)
- T2(52.9%) and FLAIR sequences(57.1%) are more sensitive than other sequences if MRI is done after 48 h.

Usefulness of various MRI sequences in the diagnosis of viral encephalitis
U.K.Misra. Acta Tropica 2010

Management

- Supportive treatment
- Vector control and enviromental sanitation

Minocycline

- JEV as neurotropic flavirus with evasion of peripheral immune system facilitating entry into CNS causing extensive neuronal inflammatory damage
- In vivo study
  - Minocycline reduces neuronal apoptosis, microglial activation, active caspase activity, proinflammatory mediators and viral titre markedly on 9^{th} day after infection
  - Differentially modulates macrophage mediated peripheral immune response following JEV
- No clinical data about outcome benefit

Mishra MK, J Neurochem 2008

Outcome

- Mortality among hospitalised patient 20-30%
- Long term sequalae in survivors 30-50%
  - weakness, cerebellar and extrapyramidal signs
  - Cognitive or language impairment
  - Psychiatric problems
  - Recurrent seizures
- Infection with JEV thought to produce lifelong immunity

Progress

- Slow weaning from ventilator and prolonged rehab course
- Discharged from hospital and walk unaided with stand-by assistance on 6/4/2014

Message

- The presence of thalamic abnormalities in a patient with the clinical presentation of encephalitis in a JE endemic area might be used to make a presumptive diagnosis of JE whilest results of lab Ix are awaited

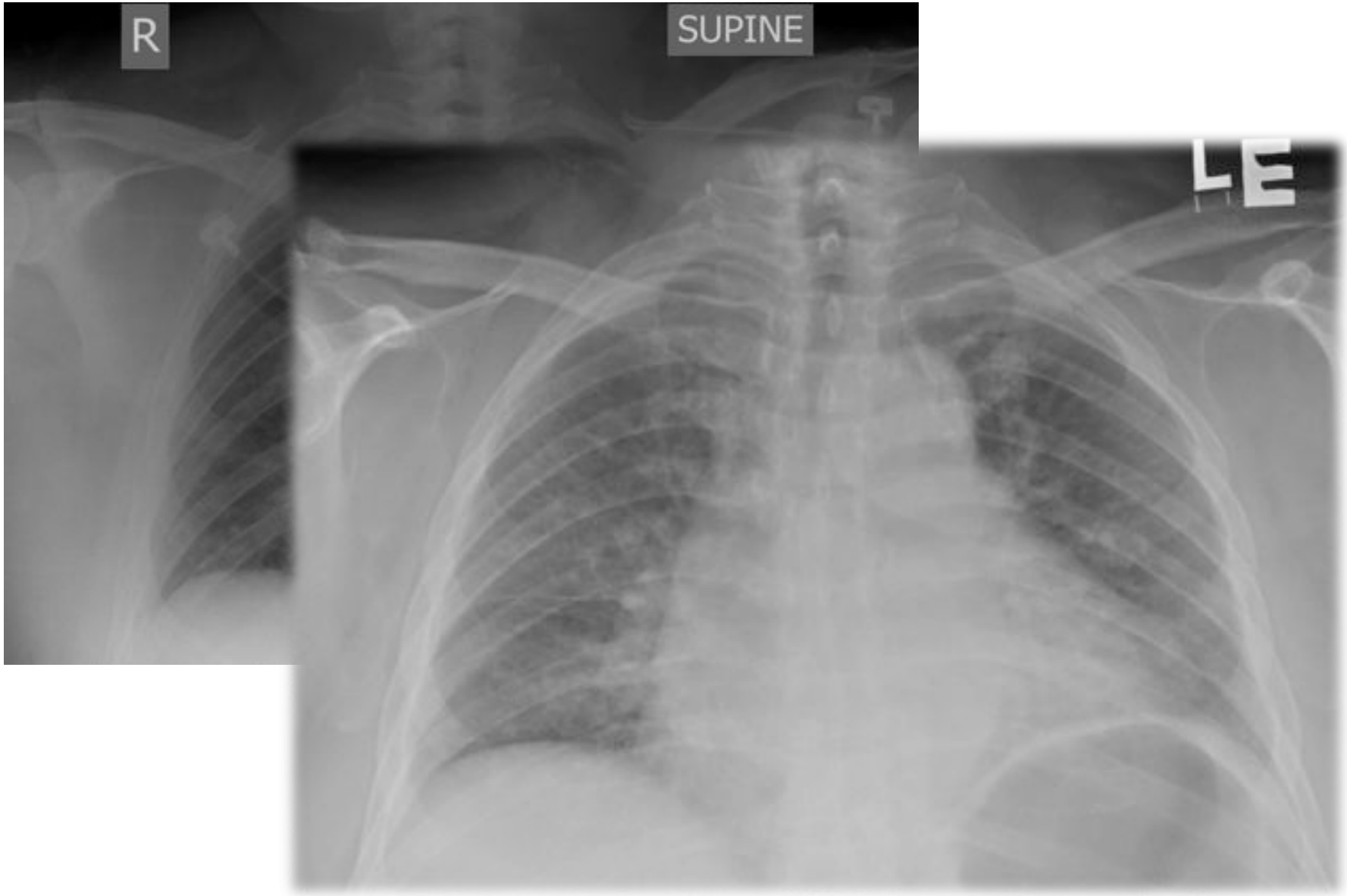
Case 2

M/59

- Housing department officer
- Chronic smoker
- PMH
  - DM
  - IHD
    - Coro 12/07: mLAD critical lesion with PCI
  - Obesity/severe OSA (AHI 60) refuse CPAP
  - HT
  - S/F 6/2013, CT C/S degenerative cervical spine
- Usual med: aspirin/carvedilol/lisinopril/ minipress/zocor/metformin/pepcidine

27/4/2014

- c/o dizziness and LL weakness and Incontinence day before
- Noticed by daughter to have SOB and poor conscious state at 0900
- 10:21 at AED: E3V4M6, drowsy
- BP 99/48 P82
- SpO2 90% on 6L O2→98% on 100% NRM
- 4 limbs power 5/5
- Chest clear, abd soft
- Istat: pH 7.19 pCO2 12.7 pO2 20 HCO3 36 BE 5
- Intubated by AED colleague and SpO2 maintained ~ 98%
- DL: grade III larynx


R
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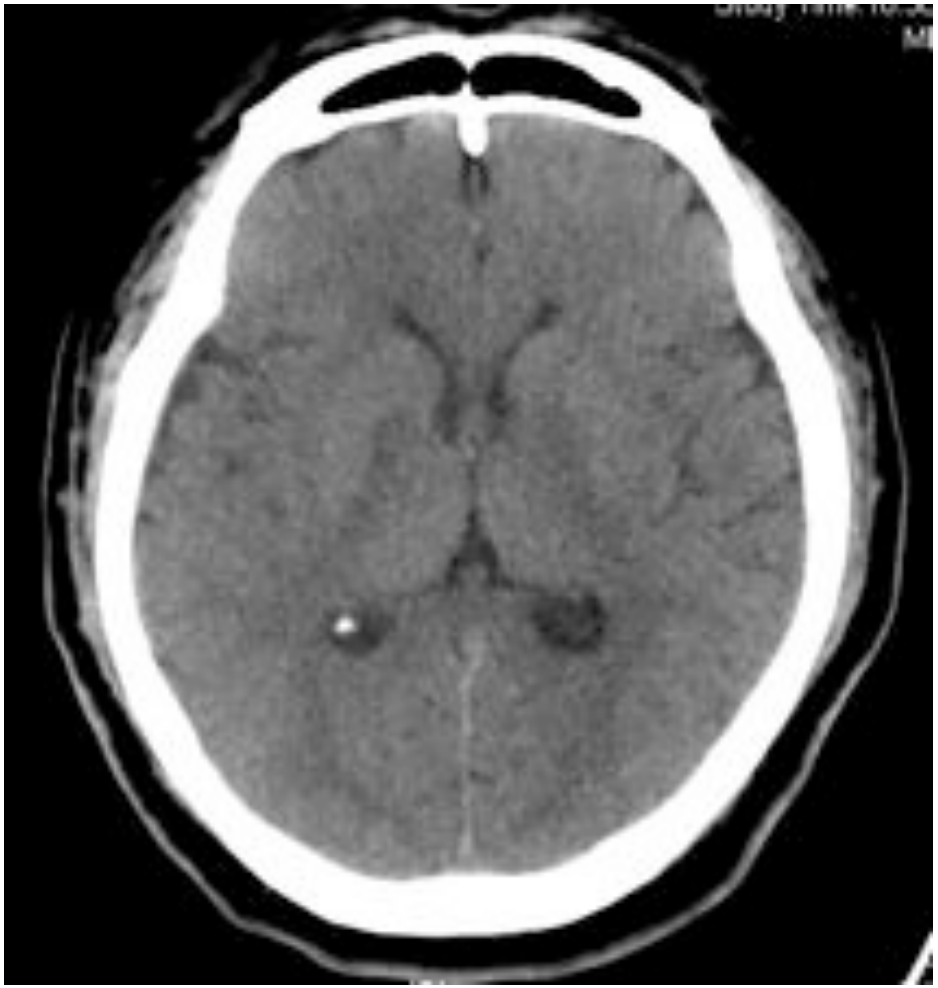


In medical ward

- Developed bradycardia with near PEA arrest with hypoxemia
- CPR X 4 min, adrenaline X1mg
- ICU: high airway pressure, pulse and oxygenation improve after manual bagging
- On resumption of ventilator, airflow limitation in small airway
- Admit ICU for difficult ventilation for difficult airway

ICU

- Transient shock, weaned adrenaline soon
- SaO2 100% on FiO2 0.8
- Afebrile E3VTM6
- Diffuse rhonchi, scanty sputum
- 4 limbs power 3-/5, rocuronium 2 hours ago
- Imp:
  - COAD with Type II resp failure
  - ? Neurological event
- Put on augmentin/bronchodilator/steroid
- Midazolam 3mg/hr
- TnI 0.4→4.7, ECG no ST change, deny chest pain
- put on aspirin/plavix/LMWH

Next day

- BP 132/54 P63 → 160/71 P62
- Obey command
- UL power full and reflexes normal
- LL: hip flexion 3/5, knee extension 3/5 ankle dorsiflexion 2/5
- knee and ankle jerk -
- Anal tone+ sensory level-
- LL perfusion well

- SaO2 100% on FiO2 0.8
- Prolonged exp phase, nil rhonchi
- CXR: elevated bil diaphragm
- pCO2 6.39

LL weakness with resp muscle involvement
? GBS, ddx: ascending myelitis/ cord compression

- Neurologist: ataxia
  - ?brainstem stroke/encephalitis

- LP:
  - Opening pressure 28 cm, clear CSF
  - WCC <1 TP 0.38
  - Sent for oligoclonal band, cytology, lactate
- Anti-ganglioside ab, VDRL, autoimmmune, SPE/IgP, anti-Achr, fasting lactate

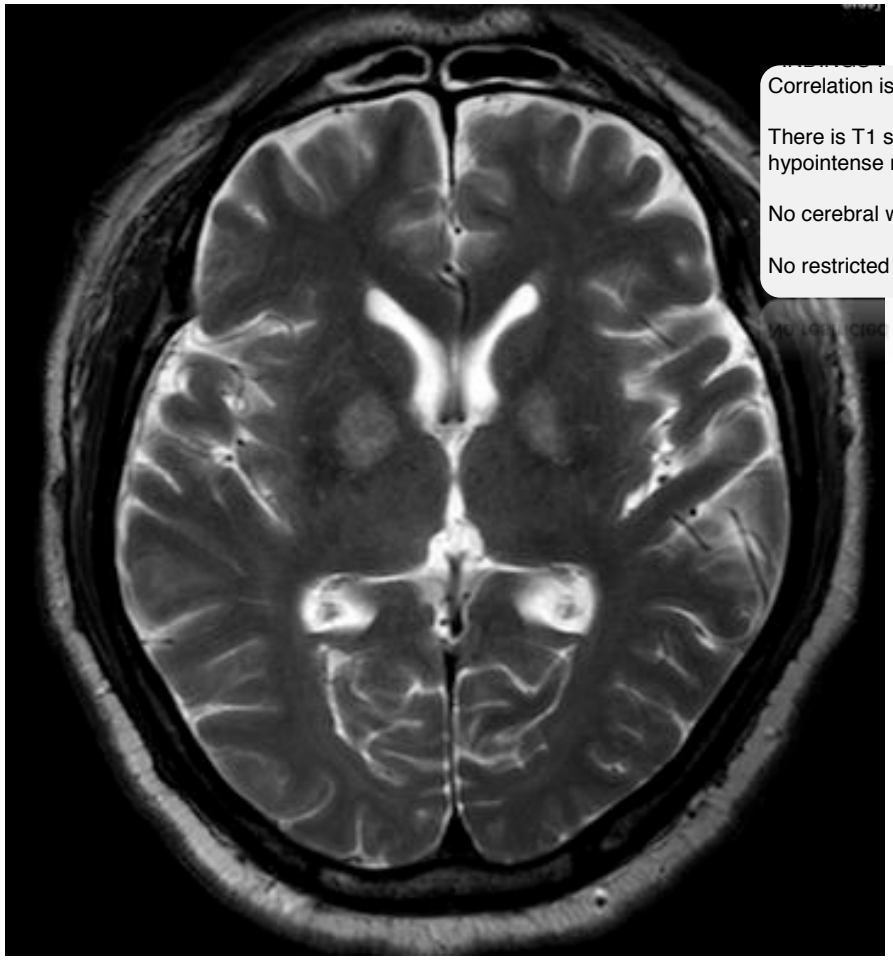
- TTE to look for thrombus:
  - RV contraction well
  - LVEF ~ 45-50% without RWMA
  - No significant valvular abnormalities
  - No vegetation/ LV thrombus seen

CTB report

Ventricles are not dilated. Midline structures are not displaced. No abnormal extra axial fluid collection. No intracerebral hematoma.
Hypodensity over bilateral globus pallidi possibility includes carbon monoxide poisoning. Correlate clinically

Impression:
Hypodensity over bilateral globus pallidi possibility includes carbon monoxide poisoning. Correlate clinically

MRI brain 29/4



Correlation is made with previous CT scan. They shows symmetric hypodensity in bilateral Globi pallidi.

There is T1 slightly hypointensity, T2 hyperintensity in bilateral Globi pallidi. They are surrounded by hypointense rim, could be haemosiderin.

No cerebral white matter hyperintensity is seen. No abnormal signal is seen in brainstem.

No restricted diffusion is demonstrated. No hydrocephalus, midline shift or extra-axial fluid collection.

MRI brain 29/4

- Typical of CO poisoning
- DDx wilson's disease, JE

No related hx of CO poisoning identified

Contact MID for CSF JE IgM

Blood X JE, copper, ceruloplasmin

Start on minocycline 100mg Q12H iv

Causes of bil BG changes

	Acute	Chronic
Toxic	Carbon monoxide	Manganese
	Cyanide	Methyl benzene (toluene)
	Methanol	
	Disulfiram	
	Hydrogen sulphide	
Metabolic	Hypoxic-Ischemic Injury	Leigh disease
	Hypoglycaemia	Kearns-Sayre syndrome
	Hyperglycaemia	Wilson's disease
	Osmotic myelinolysis	Hypoparathyroidism
	Haemolytic uremic syndrome	Liver disease
		Tay-Sachs disease
		Hallervorden-Spatz disease
		Glutaric acidemia
		Methylmalonic acidaemia
Vascular	Deep cerebral vein thrombosis	
	Hypertensive crisis	
	Cerebral thromboembolism	
Infectious/Transmissible Diseases		Creutzfeldt-Jakob
		Congenital infections
Hereditary/Degenerative		Huntington's disease
		Neurofibromatosis Type 1
Other		Radiation therapy

Progress

- E4VTM6
- Obey
- BP stable
- Lung mechanics not obstructive, weaned to low PSV
- UL 4/5
- LL 1/5

Neurologist

- Reverse supinator jerk→ level C4-C6
- Previous CT cervical spine 2013:
  - Degenerative cervical spine with bilateral foraminal narrowing C6/7
- Suggest MRI C/S

Problems

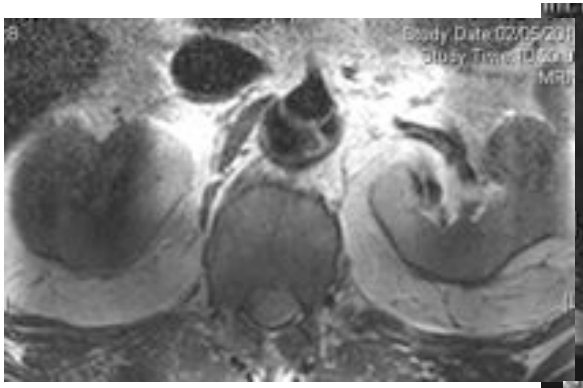
- Persistent LL>>UL flaccid weakness, no sensory loss. Painless.
- Reverse supinator jerk with hx cervical spondylosis
- T2 resp failure (with airway obstruction)
- Consciousness not impaired

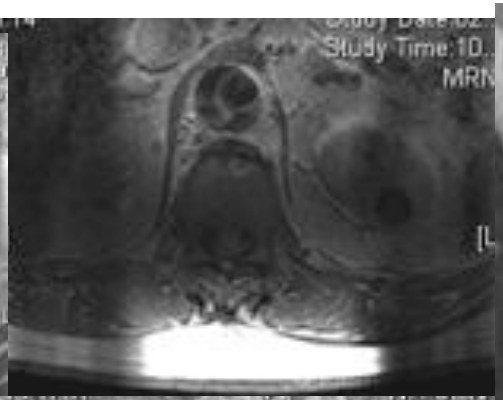
- LP (2nd day) not suggestive of CNS infection/GBS
- CT and MRI Brain imaging bilateral BG changes

Acute myelopathy Vs polyneuropathy

Level: ? Central/Brainstem/Cervical/ lumbar

Single Vs multiple pathologies

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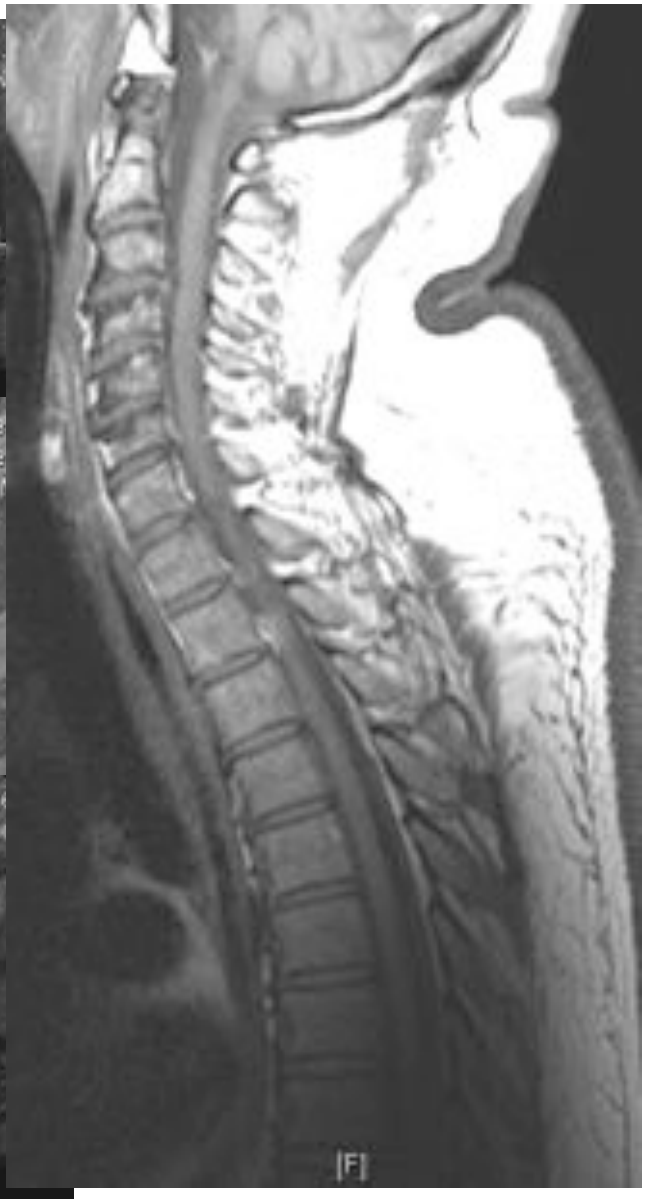
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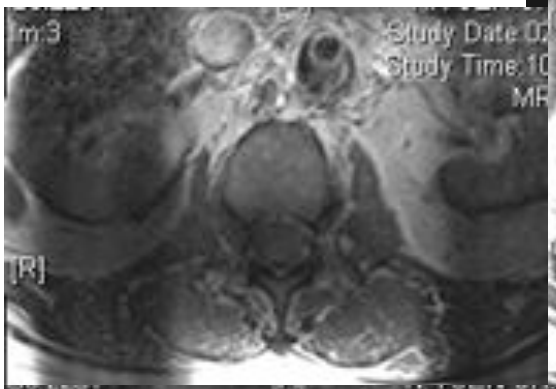
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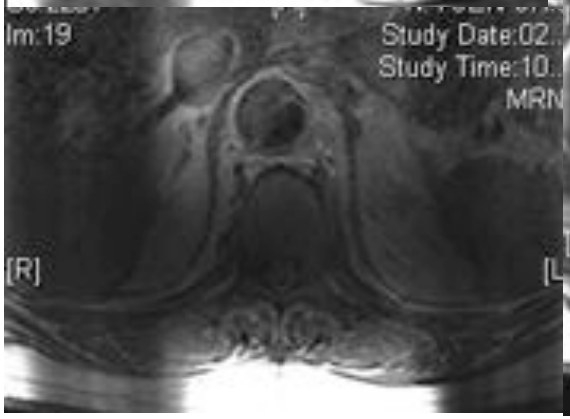
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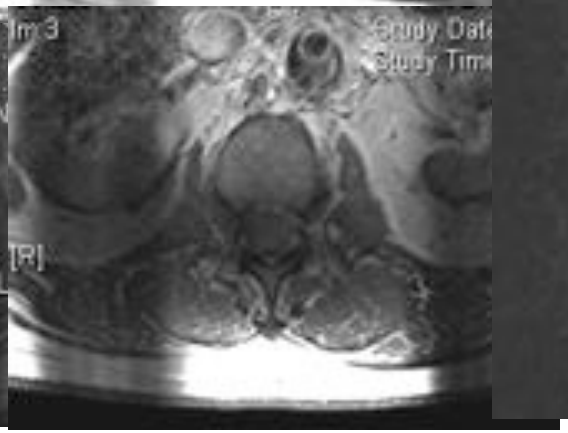
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After MRI spine…

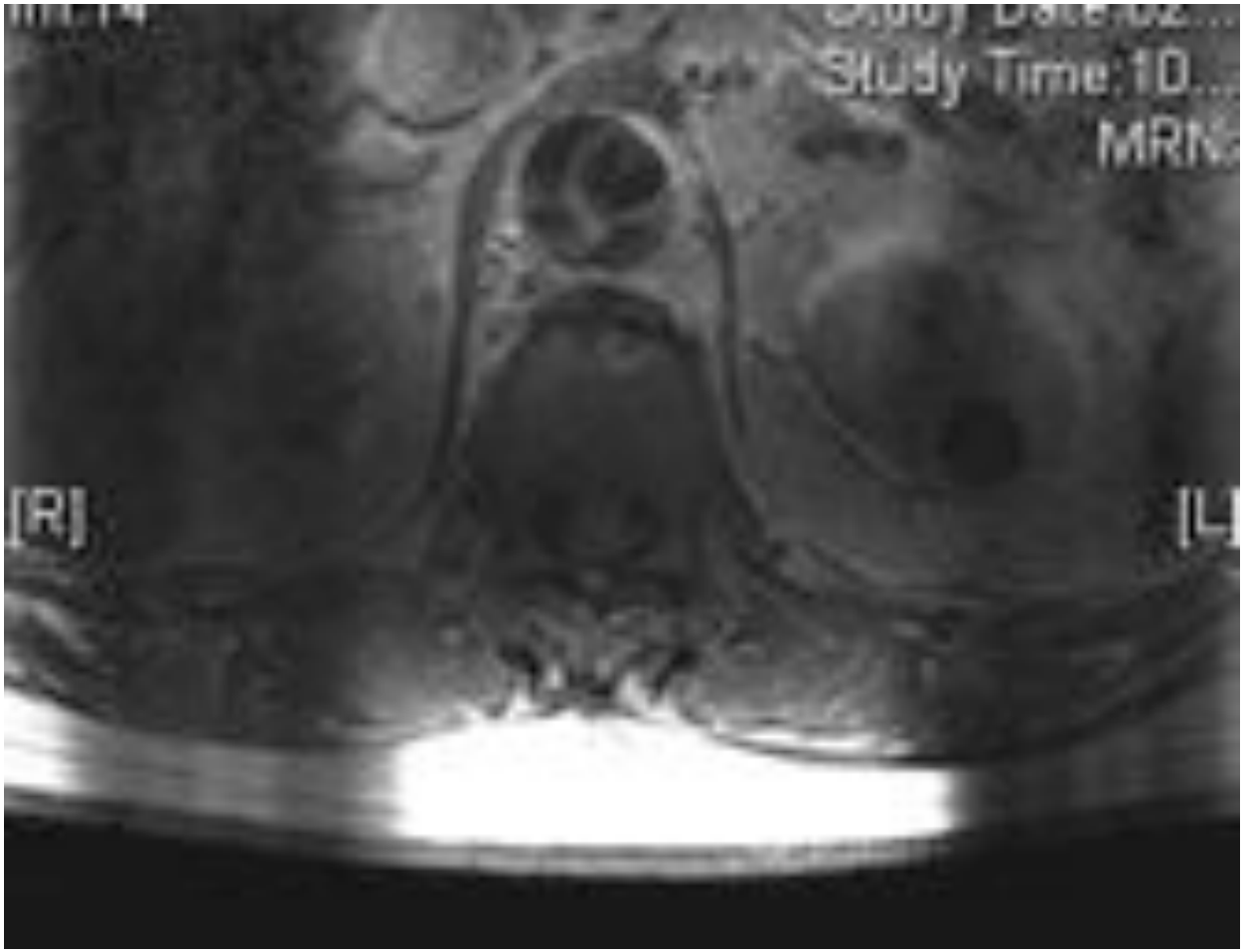
- Verbal report:
  - Multiple disc protusions at cervical region, no gross lesion over T and L

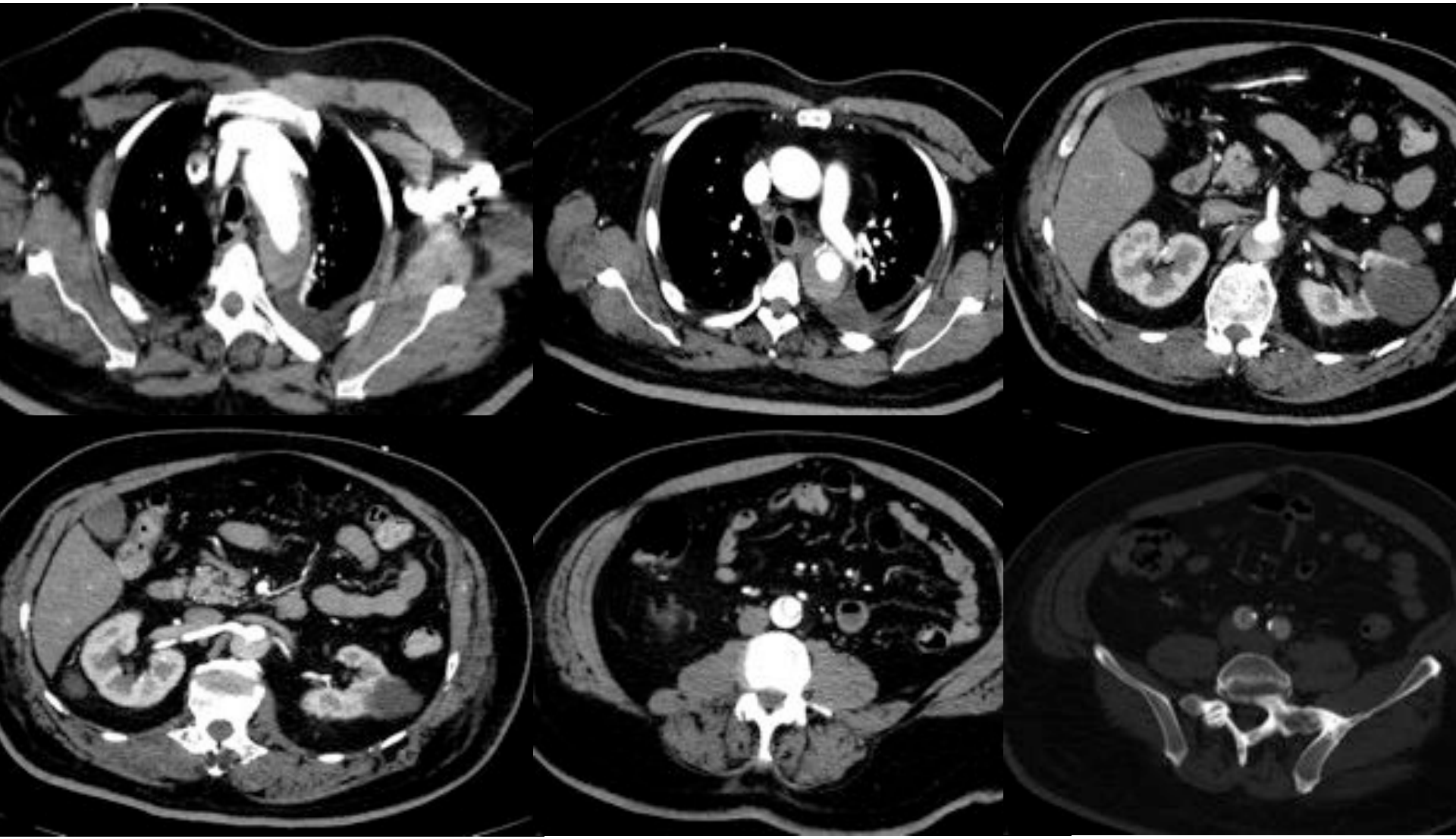
- Consult ORT → film reviewed and suggest no cord compression and await report
- Extubated on 3/5 to bipap

MRI report on 5/5

OPINION:
1. Intimal flaps noted along the abdominal aorta at the included axial sections as well at the sagittal sections from T9 down to sacral region, suggestive of aortic dissection, where the extent cannot be delineated from current MRI scan. Suggest correlation with CT scan for better delineation.
2. Lower thoracic cord near the conus appears edematous with increase T2W signal at the cord from T11-L1 vertebral levels. No significant associated enhancement. In view of presence of aortic dissection, cord infarction is suspected.
3. Cervical and lumbar spondylosis as described.

MRI whole spine on 2/5





IMPRESSION:
1. Aortic dissection originating at the left common carotid extending into the proximal common iliac arteries symmetrically.
2. Thin rind of hyperintense wall at the distal aortic arch. Intramural haematoma should be considered.
3. Wedge fracture of L1 vertebral body noted. Please correlate with MRI SPINE for evaluation of cord.

Management

- Echo by cardiac
  - Satisfactory LVEF ~ 50-55%, no RWMA
  - Valves normal
  - No AR/pericardial effusion/flap
- EIA Treponema pallidum negative
- PWH CTS:
  - No involvement of ascending aorta→ Type B aortic dissection
  - For BP control and aortogram 1 week

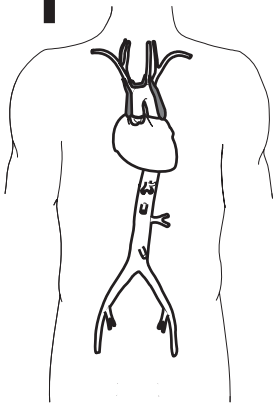
Atypical presentation of Aortic dissection? Not that atypical

- Frequency of pain-free dissection ranges between 5-15%
- Chest pain is not an obligatory symptom of aortic dissection
  - Well reported In the context of neurological sequelae of aortic dissection (2-8% of AAD)
  - Half of painless AD showed neurological symptoms only
  - Transient or permanent neurological symptoms often dramatic and mask the underlying condition

Neurological symptoms in aortic dissection: A challenge for neurologists
Charly Gaul; Cerebrovasc Dis 2008

TIA
Stroke
TGA-like syndrome
Hypoxic encephalopathy
Horner syndrome
Cardiovocal syndrome
Seizure, disturbed consciousness

Extension of dissection to aortic arch vessels
Reduced cerebral perfusion due to general hypotension
Nerve compression by enlarging false lumen

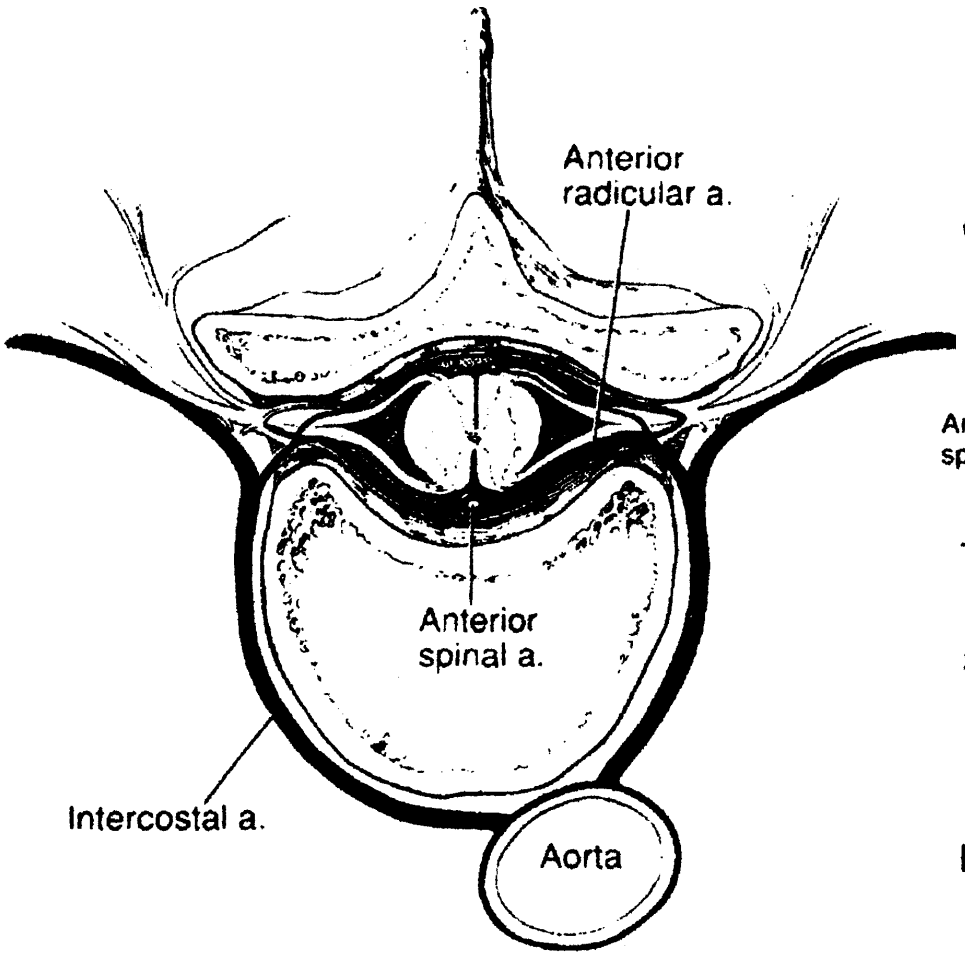


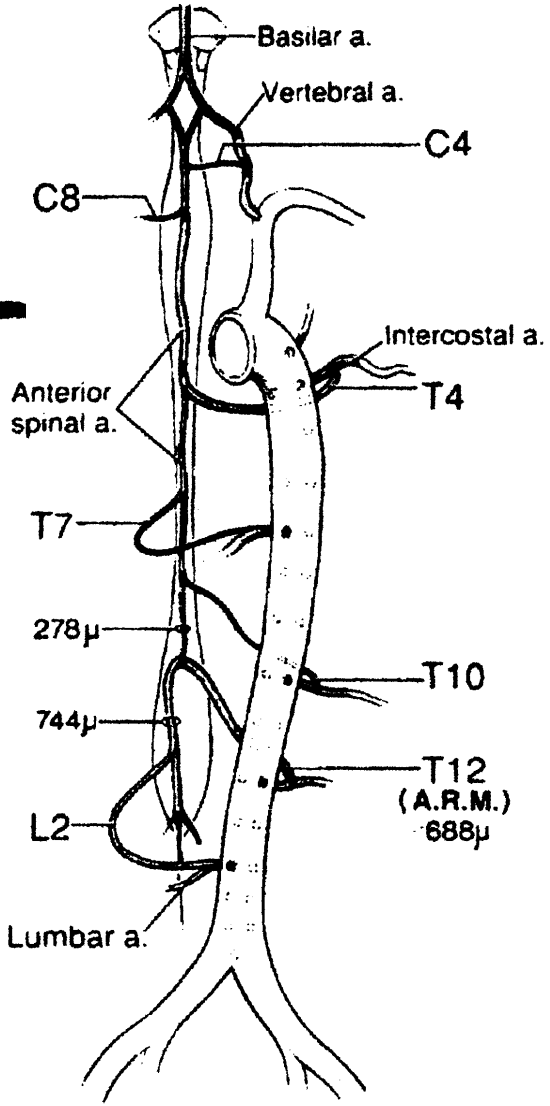
Spinal cord ischemia due to
obstruction of spinal cord
supplying arteries
(e.g. arteria radicularis magna)

Paraparesis
anterior spinal cord syndrome,
Brown-Sequard syndrome,
progressive myelopathy or
transient spinal cord ischemia

Obstruction of vasa nervorum
Compression of a nerve by the enlarging false lumen

Ischemic neuropathy (paraparesis, polyneuropathy, mononeuropathy)
Ischemic plexopathy
Nerve compression syndrome


Anterior
radicular a.
Anterior
spinal a.
Intercostal a.
Aorta


Basilar a.
Vertebral a.
C4
C8
Intercostal a.
T4
Anterior
spinal a.
T7
278μ
T10
744μ
T12
(A.R.M.)
688μ
L2
Lumbar a.

Why painless

- Dissecting haematoma only causes the intima to bulge inward and re-enter the true aortic lumen, without displacing the adventitia outward and causing pain
- Involvement of cerebral vessels
- loss of visceral and spinothalamic perception by severe spinal ischemia may dull perception of pain

Management of type B AD with spinal ischemia

No established effective treatment

- Aggressive BP control to prevent further extension and reduce risk of aortic rupture Vs insufficient collateral recruitment for acute paraplegia
  - Some suggest regulating SBP 120-140mmHg
- Heparinisation/ anti-platelet
  - Risk of bleeding into dissection, not proven to be effective
- Administration of iv naloxone
  - Various effects such as improvement of spinal cord blood flow, inhibition of proteolysis, stabilisation of lysosomal membranes
- Cerebrospinal fluid drainage
  - To reduce the degree of ischemic damage by removing endogenous opiates from spinal fluid
    - Endogenous opiates markedly increase and remained elevated for 24 to 36 hours in CSF that reduce CBF, increase vascular resistance, depress firing of single neurons and depress CNS Ach turnover
- Role of early interventional approach
  - In contrast to visceral/renal/limb ischemia , spinal cord ischemia is seldom considered an indication
  - Positive outcome reported in massive thrombus in false lumen and prolonged partial symptomatic spinal cord ischemia

Treatment methods for spinal cord injury caused by acute type B aortic dissection
Fujisawa Y et al; Asian Cardiovasc Thorac Ann 2006

Prognosis

- Painless AAD may have higher mortality then painful AAD
  - Esp when type B dissection
- Initial severe weakness (MRC <3) and young age at onset (55 years) correlated with poor recovery of motor function

Spinal Cord infarction in Chinese Patients

Cheng MY et al; Cerebrovasc Disc 2008

Progress

- Put on trandate infusion and Transferred to CCU
- Neurosurgery GR: No added neurological benefit for lumbar drainage
- In active rehabilitation
- LL power 3/5, stand with frame with 1 slight A, BI 28/100

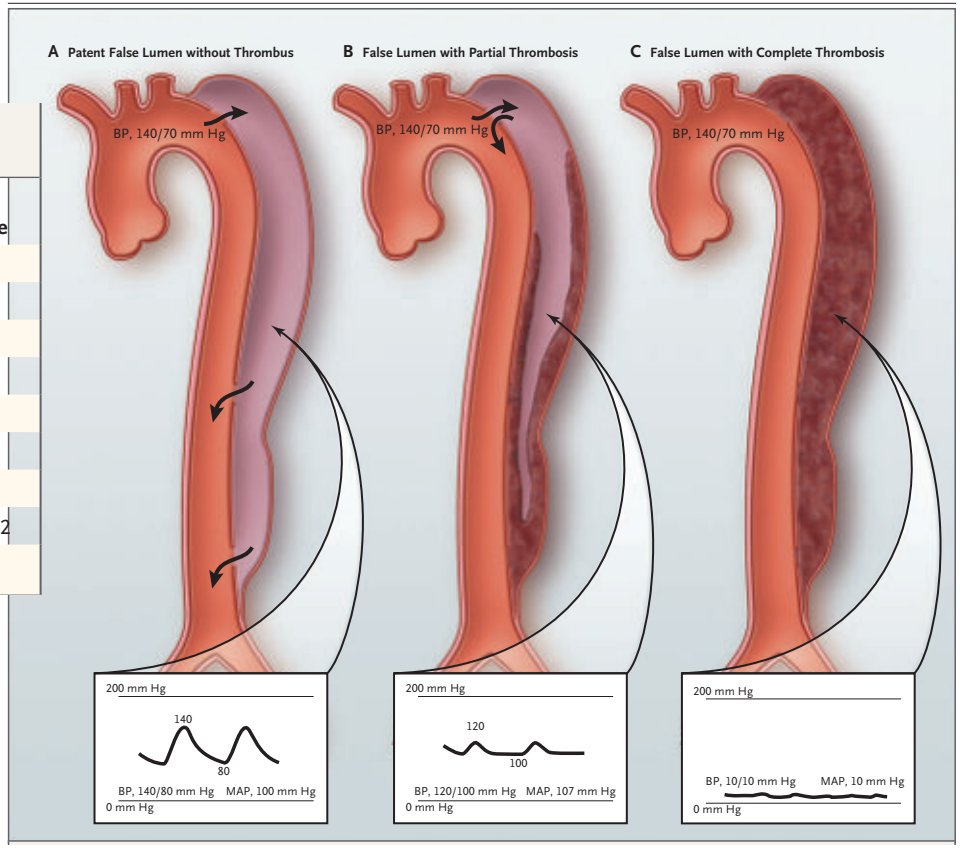
Interval CT 27/5

Previous study dated 5/5/2014 was also referred.
The aortic dissection originating at level of the left common carotid extending down into the proximal common iliac arteries were seen.
The thin rind of hyperintense wall at the distal aortic arch was still noted though less distinct.
The true lumen was well enhanced. Enhancement of the false lumen at distal thoracic aorta and adjacent segment of abdominal aorta was not present.
False lumen enhancement was still present at and below the level of celiac trunk.
The splanchnic arteries and renal arteries were opacified.
Renal excretion of contrast were fair. Bilateral renal cysts noted.
Liver, pancreas and spleen were unremarkable.

OPINIONS
Type B Aortic dissection down to the proximal common iliac arteries with partial thrombosis of proximal portions of the false lumen.

Table 3. Independent Predictors of Death after Adjustment with the Use of Multivariate Models.*

Variable	Hazard Ratio (95% CI)	P Value
Age ≥70 yr	1.42 (0.74–2.74)	0.29
Female sex	1.16 (0.62–2.17)	0.64
Surgical treatment	1.33 (0.49–3.58)	0.57
Endovascular treatment†	1.38 (0.64–3.01)	0.41
Previous aortic aneurysm‡	2.05 (1.07–3.93)	0.03
Atherosclerosis§	1.87 (1.01–3.47)	0.05
Patent false lumen¶	1.00	
Partial thrombosis of the false lumen	2.69 (1.45–4.98)	0.002
Complete thrombosis of the false lumen	1.02 (0.32–3.22)	0.98



- 24.9% of type B aortic dissection died within 3 years
- Partial thrombosis increased risk of death by a factor of 2.7

Parital Thrombosis of the false lumen in patients with acute Type B Aortic Dissection
Tsai TT et al; NEJM 2007

Diagnosis

- LL flaccid weakness
  - Type B aortic dissection with spinal infarct
  - Watershed zones: lower thoracic and lumbar
- Initial Type II resp failure
  - Transient cerebral malperfusion due to dissection
  - COAD
  - Severe OSA and morbid obesity
- Reverse supinator jerk
  - Cervical myelopathy
- Bil BG changes
  - Hypoxic ischemic encephalopathy - poorly controlled OSA > post arrest

Challenges

- Failure to perform detailed neurological exam in critically ill patient
  - Even more confusing if patient under sedation
- Difficult clinical localisation of pathology
  - Combination of CNS and PNS
  - Multiple comorbidities may account for some symptoms
- Availability of imaging

- Some clues for spinal infarction:
  - HT and atherosclerosis, LL weakness and bladder dysfunction as initial complaint, pure motor LL involvement

- Lower threshold for diagnosis of aortic dissection causing spinal infarct in older adults with vascular risk factors

  - Still require spine MRI to exclude compressive myelopathy and support diagnosis of infarction

- ? Clinical suspicion high enough at initial stage to request for TEE

Case 3

F/67

- Unremarkable past health
- NSND
- Lives alone, walk unaided

- Admitted to POH on 27/12/2013 at 8pm
- Son noticed decreased GC and intake for 1 week
- vomiting and urinary incontinence for 1 day

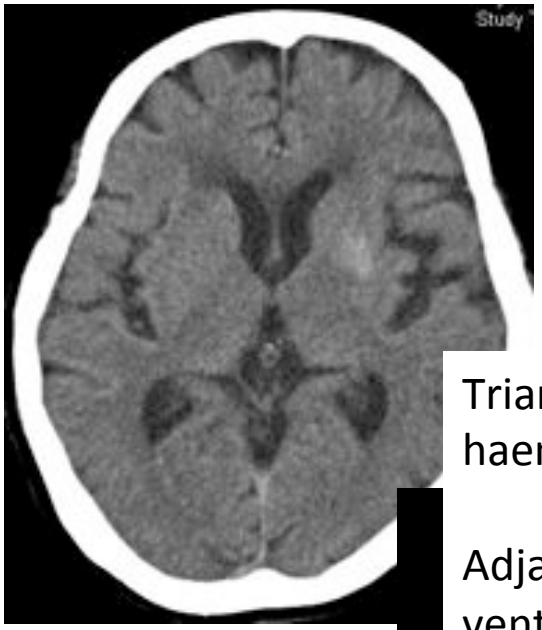
AED

- BP 132/95 P 118 Temp 36
- E3V3M5
- Pupil 3mm bilateral
- UL 3/5, LL 5/5
- Chest clear Abd soft
- Hstix 14.9 CXR clear
- ECG: ST 114bpm
- Given 500ml NS
- Decreased GC with dehydration, To medical ward

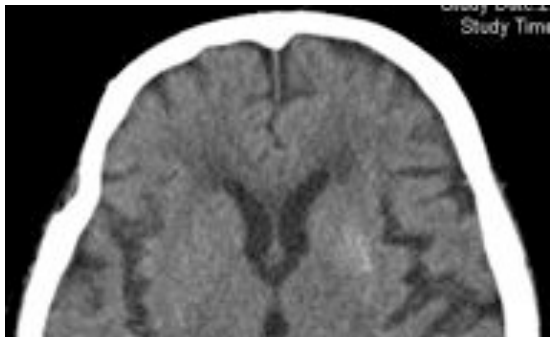
Medical ward

- E3V3M5
- T 35.2
- BP 144/101
- Severe dehyrated
- Trace urine output
- WCC 20 Hb 17 plt 158
- Na 167 K 4.8 urea 84.4 Cr 409
- ALT 63 bili/ALP normal Ca 2.54 amylase 166 INR 1.2 TnI 0.84
- VBG pH 7.34 HCO3 27 BE 0.2 RG 20

At 10pm

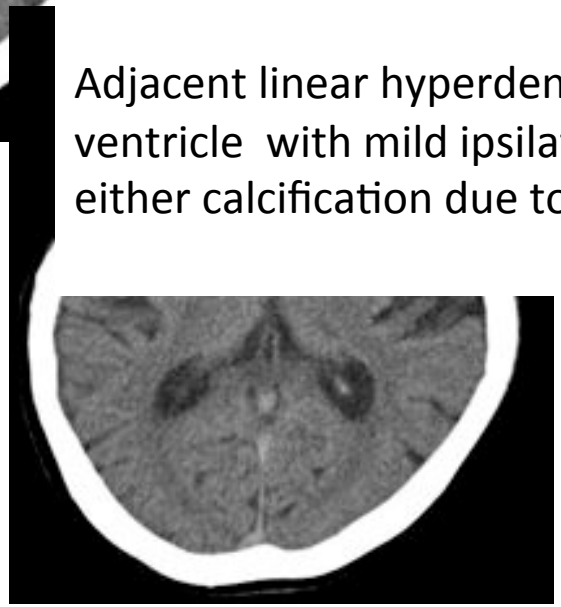


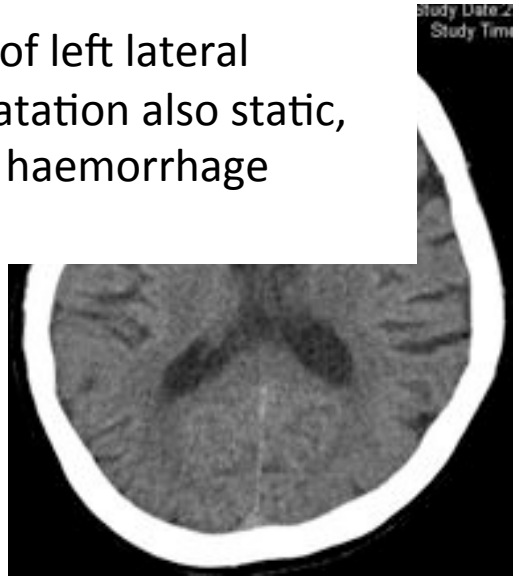
At 13 hrs later



Triangular hyperdensity at left lentiform nucleus static, haemorrhage cannot be ruled out

Adjacent linear hyperdensitity along margin of left lateral ventricle with mild ipsilateral ventricular dilatation also static, either calcification due to old insult or acute haemorrhage





Progress

- Tazocin and hydrocortisone for severe sepsis
- Aggressive rehydration but only trace urine output
- GCS further deterioated E1V2M5
- NS: early Left BG ICH not accountable for low GCS, suggest further workup
- To TMH ICU for CRRT

Problems

- Depressed consciousness
- Severe dehyration with AKI
- Left basal ganglia small ICH
- Newly Diagnosed DM with hyperglycemia
- Hypothermia
- Infection of unknown source

TMH ICU

- Bedside USG kidney: Left atrophic kidney with cortical thining, no hydronephrosis
- Rehyration and rewarming
- Still oliguric
- Na 163 K 4.7 urea 82.7 Cr 426
- Ca 2.33 PO4 2.32 Glucose 24
- Start on CVVH of 2L/hr since 1600

Progress on D2

- LP
  - Opening pressure 30cmH2O
  - Clear CSF
  - RC 4 WCC <1 GS neg
  - Protein 0.78
  - Glucose 6.5 (Serum 11.2)

D2

- E2V1M6
- BP stable
- normothermic
- urine output 30-40ml/hr

Neurological deterioation on D2

- E2V1M5-6
- 2L O2 nc
- Decreased muscle tone
- Hyporeflexia UL, areflexic LL
- Poor gag response
- Repeat LP
  - CSF TP 0.6 GLucose 5.8
  - RC 291 WC 1 GS neg

EEG

- Generalised slow wave without epileptiform discharge

Neurologist's comment

Severe encephalopathy

DDx: metabolic, toxic, osmotic, sepsis

critical illness neuromyopathy

? Underlying DM neuropathy

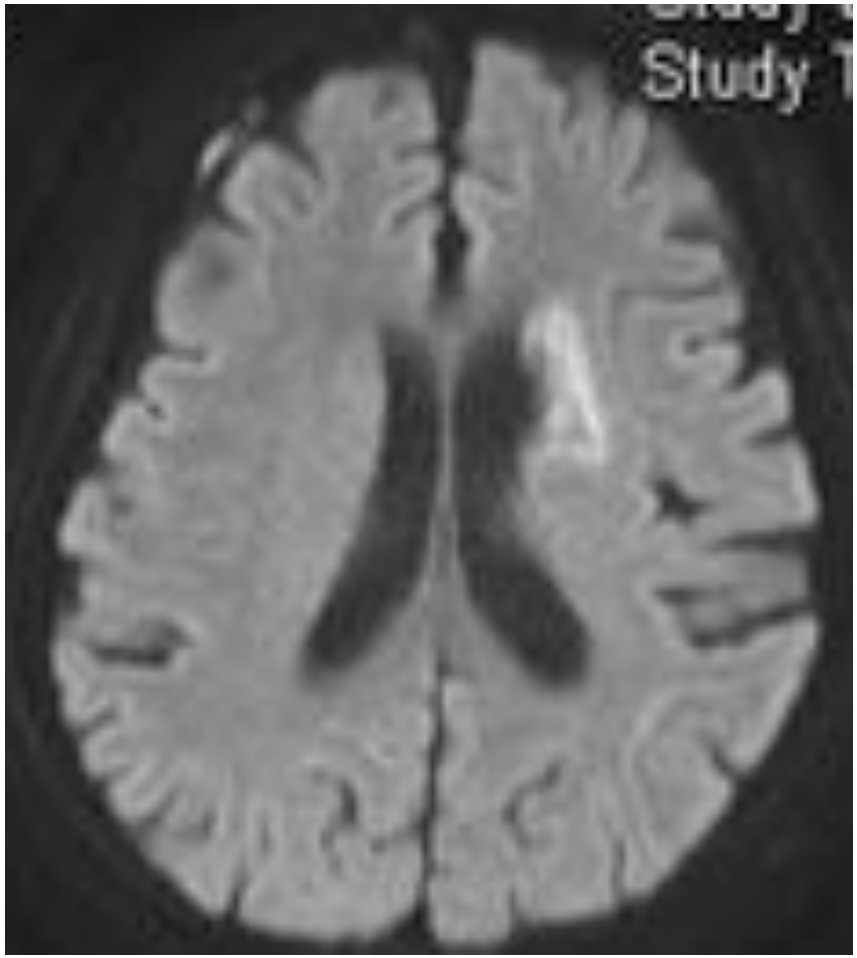
More workup…

- JE serology negative
- NH3 26
- TFT normal
- Toxicology negative
- 2 sets of LP negative for microbiology

What do you think?

MRI brain 2/1/2014 (D5)

- T2W hyperintense lesion in left caudate head and lentiform nucleus with restricted diffusion, ill-defined foci of T1W hyperintensity
- Slit-like T2W hypointense lesion in putamen
- Correlating with the clinical presentation of hyperglycaemic status, features can be compatible with non-ketotic hyperglycaemic hemichorea. Lenticulostrate territory infarct is the DDx



Calculation

- Calculated osmolarity
  - Na X 2 + K + Glu + urea (in mmol/L)
  - = 163 X 2 + 4.7 + 24 + 82.6
  - = 437.3 mOsmo/kg
- Effective osmolality (tonicity)
  - Na X2 + Glu
  - = 350 mOsmo/Kg
- Free water deficit
  - Total body water X (162/140-1)
  - =4L

At 05:53 next day

	28/12 14:46	28/12 17:20	29/12 05:53
Na	163	167	149
K	4.7	3.8	3.9
Urea	82.6	71.9	28.3
Creatinine	426	358	153
Glucose	24		9.5

- Gained 1.8L IVF after 12 hours
- Calculated osmolarity =437.3→ 339.7 mOsmo/kg
- Effective osmolality = 350→ 307.5 mOsmo/kg
- CRRT stopped (after 19 hrs)

Diagnosis

- Osmotic encephalopathy
  - Initial extreme azotemia, hypernatremia and hyperosmolality in severe acute pre-renal failure
    - Rapid water shifts from intracellular to extracellular spaces producing relative glial dehyration
  - Dialysis disequilibrium syndrome
    - Further osmotic shift induced by rapid correction of electrolytes by RRT and IVF
    - Urea removed more slowly across the BBB than from plasma, reverse osmotic gradient which promotes water movement into brain, may induce myelinolysis too (case reports)
    - Osmotic effect of rapid correction of hypernatremia add on the effect of relatively high brain urea during CRRT

Atypical imaging features but clinical progress is most consistent with osmotic demyelination

Osmotic demyelination syndrome

- previously "central pontine myelinolysis" (CPM) / "extrapontine myelinolysis" (EPM)
- characterized by acute demyelination caused by rapid shifts in serum osmolality

Causes of ODS

Can be caused by any change in osmotic gradient

- Most common: rapid iatrogenic correction of hyponatremia
- Uncommonly from correction of osmotic derangement with azotemia, hyperglycemia, hypokalemia, or ketoacidosis

Precise mechanism of osmotic stress-related myelinolysis unknown

- Relative intracellular hypotonicity
- Serum osmolality change causes endothelial damage
- Organic osmolyte deficiency predisposes to endothelial breakdown
- Endothelial cells shrink, causing breakdown of blood brain barrier
- Accumulation of hypertonic sodium-rich fluid in extracerebral fluid
- Hypertonic ECF, release of myelin toxins damages white matter
- Cell death

Exacerbating factors

- Hepatic, renal, adrenal, pituitary, or paraneoplastic disease
- Malnutritional status
- Extensive Burn, transplantation, and other surgical patients

Presentation

- Seizures, altered mental status
- Often biphasic when hyponatremia present
  - ODMS symptoms emerge 2-4 days (occasionally weeks) after correction of hyponatremia
  - Changing level of consciousness, disorientation
  - Pseudobulbar palsy, dysarthria, dysphagia
  - Movement disorder (EPM)
- Symptoms may resolve with serum osmolality increase

Imaging

- Best diagnostic clue: Central pons T2 hyperintensity with sparing of periphery
- Location
  - 50% in pons (CPM)
    - Central fibers involved; peripheral fibers spared
  - 50% extra-pontine sites (EPM)
    - Basal ganglia (BG), Cerebral white matter
    - Uncommon: Cerebral cortex, middle cerebellar peduncles
- Size: Variable extent

Imaging

- Morphology
  - Round or triangular-shaped (pons) , often bilateral/symmetric
  - Gyriform (cortical involvement)
- imaging findings typically lag behind clinical symptoms, and images acquired within 1–2 weeks often show no features of the disease

CT findings

- NECT
  - Low density in affected areas (pons, BG, etc.)
  - No hemorrhage
- CECT
  - Classic: No enhancement
  - Early, acute/severe demyelination may enhance moderately

MRI

- T1WI
  - Acute
    - Classic: Mildly/moderately hypointense
    - Less common: Can be isointense with surrounding normal brain
  - Subacute
    - May resolve completely
    - Less common: Hyperintensity at 1-4 months (coagulative necrosis)
- T2WI
  - Acute:
    - Confluent hyperintensity in central pons with sparing of periphery and corticospinal tracts
    - Symmetric hyperintensity
  - Subacute:
    - Hyperintensity often normalizes, may resolve completely
- DWI
  - Restricts (mildly hyperintense)
- ADC: Variable; normal to mildly hyperintense

Treatment

- largely supportive
- Case reports have suggested steroids, intravenous immunoglobulin, plasmapheresis and thyrotropin-releasing hormone
  - Inadequate data
- Animal studies have suggested that reintroducing hyponatremia may be beneficial, little research has been done in humans

Prognosis

- Complete recovery may occur
- Residual deficits
  - Memory, cognitive impairment
  - Ataxia, spasticity, diplopia
- Co-morbid conditions common, worse prognosis
  - Spastic quadriparesis
  - "Locked in" syndrome; may progress to coma, death
- No apparent connection to clinical features or imaging

Best cases from the AFIP: osmotic demyelination syndrome. Howard SA et al; Radiographics 2009

Progress

- GCS static E3V2M5, RFT normalised gradually
- Transferred to general ward on 3/1/14
- Rehabilitation training
  - Gradual improvement
  - Weaned NGT
  - Walk with stick with 1 mild A
  - Limbs power 4/5

Lesson to learn

- Caution should be undertaken
  - Too rapid correction of hypernatremia/uremia/ osmolality
- Beware of rapid correction after vigorous IVF and CRRT
  - Frequent blood monitoring
  - Lower dosage of CRRT
  - Sodium profiling, high sodium or hyperglycaemic dialysate

In summary

- Neurology cases often have beautiful imagings

→ but difficult to interpret

Take home messages

- Thalamic lesion is specific features of Japanese B encephalitis
- Acute painless paraplegia→ Aortic dissection with spinal ischemia is essential differential diagnosis
- Beware of ODS in patient presents with extreme electrolyte and osmolality abnormality, even imaging finding is absent; and imaging severity is not prognostic
- MRI brain may help in narrowing diagnosis, but can be misleading without clinical correlation

"They may be ever seeing but never perceiving"
Mark 4:12

Thank you!