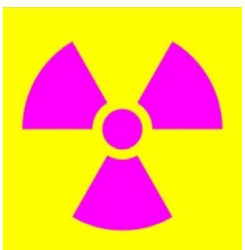
Contents

FUNDAMENTALS OF RADIOLOGY

----- Active space -----

Symbols :



Trefoil : Radiation Hazard

X-ray radiation hazard

Sealed radiation source

Electromagnetic Spectrum & Radiation Units

00:02:23

ELECTROMAGNETIC SPECTRUM

Radio waves : Micro waves : Infrared : Visible light : Ultraviolet : X-rays : Gamma rays

(Minimum) Frequency and energy (Maximum)

Properties of EM Spectrum :

Mass : Absent.

Velocity : 3×10^8 m/s (Speed of light).

Types of waves : Crest and trough.

Properties of X-rays :

Frequency : High.

Energy : High.

Wavelength : 0.01 to 10 nm.

Energy content : 100 eV to 100 KeV.

RADIATION UNIT

	Conventional Unit	S.I Unit
Radiation expoure	Roentgen	Coulomb/kg (Charge/ weight)
Radiation absorbed	Radiation absorbed dose (RAD)	Gray (Gy)
Absorbed dose equivalent	Radiation Equivalent in Man (REM)	Sievert (Sv)
Radioactivity	Curie	Becquerel

Note : "Radioactivity" term coined by Henri Becquerel.

Effects of Radiation

00:10:12

Determining Factors :

- Duration
- Intensity

} of exposure to radiation.

- Sensitivity of tissues to radiation.

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Law of Radiobiology/Law of Bergonie and Tribondeau :

Radiosensitivity ∝ Tissues with → Maximum undifferentiated cells.
→ Active mitosis.

Most sensitive : Bone marrow > GIT > CNS/musculoskeletal system.

Acute Radiation Syndromes :

Stages :

Stage I : Prodromal (Minutes to hours).

Stage II : Latent (Hours to days).

Stage III : Manifest Illness (Days to weeks).

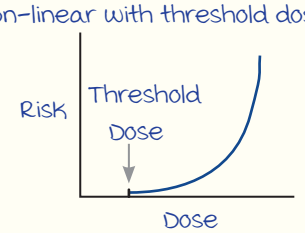
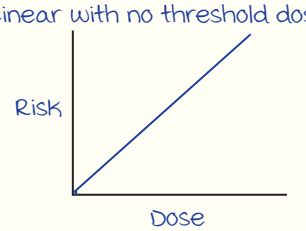
Stage IV : Recovery/death (Weeks to years).

Syndromes :

In order of appearance :

	Acute hematological syndrome	Acute GI tract syndrome	Acute CNS syndrome
Threshold dose	1 – 2 Gy (Least)	6 – 10 Gy	>20 Gy
manifestations	• Pancytopenia • Hemorrhage } Death • Infection	Diarrhoea (1st symptom)	-

Types of Effects :

	Deterministic	Stochastic
Examples	• Acute radiation syndromes • Cataract • Skin damage • Sterility (Gonadal damage)	• Carcinogenesis • Mutations/Chromosomal aberrations
Onset	Acute to subacute	Chronic/delayed
Threshold dose	Determined	Not determined
Severity	Dose dependent	Dose independent
Risk-Dose relationship	Non-linear with threshold dose 	Linear with no threshold dose 

Radiation Exposure

00:21:32

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	Types	Scans	Exposure values (mSv)
Danger	CT/PET/radionuclide studies (Highest exposure)	PET Scan	25
		CT Abdomen	10
		CT Thorax	8
		Bone Scan	–
		CT Head/Brain	3.5
Warning	Diagnostic procedures (multiple exposure)	Barium Enema	7
		Intravenous Urogram	–
		Barium Meal follow through	–
		Barium Meal	–
		Barium Swallow	–
		Micturating Cystourethrography (MCU)	1.2
Safe	Spot radiographs (Exposure once/ twice)	Lumbar Spine	1.0
		Abdomen X-ray	–
		Hip X-ray	–
		Skull X-ray	–
		Chest X-ray	0.02
		Limb/Joint X-ray	0.01 (least)

Guidelines :

International guidelines : By International Commission on Radiological Protection (ICRP) & International Commission on Radiation Units (ICRU).

		Public exposure	Occupational exposure
Effective dose		1 mSv/year	• 20 mSv/year or 50 mSv in any 1 yr. OR • < 100 mSv in 5 years.
Annual equivalent dose	Lens of eye	15 mSv	150 mSv
	Skin	50 mSv	500 mSv
Pregnant females		<1 mSv	

Indian guidelines : By Atomic Energy Regulatory Board (AERB).

Same as international, except occupational exposure → Effective dose of 30 mSv in any 1 year provided <100 mSv in 5 years.

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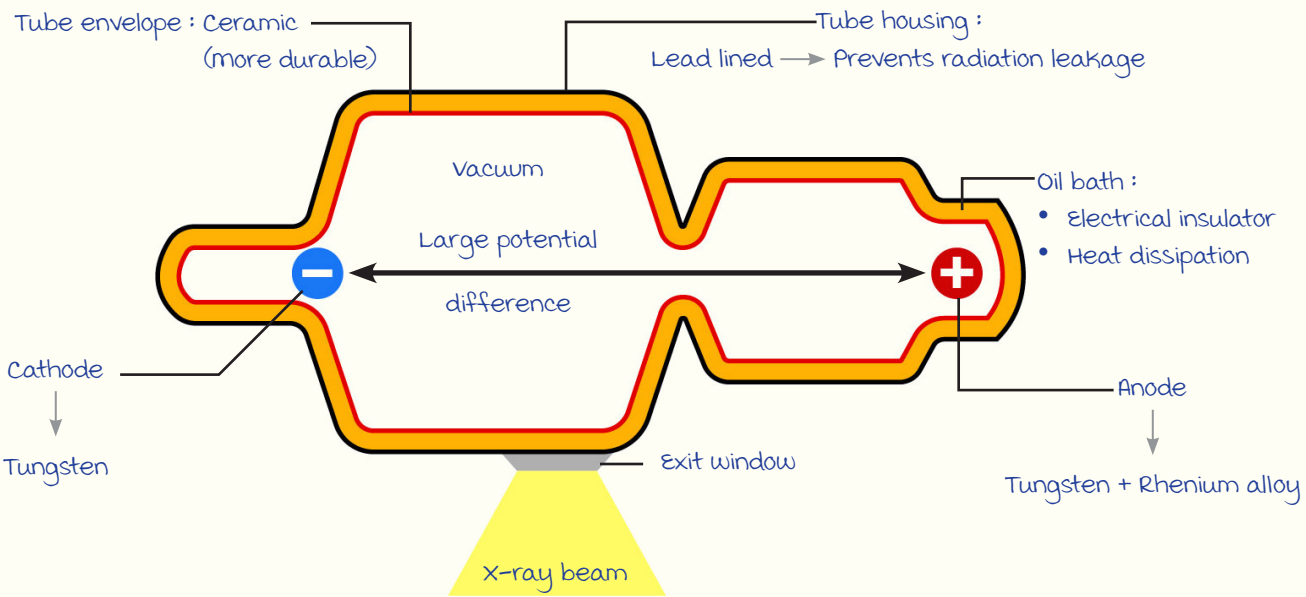
X-ray Production & Interaction

00:31:33

Structure of X-ray Tube :



X-rays are produced when electron beam strikes anode.

Mechanisms of X-Ray Production :

	Continuous spectrum	Characteristic spectrum
Mechanism	Acceleration/deceleration of e^-	Shifting of e^- from outer to inner shell
Frequency of use	70-80% (m/c)	20-30%
Additional points	AKA Bremsstrahlung/ white/braking radiation.	Used in mammography.

X-ray Interactions :

Occurs inside patient's body.

	Compton effect (m/c)	Photoelectric effect
AKA	Mid energy phenomenon	Low energy phenomenon
Interaction b/w	X-ray photon & outer shell e^-	X-ray photon & inner shell e^-
Outcome :	↑Deviation of X-ray	No deviation
• Scatter radiation	more (↑Distortion)	Absent
• Image resolution	Low	Better
• Desired level	↓Effect	↑Effect

----- Active space -----

Factors Determining Exposure of X-ray Image :

Adjustments done on X-ray console based on image requirement.

	Tube potential (TP)	Tube current (TC)
Unit	Kilovoltage Peak (kVp)	Milli-Ampere second (mAs)
Determines	• $\propto$ Penetration • $\propto \frac{1}{\text{Image contrast}}$	$\propto$ Image contrast

Thermoluminescent Dosimeter (TLD) Badge :

Use : Monitors occupational radiation exposure.

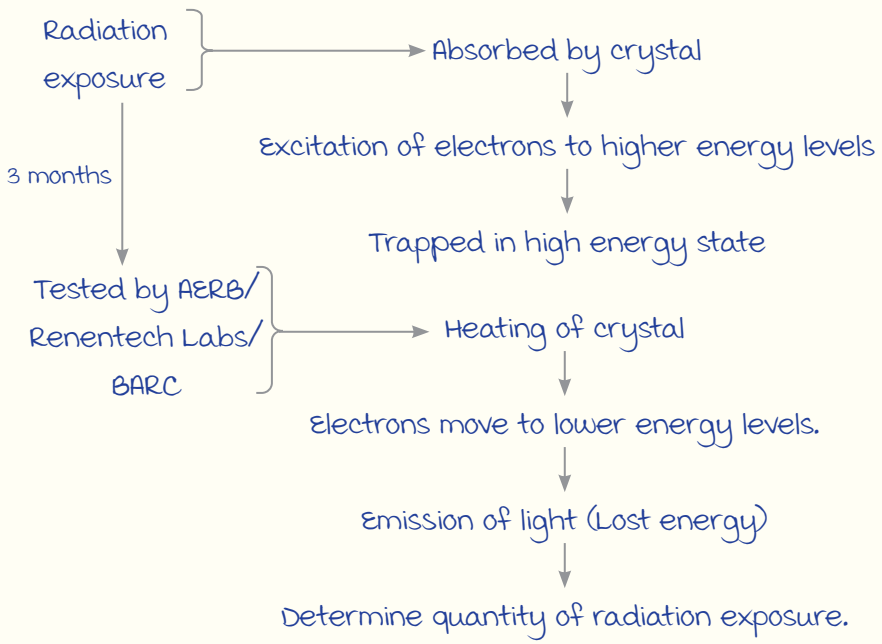
Range : 0.01 mGy – 10Gy.

Composition : Phosphor crystals

- Lithium Fluoride (LiF).
- Lithium Borate.
- Beryllium Oxide (BeO).

TLD badge

Mechanism of action :



Computed Tomography (CT)

00:47:49

CT Room :

Equipment : CT equipment room + CT console.

CT equipment room :

- Lined by lead → Prevent leakage of radiation.
- Thickness :
  - Lead : 1/16th inch (OR)
  - Concrete : 4–6 inches.

----- Active space -----

Hounsfield Unit/CT Value Scale :

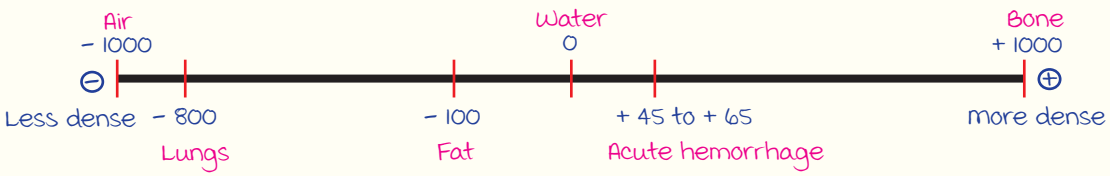
- Numerical value of tissues on CT scan.

$$HU_x = 1000 \times \frac{\mu_x - \mu_{water}}{\mu_{water}}$$

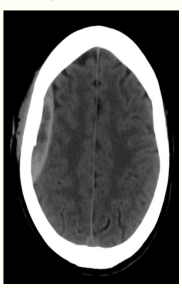
HU_x : Hounsfield unit of tissue

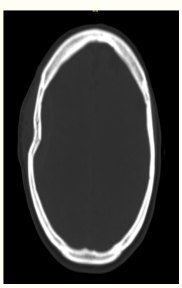
μ : Linear attenuation co-efficient

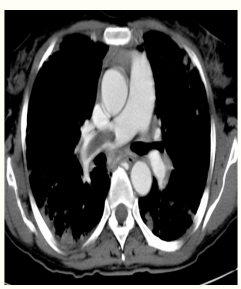
- It is determined by electron density.
- Values :

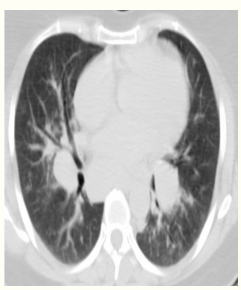


Windowing : Adjusting image contrast using range of Hounsfield units appreciable to human eye.


Brain window
(0 to 100 Hu)


Bone window
(900 to 1000 Hu)


Mediastinal window
(0 to 100 Hu)


Lung window
(-900 to -700 Hu)

CT Polytrauma/whole body CT/Pan-scan :

Standard protocol :

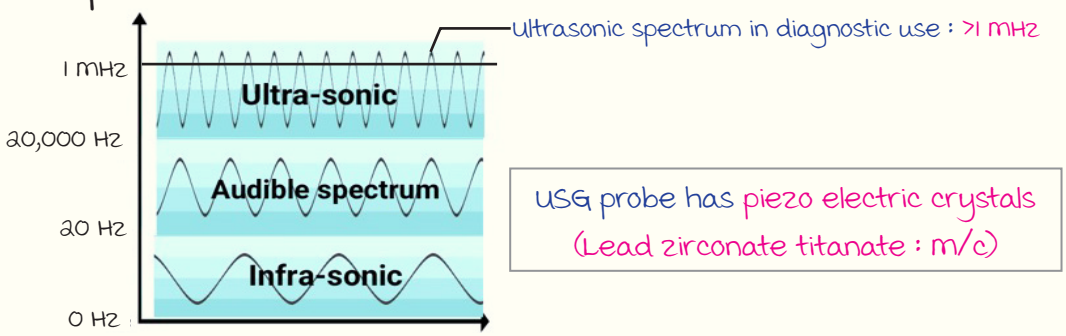
- Non contrast CT of the head + cervical spine.
- Contrast enhanced CT of the chest + abdomen + pelvis.

Note : Limb CT is not included.

Ultrasonography

00:57:45

Sound Spectrum :



USG probe has piezo electric crystals
(Lead zirconate titanate : m/c)

----- Active space -----

USG Basic Principle :

Reverse piezoelectric effect :

Electric current passing through the crystal produces vibrations in the tissues.

Piezoelectric effect :

Vibrations reflected by tissues are converted back into electric impulses.

Magnetic Resonance Imaging (MRI) 01:02:40

Principle :

Based on gyromagnetic property of hydrogen nucleus → Magnetic field.

Contraindications :

Absolute C/I : Interference/effect of magnetic field → Fatal consequences.

1. Metallic foreign body in eye.
2. Cardiac pacemaker.
3. Cochlear implants.
4. Ferromagnetic hemostatic CNS aneurysm clips.

Relative C/I :

1. Claustrophobia : Sedate the pt. → Then do MRI
2. Insulin pumps.
3. Nerve stimulators.
4. Prosthetic heart valves.
5. 1st trimester of pregnancy.

Faraday's Cage :

Shielding : Prevents action/interference of MRI magnet on outside devices & vice-versa.

Faraday's cage

Contrast Media : 01:08:54

Imaging modality	Contrast media
X-ray/CT	Barium, Iodine
USG	Stabilized microbubbles (Expired by lungs → Safe in renal failure)
MRI	Gadolinium

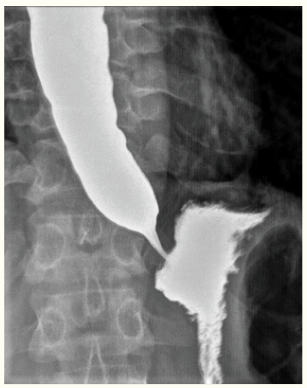
----- Active space -----

BARIUM

$BaSO_4$ suspension used.

Applications :

GI studies.



1. Barium swallow :

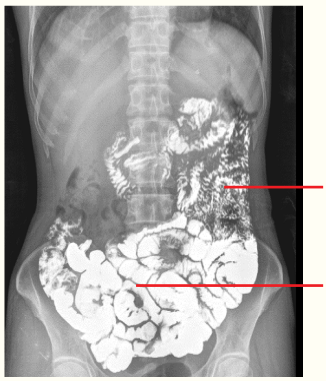
To evaluate :

- Upper pharynx.
- Esophagus.
- Gastro-esophageal junction.

2. Barium meal :

To evaluate :

- Stomach.
- Proximal duodenum.



3. Barium meal follow through (BMFT)

To evaluate small bowel.

Feathery appearance of jejunal loop,

Featureless appearance of ileum (In central abdomen)

4. Barium enema :

To evaluate large bowel.

Contraindications :

Absolute : Perforation (Causes severe chemical peritonitis).

Relative :

- Small bowel obstruction (SBO).
- Hypersensitivity.
- Recto-vaginal/vesico-vaginal/tracheo-esophageal fistula.
- Left sided colonic obstruction : Excessive stasis → Barium converts into fecoliths.

IODINATED CONTRAST

Iodine-particle ratio : (Should be high)

$$\frac{\text{Iodine (should be high to block X-rays)}}{\text{Osmotically active particle (Should be low to avoid adverse effects)}}$$

Types of Iodinated Contrast :

----- Active space -----

	High osmolar	Low osmolar		
	Ionic monomers	Ionic dimers	Non-ionic monomers	Non-ionic dimers
Features	–	–	• m/c used contrast • Chemically stable : Low adverse effects	• Iso-osmolar contrast • Safest • High cost
I : P Ratio	3 : 2 (Worst)	6 : 2	3 : 1	6 : 1 (Best)
Examples	Salts of Diatrizoic acid : • Trazografs • Urograffin • Angiograffin • Gastrograffin • Iothalmic acid (Conray)	• Ioxaglic acid • Iocarmic acid	• Iohexol/Omnipaque (m/c) • Iopamidol • Ioversol • Amipaque	• Iotrol • Iotrolan • Iodixanol

Contrast Induced Nephropathy (CIN) :

Diagnostic criteria : ↑ S. creatinine

- >25% Per injection value
- 0.5 mg/dL absolute increase

} within 48–72 hrs of IV contrast.

Laboratory Markers :

- S. creatinine .
- S. Cystatin C.
- Estimated GFR (eGFR) <60 mL/min.
- Plasma neutrophil gelatinase associated lipocalin (NGAL).

Risk Factors :

- Pre-existing chronic kidney disease (CKD) : Most important.
- Anemia.
- Hypovolemia/Dehydration.
- Elderly.
- Diabetes mellitus.
- Multiple myeloma.
- Metabolic Syndrome.

Management :

- Self limiting condition : Maintain fluid and electrolyte balance.
- Hemodialysis (Rare).

Prevention : Pre-contrast

- Renal function tests : To rule out CKD.
- Hydration.
- Bicarbonate therapy.
- N-Acetyl cysteine.
- Vitamin C.
- Rosuvastatin.

----- Active space -----

MRI CONTRAST AGENTS

Types :

	T1 relaxation agents	T2 relaxation agents
Example	Gadolinium (m/c)	Super paramagnetic iron oxide (SPIO)
MRI sequence	Bright on T1w	Dark on T2w
Comments	• Paramagnetic agent • C/I in pregnancy	Used to detect ↑ Kupffer cell activity (Focal nodular hyperplasia)

Hepatocyte specific contrast agents :

- Gd-Manganese DPDP.
- Mangafodipir trisodium.
- Gd-BOPTA.
- Gd-EOB-DTPA.

Nephrogenic Systemic Fibrosis :

Adverse effect of MRI contrast d/t pre-existing renal impairment.

Causative agents :

- Omniscan/Gadodiamide (m/c) : Banned.
- Magnevist/Gadopentetate dimeglumine (2nd m/c).
- Optimark/Gadoversetamide.

USG CONTRAST AGENTS

Safe in renal failures.

Classification :

	1st Generation	2nd Generation	3rd Generation
Shell	None	Protein	Protein/lipid/polymer
Stability	Least	Moderate	Highest (m/c used)

RADIONUCLIDE IMAGING AND RADIOTHERAPY

----- Active space -----

Planar Scintigraphy vs. Single Photon Emission Computed Tomography (SPECT) :

Radioisotope of iodine injected → Uptake in thyroid tissues → Detected by γ cameras.

Based on no. of γ cameras

	Planar scintigraphy	SPECT
No. of planes	Uniplanar	multiplanar
γ cameras	Single	multiple
Resolution	Poor	Good
Sensitivity	Low	High

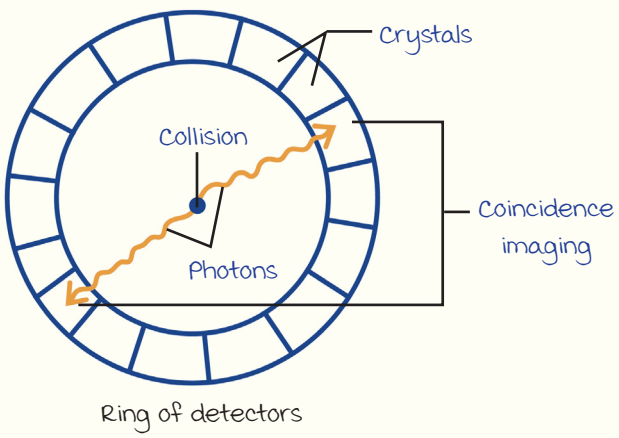
PET Scan

00:04:40

Position Emission Tomography (PET).

Principle → Annihilation : Positron & electron → γ energy photon.

→ Co-incidence imaging : Only true signals detected by crystals.



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Indication :

Cancer imaging (most important) :

- Primary diagnosis.
- Staging & detection of metastases.
- Response to treatment.
- Recurrence detection.

18-FDG (Fluoro-deoxy-glucose) :

- m/c used radionuclide for PET scan.
- Cancer cells : ↑ 18 FDG uptake than normal cells (D/t Warburg effect).

Warburg effect :

Pyruvate $\xrightarrow[\text{Glycolysis}]{\text{Aerobic}}$ Lactate (Even in presence of O_2).

↓

Shunted for cell division intermediates.

PET vs. CT scan : Fusion imaging technique.

CT	PET	PET CT
Gives structural/anatomical information	Gives functional/metabolic information as a colour map	Colour map superimposed on CT image

Drawbacks of PET Scan :

False negative (PET ⊖, tumor ⊕)	False positive (PET ⊕, tumor ⊖)
• Small tumor size (<1 cm) : Low output of γ rays ⟶ Undetected. • Low grade malignancy (Slow proliferation rate) : – Typical carcinoid tumor. – Bronchoalveolar cancer. – Mets from primary mucinous tumor. – Post Chemotherapy tumor. • Hyperglycemia : Competitive inhibition of FDG by excess glucose.	• Infections : – Cellulitis. – Abscess. • Granulomatous conditions.

Newer FDA approved isotopes for PET ☢ :

Isotope	Indication
Ga-68 PSMA (Prostate specific membrane antigen)	Prostate cancer
Carbon-11 Choline	Staging of prostate cancer : Detection of mets in lungs, brain, GIT, Genito urinary tract
Fluorine-18 Florbetaben/Flutemetanol/ Florbetapir	Detection of amyloid deposits in brain
Co-64 Dotatate	Somatostatin receptor ⊕ ; neuroendocrine tumors
Nitrogen-13 Ammonia & Rubidium-82	Myocardial perfusion (Traditionally used : Thallium)

Technetium-99m

00:19:15

----- Active space -----

- m/c used isotope in nuclear medicine.
- Production & disintegration pathway.

Synthesized from molybdenum-99 → Tc-99m : (metastable isomer. • $T_{1/2}$: 6 hrs.) —Disintegration→ Tc-99 → Disintegrates into Ruthenium-99.

Applications :

Tc^{99} tagged with	Use
I^-	Thyroid imaging
RBC	Detect site of bleeding
Neutrophils	Detect hidden foci of infection (more specific than Ga-67)

Gallium-67 Scan

00:23:57

- Sensitive for detection of infection/inflammation (Pyrexia of unknown origin)
- Low specificity : False positive in → Sarcoidosis (Panda sign/Lambda sign). → Lymphoma.

Organ Imaging

00:25:45

Renal Imaging :

Evaluation	Radionuclide used	Mechanism/Interpretation
Static/Structural/Anatomical	Tc-99m DMSA (Dimercapto succinic acid)	-
GFR estimation	Tc DTPA	Excreted exclusively by glomerular filtration
Dynamic/renal function evaluation	Tc MAG3 (mercaptoacetyltriglycine)	Excreted by glomerular filtration + tubular secretion
Renal artery stenosis (RAS)	Captopril Tc 99-DTPA (Captopril causes ↓ GFR)	Do Tc-99 DTPA Scan → measure baseline GFR → Give small dose of Captopril → measure GFR again by Tc-99 DTPA : GFR_a If GFR_a < GFR_i → RAS

----- Active space -----

Cardiac Imaging :

Imaging technique	Radionuclide used	Interpretation
Cardiac perfusion imaging	• Thallium 201 (Accumulates in intracellular spaces like K^+) • 13 N ammonia & Rubidium 82	• Normal myocardium : Hot spot • Infarct : Cold spot (No perfusion)
Infarct maging/Infarct scintigraphy	99m TC-stannous pyrophosphate	Infarct : Hotspot
Radionuclide ventriculography/ MUGA scan	99m Tc- RBCs	Cardiac output is assessed using EDV & ESV
Myocardial viability assessment	18 FDG PET	Ischemic myocardium takes up 18 FDG (Glucox : Energy source) Note : Normal myocardium utilises fatty acid as energy source.

MUGA : Multiple gated acquisition scan ; EDV : End diastolic volume ; ESV : End systolic volume.

Lung Imaging :

Ventilation perfusion scan :

Evaluation	Radionuclide	Interpretation
Ventilation (V)	Tc-99m aerosols	• Normal lung : V/Q = 1 • Early PE : $\frac{\text{V (Normal)}}{\text{Q (}\downarrow\text{/Absent)}}$ } Mismatch defect • Advanced PE (PE + Lung infarct) – CXR : Opacity – V : Abnormal – Q : Abnormal } Triple match
Perfusion (Q)	99m Macroaggregated albumin	

PE : Pulmonary embolism.

GI Tract Imaging :

Radionuclide scan :

- High sensitvity.
- Threshold for detection of bleeding : 0.05 -0.1 ml/min.

Evaluate	Radionuclide used
Active GI bleed	99m Tc sulfur colloid
Intermittent GI bleed	99m Tc RBCs
Meckel's diverticulum (Ectopic gastric mucosa)	99m Tc pertechnate (IOC) : Has affinity for gastric mucosa

Hepatobiliary Imaging :

Hepatic Iminodiacetic acid (HIDA) scan :

IV HIDA → Taken up by hepatocytes → Secreted into bile → Biliary tree visualization.

----- Active space -----

Normal : Entire biliary tree is visualised.

Acute cholecystitis :

Gall bladder is not visualised on HIDA scan

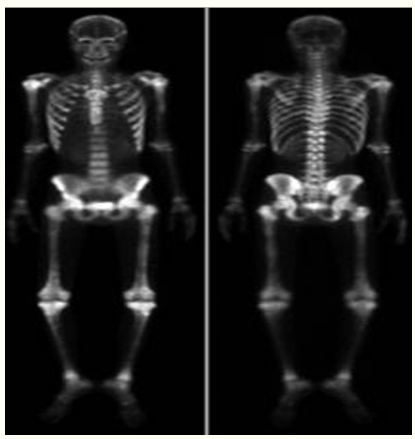
Skeletal Imaging :

Tc-99 MDP (methyl diphosphonate) bone scan :

Detects stress fractures/avascular necrosis/tumors.

Super scan :

- Excessively high uptake of T_c 99 MDP in bones.
- No excretion via kidneys & urinary bladder.
- Seen in :
  - Hyperparathyroidism.
  - Renal failure.
  - Paget's disease.
  - Metabolic bone disease.

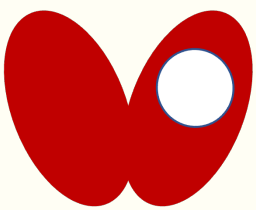
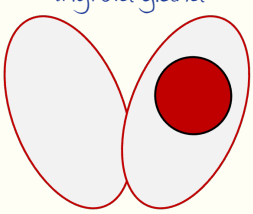


Super scan

Neck Imaging :

Diagnostic use : Thyroid nodule imaging.

Radionuclide used : 99m Tc-pertechnetate/I^{123} Na-Iodide.

	Cold nodule	Warm nodule	Hot nodule
Radionuclide uptake	No uptake 	Similar to normal thyroid gland 	more than normal thyroid gland 
Risk of malignancy	Highest (20%)	moderate	Least (2%)

Therapeutic use :

- Iodine-131 : Papillary thyroid cancer.
- Iodine – 125 : Brachytherapy.

Note :

Iodine 124 : Experimented for use in PET scan.

----- Active space -----

Miscellaneous Imaging :

Tissue	Scan	Features
Parathyroid	99m Tc-SestaMIBI scan	IOC for parathyroid localization
	99m Tc tetrofosmin scan	-
	4D CECT scan	IOC for parathyroid tumors
Salivary gland	99m Tc pertechnate scan	• Tumors : Cold spot. Except Warthin's tumor/ Adenolymphoma : Hot spot.
Neuroendocrine/ Catecholamine producing tumor	I^{131} MIBG scan (meta-Iodo-Benzyl guanidine)	Detects : • Pheochromocytomas. • Paragangliomas. • Medullary thyroid cancer. • Neuroblastoma. • Ganglioneuromas. • Ganglio neuroblastomas. • Carcinoid tumors.
	CE-MRI	IOC for adrenal pheochromocytoma
	Ga-68 : • DOTA peptide PET/CT • DOTATATE PET/CT • DOTATOC PET/CT	IOC for extra-adrenal pheochromocytoma

Components of Radiotherapy

00:49:52

	α	β	x ray (m/c used)	γ
Damaging power	max			min
Ionization	max			min
Penetration	min			max
Examples	• Radium-223 : Rx of painful bone mets. • Radon-222 : Air pollutant & can cause lung cancer.	• Phosphorous-32 : Rx of polycythemia rubra vera. • Strontium-89 : Rx of bone mets. • Yttrium-90 : Trans arterial Chemo embolisation of hepatocellular cancer.		• Tc-99 : Diagnostic purpose. • Cobalt-60 : Teletherapy.

Bragg's peak :

Seen with heavy & charged particles → α particles. Protons.

Note : Kerala has the maximum dose of natural radiation in India.

----- Active space -----

Mechanisms :

Ionisation ⟶ Double stranded DNA breaks.

FRACTIONATED RADIOTHERAPY

Total required dose is split into multiple fractions & then administered.

	Hypofractionation	Conventional fractionation	Hyperfractionation
Frequency of Radiotherapy	<5 fractions of dose/ week	• 1 fraction of dose/ day for the week (Monday – Friday) • Weekend : Holiday period.	> fraction of dose/ day
Indication	• Palliative care • melanoma • Soft tissue sarcoma	-	Aggressive tumors : • Cerebral glioma • Small cell lung cancer • Head, neck, face cancer

5 Rs of fractionated radiotherapy :

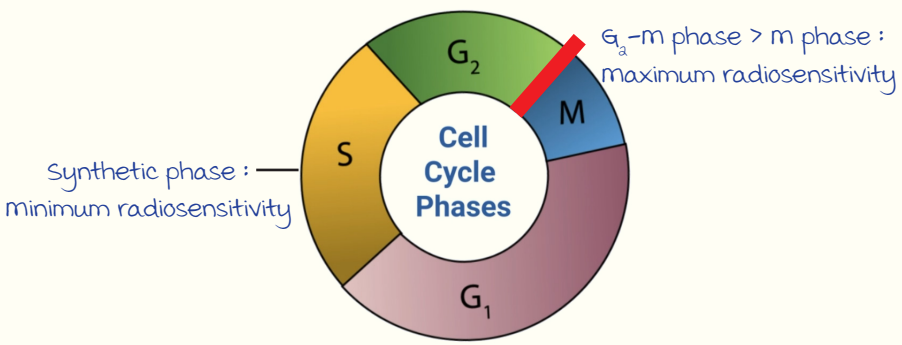
1. Radiosensitivity : Baseline criteria to start RT.
2. Repair
3. Repopulation

} ↓ response to RT.

4. Reoxygenation
5. Reassortment

} ↑ response to RT.

CELL CYCLE SENSITIVITY TO RADIOTHERAPY



TUMORS SENSITIVE & RESISTANT TO RADIOTHERAPY

Most radio resistant	Most radiosensitive
Mnemonic MOP : Melanoma Osteosarcoma Pancreatic cancer	Mnemonic WELMS : Wilms Ewings Lymphoma Multiple myeloma Seminoma

----- Active space -----

Types of Radiotherapy

01:03:58

1. External Beam Radiotherapy (EBRT)/Teletherapy (m/c) :

Radiation source is at a distance from patients body.

Types :

- Cobalt-60 machine (m/c)
- Linear accelerators (LINAC) :
  - Modified heavy duty X-ray tubes
  - Output : High energy X-ray + e^-

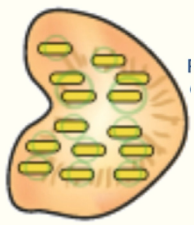
Disadvantage : Normal tissue lying in the path of beam is exposed to radiation.

Note :

Cobalt-59 : Natural form of cobalt.

2. Brachytherapy :

- Radiation source placed inside/on tumor.
- Reduces exposure to normal tissue.

Type	Features	Examples
Interstitial 	Empty metal shells placed within tumor → Remote after loading : Fills shells with isotope → Radiation emitted for a few mm (Only tumor is exposed to radiation)	Ca prostate
Intracavitary 	Radiation source placed inside a naturally occurring body cavity	Ca cervix
Mould 	Radiation source placed on surface of body/tumor	Ca of tip of finger
Systemic	IV injection of isotope which gets concentrated in target organ	• I^{131} : Papillary thyroid Ca • P^{32} : Polycythemia rubra vera • Strontium 89 & Samarium 132 : In bone mets

Special Applications Of Radiotherapy (RT)

01:09:18

----- Active space -----

Radiotherapy (RT)	Feature	Indication
Intraoperative	Stationary mega voltage electron beam	Ca pancreas
Stereotactic radiosurgery (RS)/r Knife RS	• Multiple beams of uniform strength • For accurate localisation 3DCT/MRI done • Leksell frames (Helmets) is worn by the patient	Brain tumors
Intensity modulated RT	Multiple beams of varying strength	-
Craniospinal irradiation	Can be used prophylactically or also to limit spread as part of Rx	Highly aggressive tumors

Emergency RT indications :

Tumor/mets causing :

- ↑ Intracranial tension.
- Spinal cord compression.
- Cardiac tamponade.
- SVC compression.
- Tumor lysis syndrome.
- Hypercalcemia.

----- Active space -----

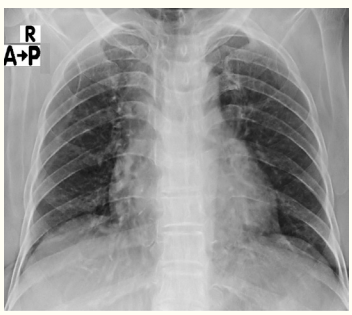
RESPIRATORY IMAGING : PART 1

CXR Views

00:00:30

	PA view	AP view
Indication	m/c used	Children, unconscious or critically ill patients, polytrauma
Direction of X-ray beam	• Posterior → Anterior • Centered at inferior angle of scapula/T_8 body/T_7 spinous process	• Anterior → Posterior • Divergent
Tube-film distance	6 ft/72 inches/180 cm	Less
Heart size	Normal	False cardiomegaly

PA view of lungs



AP view of lungs

Techniques of Projection :

$$KVp \propto \frac{\text{Penetration}}{\text{Image contrast}}$$

	Low KVp technique	High KVp technique
KVp	60 – 80	120 – 170
Enhancement	Image contrast	Penetration
Detects	• Miliary nodules • Calcifications	Reassess hidden areas on X-ray

CXR standard technique :

- PA view.
- Erect position.
- Suspended end inspiration.

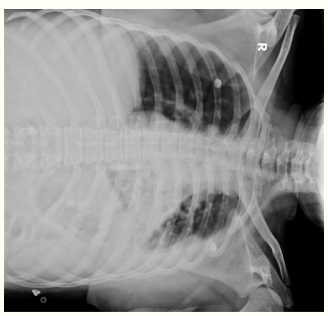
----- Active space -----

Indications for Expiratory CXR :

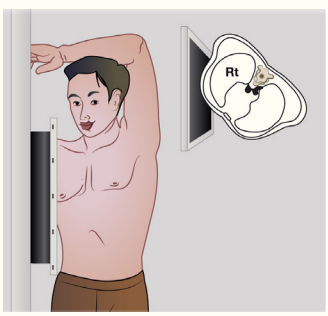
- Pneumothorax.
- Foreign body aspiration.
- Obstructive lung diseases (Chronic bronchitis, emphysema).
- Diaphragmatic palsy.

Other CXR Views :

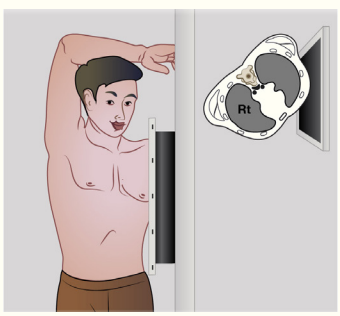
CXR view	Best visualised feature
Lateral decubitus view	Minimal pleural effusion
Ⓡ Anterior oblique view	• Ⓛ lung • Esophagus (Barium study) • Sternum
Ⓛ Anterior oblique view	• Ⓡ lung • Aortic window
Posterior oblique view (Ⓡ & Ⓛ)	Ipsilateral rib fractures
Apicogram	Lung apices
Lordotic view	Middle lobe pathologies



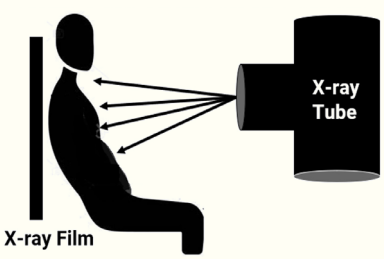
Pleural effusion :
Lateral decubitus view



Right anterior oblique view



Left anterior oblique view



Apicogram/Lordotic view

Right posterior oblique view

Left posterior oblique view

----- Active space -----

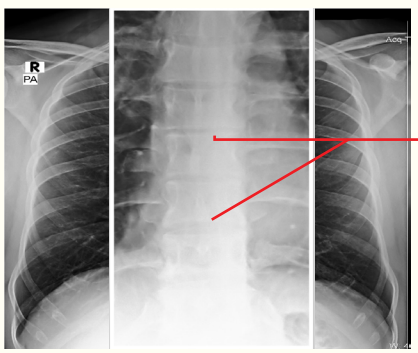
Note :

Fluid accumulation	IOC
Pleural effusion	USG
Pericardial effusion	Echocardiography
Ascites	Focused assessment with sonography in trauma (FAST)
Air accumulation	IOC
Pneumothorax	CT
Pneumomediastinum	
Pneumoperitoneum	
Retroperitoneal organs : Pancreas (Obscured by gastric air)	CECT
Renal/ureteric calculi	NCCT

Normal CXR Interpretation

00:13:10

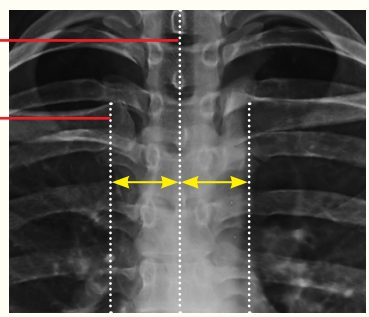
Level of Exposure :



Margins of lower thoracic vertebral bodies just seen → Adequate exposure

Centering :

- If both yellow lines are equal : Well centred.
- ↑Distance on Ⓛ → Ⓛ rotation : Ⓛ lung seems darker → U/L radiolucency.
- ↑Distance on Ⓡ → Ⓡ rotation : Ⓡ lung seems darker → U/L radiolucency.



Identification of Ribs :

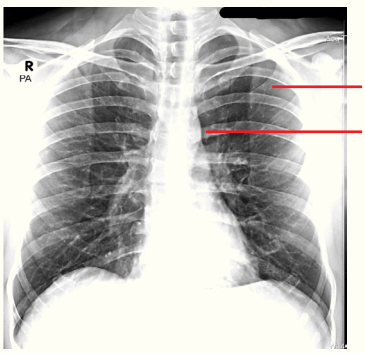
	Anterior ends of ribs	Posterior ends of ribs
Distance from midline	Away from midline	Closer to midline
Orientation	Oblique	Horizontal
Indicator of adequate inspiration (Min. no. of ends of ribs seen above diaphragm)	6	10

----- Active space -----

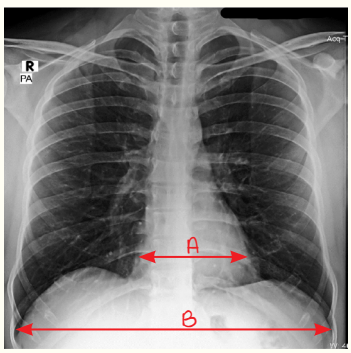
Cardiothoracic (CT) Ratio :

- To assess cardiomegaly.
- CT ratio = $\frac{\text{max. transverse diameter of heart (A)}}{\text{max. transverse diameter of inner thorax (B)}}$
- CT ratio values :

	Normal	Cardiomegaly
PA view	< 0.50	> 0.50
AP view	< 0.55	> 0.55

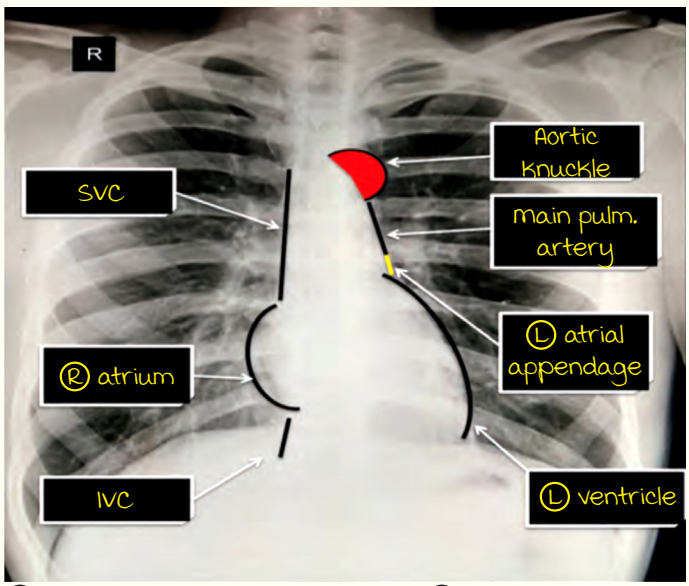


Identification of ribs



CT ratio assessment

Mediastinal margins : Right ventricle doesn't contribute to any borders.

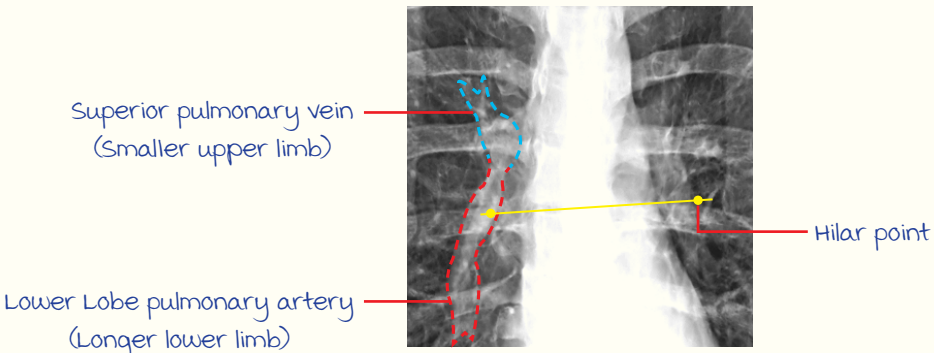


Ⓡ mediastinal margin Ⓛ mediastinal margin

Hilum :

- Ⓝ hilum shape : Concave (Laterally).
  Convex lobulated contours → Lymphadenopathy (TB, sarcoidosis).
- Hilar point : Ⓛ higher or equal to Ⓡ.
  Ⓛ can never be lower than Ⓡ.

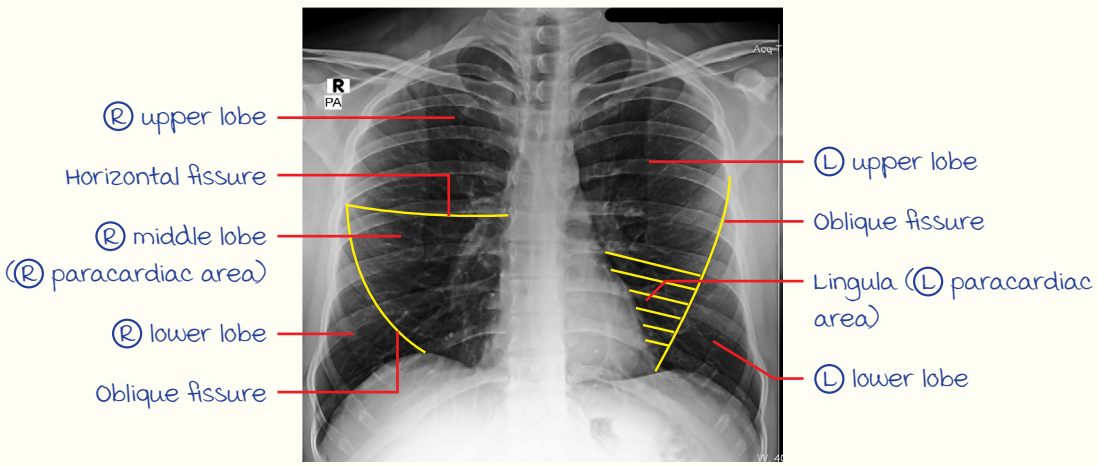
----- Active space -----



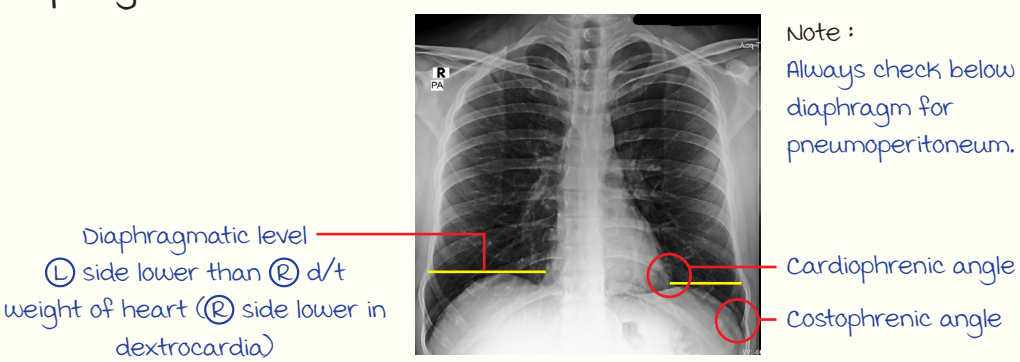
Hilar shadows

(Lower lobe veins have no contribution)

Lobar anatomy :



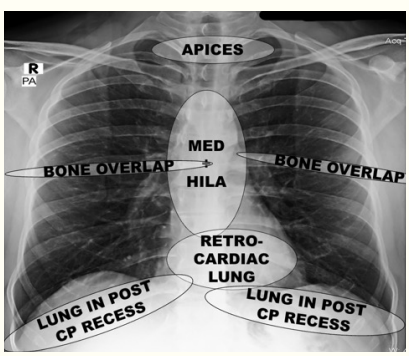
Diaphragm :



Note :
Always check below diaphragm for pneumoperitoneum.

Hidden Areas :

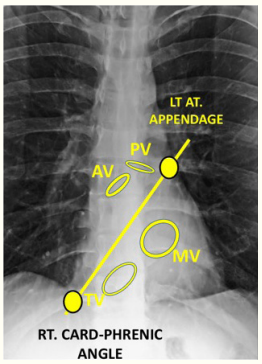
Areas not well-visualized on CXR.



Prosthetic Cardiac Valves & Incidental Findings on CXR

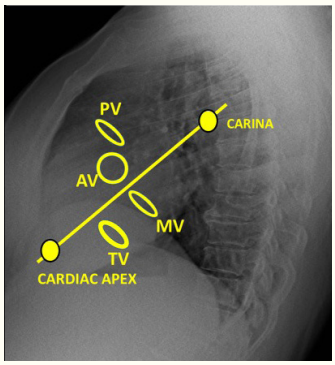
00:36:53 ----- Active space -----

Prosthetic Cardiac Valves :



PA view

From above to below :
PV : Pulmonary valve
AV : Aortic valve
MV : Mitral valve
TV : Tricuspid valve

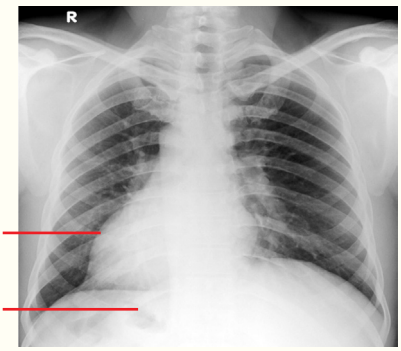


Lateral view

Dextrocardia with Situs Inversus :

A/W Kartagener syndrome.

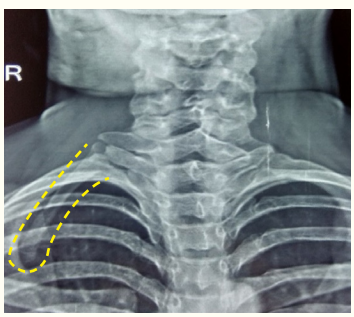
- Dextrocardia.
- Situs inversus.
- Ciliary dysfunction :
  - Recurrent infections.
  - Bronchiectasis.
  - Infertility.



Dextrocardia with situs inversus

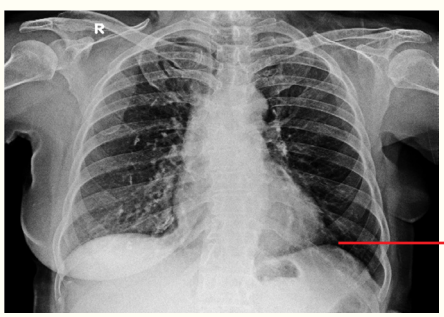
Cervical Rib :

- Articulates with transverse process of cervical vertebra.
- A/W thoracic outlet syndrome :
  Compression of subclavian vessels b/w cervical rib & 1st rib → Upper limb ischemia.

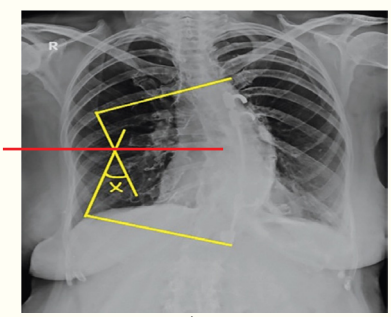


Cervical rib

Post Mastectomy CXR :



Scoliosis :



Cobb's angle
Used to quantify scoliosis

----- Active space -----

Pneumoperitoneum :

	Pneumoperitoneum	Pseudopneumoperitoneum
X-ray features	Free air below dome of diaphragm	Air in bowel loop (Chilaiditi sign)
Cause	Hollow viscus perforation	Colon trapped b/w liver & diaphragm
Rx	Laparotomy	-
X-ray image		

Note : Chilaiditi syndrome → Chilaiditi sign + pain.

Differential Radiographic Density Signs

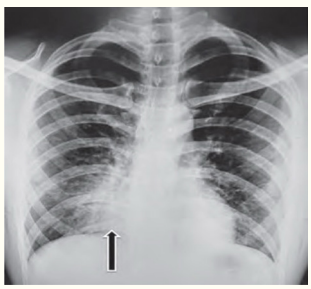
00:46:53

- Sharp borders visualized b/w structures of different radiographic densities.
- Radiographic densities in ↑order : Air < Fat < Water < Bone < metal.

Silhouette Sign :

Positive silhouette sign : Inability to visualize a sharp border d/t adjacent structures having same radiographic density.

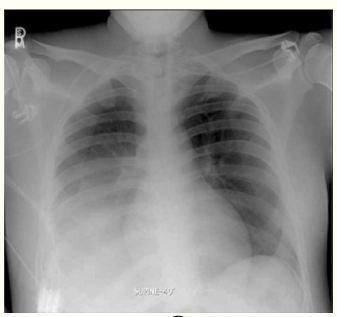
Structure obscured	Lobe involved
Ⓡ upper mediastinal border	RUL (Anterior segment)
Ⓡ heart border	RML
Ⓡ dome of diaphragm	RLL > RML
Aortic knuckle	LUL (Apicoposterior segment)
Lateral margin of descending thoracic aorta	LLL (Superior/posterobasal segment)
Ⓛ heart border	Lingular segment of LUL
Ⓛ dome of diaphragm	LLL



Positive silhouette sign : Ⓡ heart border obscured d/t RML consolidation

Loss of Ⓛ dome of diaphragm : LLL (Ⓛ heart border ⊕)

Loss of Ⓡ upper mediastinal margin : RUL anterior segment



Loss of Ⓡ dome of diaphragm : RLL (Ⓡ heart border ⊕)

Loss of Ⓛ heart border : Lingular segment of LUL

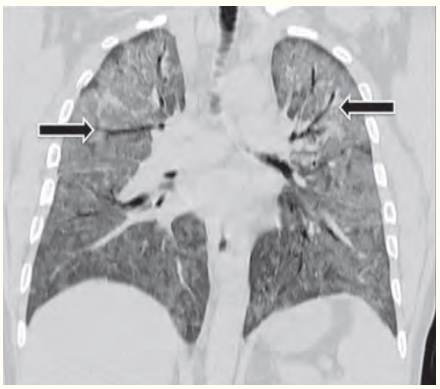
----- Active space -----

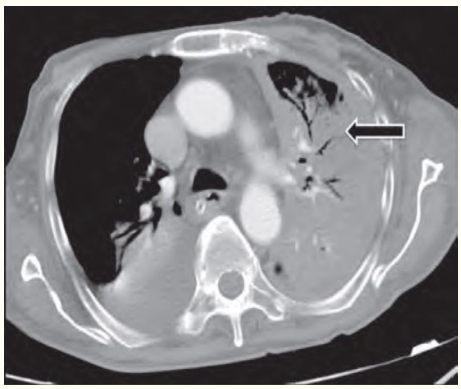
Air Bronchogram Sign :

Black branching lines (Air density) against the opacity of consolidation (Water density).

Causes :

- Infective consolidation (m/c).
- Pulmonary edema.
- Interstitial lung disease.
- Bronchoalveolar Ca (Low grade lung Ca).
- Pulmonary lymphoma.
- Pulmonary infarct.
- Pulmonary hemorrhage.





----- Active space -----

RESPIRATORY IMAGING : PART 2

Pneumonia

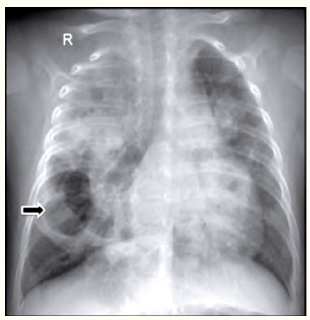
00:00:53

Staphylococcal Pneumonia :

History : Fever, cough + expectoration, breathlessness, on antibiotics.

X-Ray : Single/multiple pneumatoceles (Air-filled cysts).

Differentials : Staphylococcus, pneumocystis (In HIV +ve).



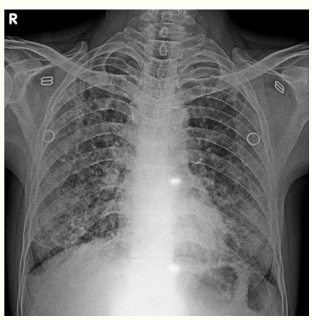
Staphylococcal pneumonia showing pneumatocele

Atypical/Mycoplasma Pneumonia :

History :

- ↓prominent symptoms of LRTI.
- ↑constitutional symptoms.

X-Ray : Reticulonodular pattern of consolidation.



Atypical pneumonia

Legionella Pneumonia :

History :

- Acute oubreak 2-8 days after an indoor gathering (Spreads through contaminated water in coolers/AC).
- Signs of LRTI.
- GIT involvement : Nausea, vomiting, loose stools.
- CNS involvement : Headache, confusion, lethargy.
- Electrolyte imbalance.

X-ray : B/L multifocal involvement.

Legionella pneumonia

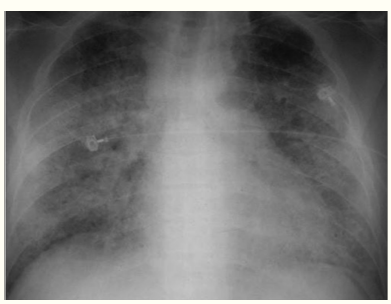
Pneumocystis Pneumonia :

History :

- K/C/O HIV (CD4 <200 cells/mm^3).
- Insidious dyspnea, non productive cough.

X-Ray : Reticular central opacities + pneumatoceles.

HRCT : Central perihilar ground glass opacities (GGO).



Pneumocystis pneumonia

Cavitatory Lesions

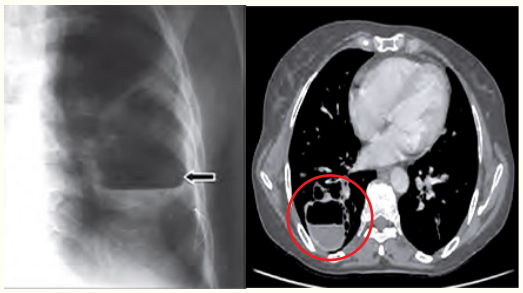
00:06:39 ----- Active space -----

Lung Abscess :

History :

- Unconscious chronic alcoholic.
- Aspiration followed by cough + expectoration, high grade fever.

Imaging : Cavitatory lesion + air-fluid level.



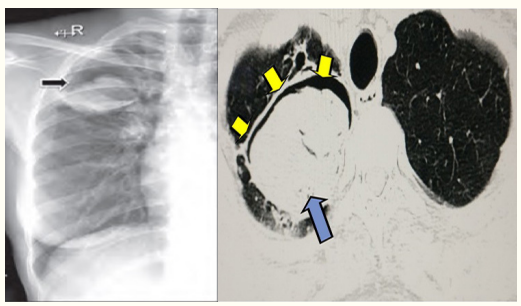
Lung abscess showing air-fluid

Aspergilloma :

History :

- Past h/o tuberculosis.
- Asymptomatic/occasional cough + hemoptysis.

Imaging : Monod sign → Lung cavity with mobile dependent contents.



Aspergilloma : Monod sign

Note :

Air crescent sign : Seen is invasive aspergillosis.

Pediatric Imaging

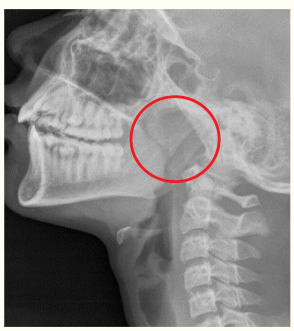
00:09:08

Enlarged Adenoids :

History : Child with 2 episodes of otitis media, persistent rhinorrhoea & nasal congestion.

X-Ray : ↑adenoid size in posterosuperior nasopharynx.

Ⓝ Adenoids



Enlarged adenoids with narrow nasopharyngeal airway

Acute Epiglottitis :

History :

- 4 yr old child with h/o H. influenza B infection.
- C/O fever, altered voice, difficulty in speaking, inspiratory stridor.

X-Ray : Thickened epiglottis (Thumb sign).

Ⓝ epiglottis

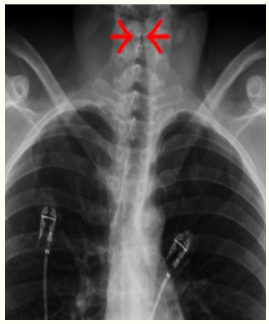
Acute epiglottitis : Thumb sign

----- Active space -----

Croup/Acute Laryngotracheobronchitis :

History : Child with protracted barking cough + inspiratory stridor.

X Ray : Steeple sign (Subglottic area resembles a steeple instead of dome).



Croup : Steeple sign

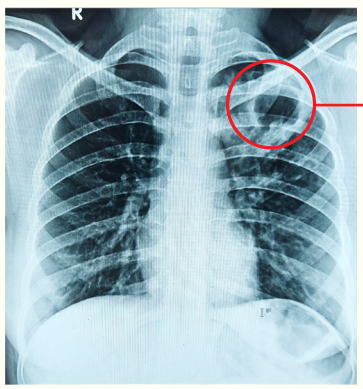
Ⓝ dome-shaped subglottic area

Tuberculosis

00:12:54

Post Primary TB :

m/c type in adults.



X-Ray

Cavitation (Never seen in 1° TB) + surrounding consolidation.

HRCT

Tree-in-bud appearance :

- D/t endobronchial spread of disease.
- Not specific to TB.

Miliary TB :

- Multiple, tiny nodules of 1-3 mm size.
- Diffusely scattered in B/L lungs d/t hematogenous spread.

X-Ray

HRCT

Note : Causes of miliary nodules.

Infections	• TB (m/c cause in India) • Varicella • Blastomycosis • Coccidiomycosis • Cryptococcosis	Pneumoconiosis	• Silicosis • Coal worker's pneumoconiosis
		Allergic	• Hypersensitivity pneumonitis • Loeffler's syndrome
Neoplasms	• Lymphangitis carcinomatosa • Metastasis • Lymphoma • Leukemia	Cardiac causes	• Chronic pulmonary edema • Chronic mitral stenosis
		Others	• Sarcoidosis • Alveolar microlithiasis

----- Active space -----

Eponyms in TB :

	Meaning
Ghon's focus/lesion	Pulmonary parenchymal evidence of 1° TB infection.
Ghon's complex	Ghon's focus + lymphatics + hilar lymph nodes.
Ranke's complex	Calcified ghon's complex.
Simon's complex	Apical lung nodule d/t hematogenous spread.
Assman's complex	Reactivated Simon's complex.
Puhl's lesion/Aschoff Puhl reinfection	Chronic pulmonary TB involving lung apex.
Weigert focus	Caseating focus in pulmonary venous wall.
Rasmussen's focus	Pulmonary artery aneurysm close to TB lesions.

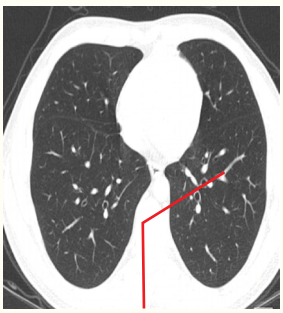
COVID-19

00:20:07

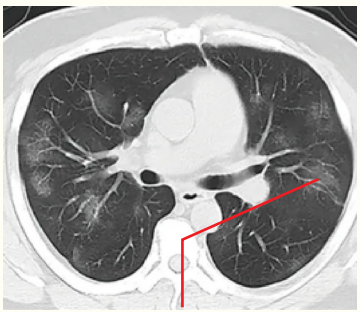
- IOC (Overall) : RT-PCR.
- Imaging IOC : HRCT.
- 1st imaging investigation : CXR.

HRCT Findings :

- Peripheral, multifocal GGO.
- Reverse halo/Atoll sign.

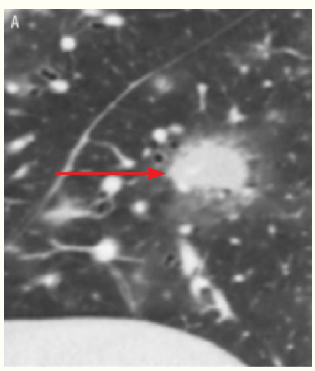


Normal lung on HRCT
Deep grey with white lines & dots d/t the blood vessels

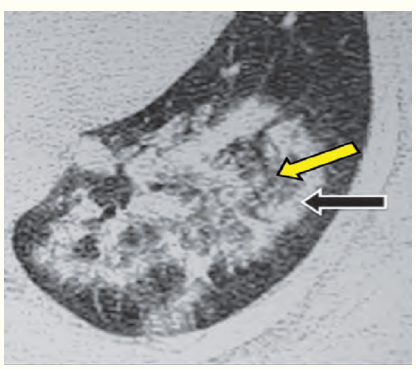


Ground glass opacity
Hazy increase in density with visible blood vessels.

Consolidation :
Markedly increased density with obscured blood vessels & visible air bronchograms



Halo sign :
Central consolidation + peripheral halo of GGO ⟶ Invasive aspergillosis.



Reverse halo/Atoll sign :
Central GGO + Peripheral rim of consolidation ⟶ COVID, organising pneumonia.

----- Active space -----

CT Involvement Score :

Assess extent & severity of lung involvement.

Assess the % of each lung lobe involved		Scoring scale
Lung lobe	Score	• No involvement : 0 (minimum) • <5% : 1 • 5–25% : 2 • 25–50% : 3 • 50–75% : 4 • >75% : 5 (maximum).
Right upper lobe	0–5	
Right middle lobe		
Right lower lobe		
Left upper lobe		
Left lower lobe		
Total score	0–25	

CORADS (Covid-19 Reporting and Data System) :

To predict the probability of covid-19 infection.

Type	Chance of infection	CT findings
CORADS 1	Highly unlikely	Normal CT
CORADS 2	Unlikely	Effusion/lymphadenopathy (Not seen in covid)
CORADS 3	Equivocal	Single central GGO
CORADS 4	Probable	Few GGO
CORADS 5	Highly likely	Peripheral multifocal GGO
CORADS 6	100%	RT-PCR positive (Irrespective of CT findings)

Pleural Effusion

00:27:55

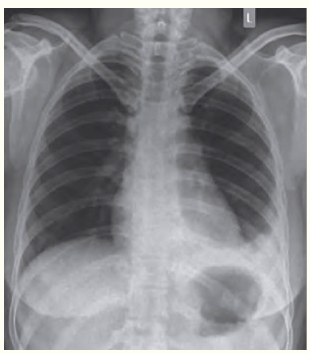
Best CXR view : Lateral decubitus.

IOC : USG

Typical Findings :

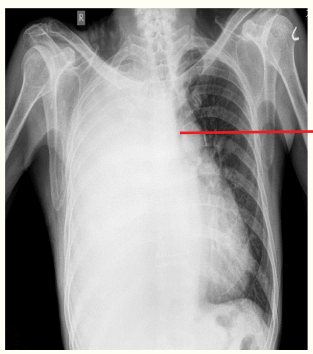
Blunting of CP angle :

- Earliest sign on CXR.
- Signifies 200–300 cc of fluid.



Pleural meniscus sign :

↑ fluid → Fluid settles & forms meniscus.



Opaque hemithorax/white out lung :

- D/t large effusion.
- IOC : CECT.
- 1st investigation : CXR.

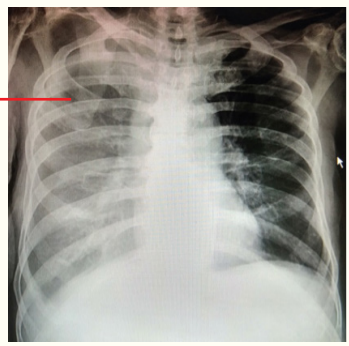
Note : D/D for for opaque hemithorax.

----- Active space -----

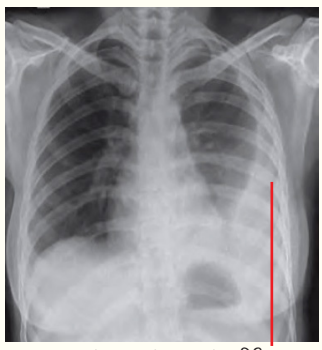
D/D	Effect on mediastinum
Massive pleural effusion	Pushed to opposite side
Lung collapse	Pulled towards affected side
Consolidation	No shift

Atypical Findings :

Apparent ↑ in density :
- Vascular markings ⊕.
- Hilar shadows ⊕.

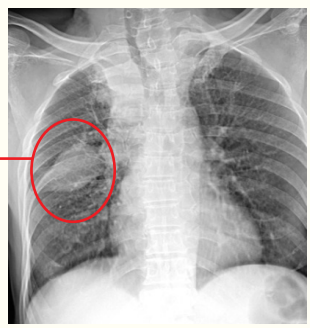


1. Pleural effusion in A-P view (Supine position)



2. Lamellar pleural effusion

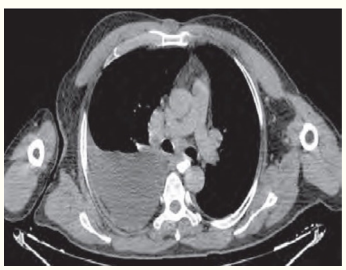
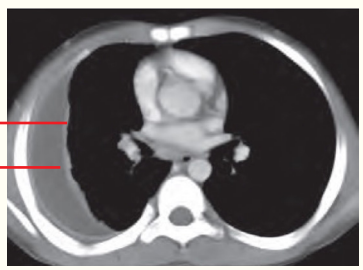
- Mass like opacity in Ⓡ middle zone (D/t fluid accumulation in horizontal fissure).
- Disappears on treating heart failure (In 72 hrs).
- AKA vanishing/phantom lung tumor.



3. Loculated/fissural PE :

C/F : Elderly male with congestive heart failure (Exertional dyspnea, basal crepitations, bipedal edema)

Pleural Effusion vs Empyema :

	Plural effusion	Empyema
Fluid distribution	In dependent area	Along thoracic wall
Enhancement	⊖	⊕ d/t pus → Split pleura signs
Clinical Features	Cough, mild breathlessness	↑grade fever, ↑TLC
		Visceral pleura Parietal pleura  Split pleura sign

----- Active space -----

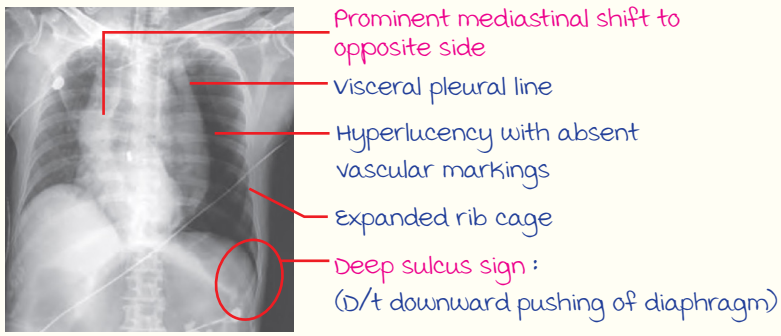
Pneumothorax

00:37:00

Definition : Air within the pleural cavity.

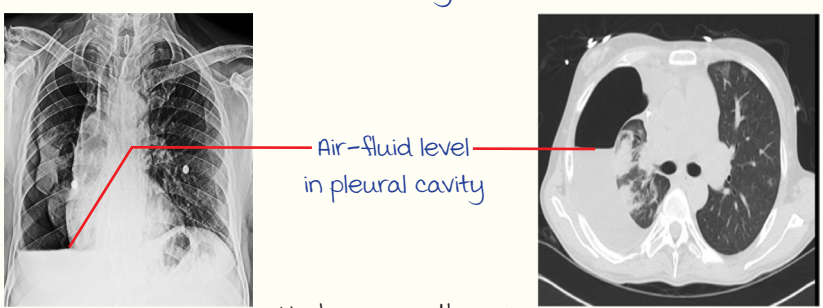
C/F :

- Mechanical ventilation ⊕.
- Hypoxia.
- Tachycardia.
- Hypotension.
- ↑JVP.



Tension pneumothorax

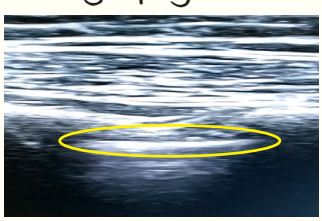
- Best CXR view : Expiratory CXR.
- IOC : CT.
- Rx : Needle thoracocentesis followed by intercostal drain tube insertion.
  - Children : 2nd ICS in midclavicular line.
  - Adults : 5th ICS anterior to midaxillary line.



Hydropneumothorax

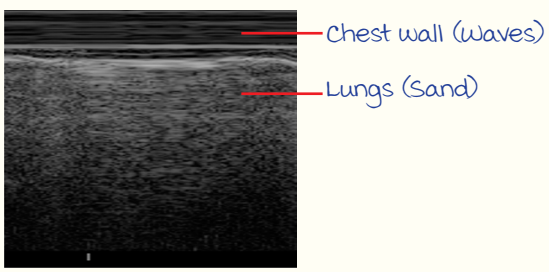
USG Assessment – POCUS (Point of Care Ultrasonography) :

1. Sliding pleural line :
   - Normal : Sliding movement of pleural line with respiration.
   - Pneumothorax : No sliding pleural line.

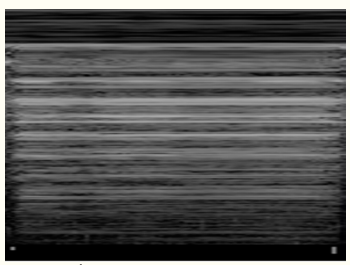


Pleural line

2. M mode :



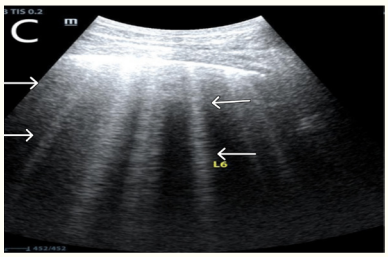
Seashore sign : Normal



Stratosphere/Barcode sign in pneumothorax

3. B-lines & A-lines :

----- Active space -----



B-lines (Vertical) : Normal

A-lines (Horizontal) in pneumothorax

Lobar collapse

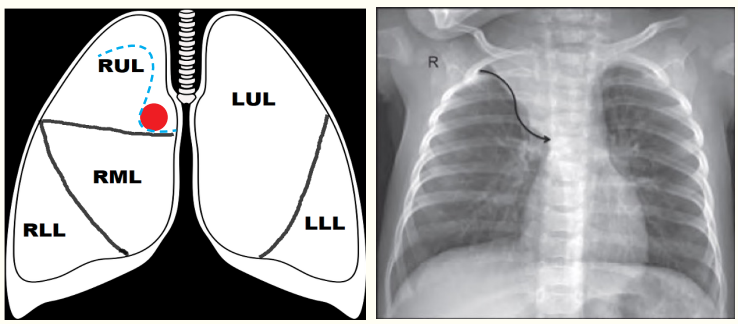
00:46:10

RUL collapse :

Upward collapse → Pulls horizontal fissure up.

Golden S sign :

At central mass lesion
- → RUL collapse → Lateral concavity.
- → Mass in RUL → Medial convexity.

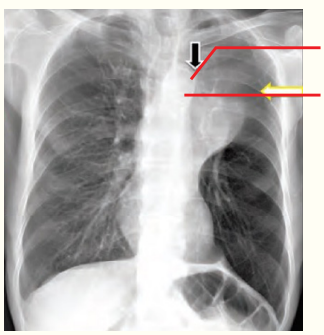


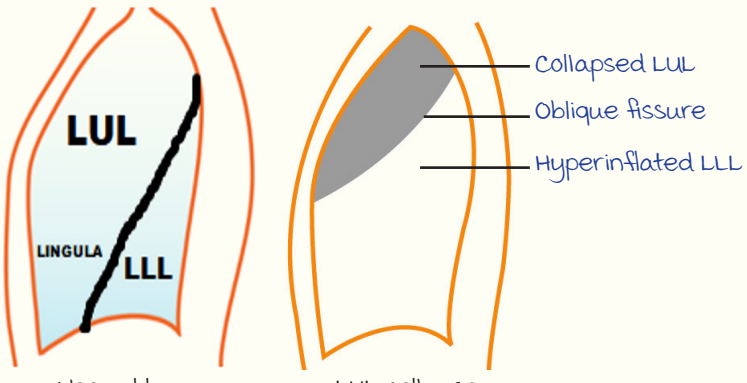
Golden S sign

LUL collapse :

Collapse forwards → Pulls oblique fissure forwards.

Luftsichel sign : Aortic knuckle lined by superior segment of hyperinflated LLL.





Normal lung LUL collapse

----- Active space -----

Mediastinal Imaging

00:48:55

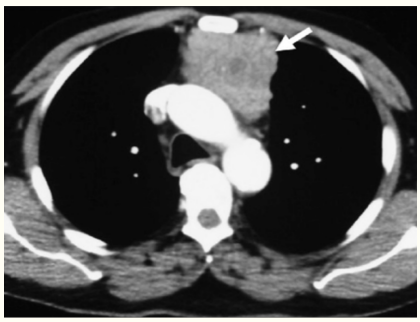
MEDIASTINAL MASSES

First investigation : CXR.

IOC : CECT scan.

Thymoma :

- Overall m/c mediastinal mass lesion.
- m/c anterior mediastinal mass lesion.



Thymoma :
A/w myasthenia gravis

Middle Mediastinal Lesions :

- m/c : Lymphoma.
- m/c in children : Foregut duplication cysts (Bronchogenic cysts).

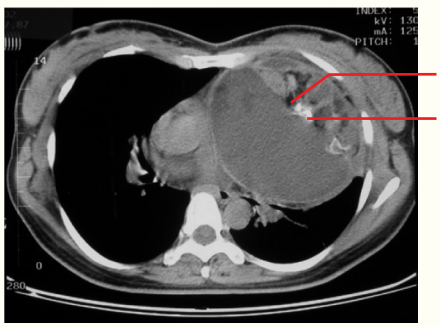
Posterior Mediastinal Lesions :

m/c : Neurogenic tumors.

Anterior Mediastinal Lesions :

Mnemonic : 4T

1. Thymoma.
2. Teratoma.
3. Terrible lymphoma.
4. Thyroid lesions.



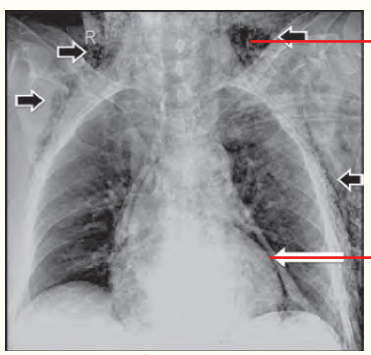
Teratoma

PNEUMOMEDIASTINUM

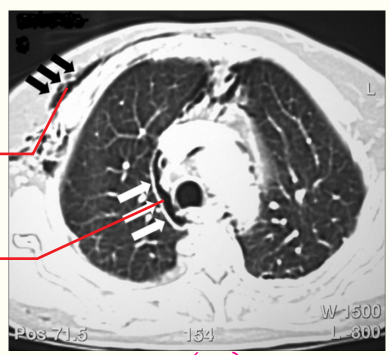
Clinical Features :

- H/o chest trauma/neck surgery (Causing tracheal or esophageal injury).
- Chest discomfort.
- Crepitations over neck/chest wall (D/t air specs).

Investigations :



CXR (PA view) : Initial investigation



CT (IOC)

Signs :

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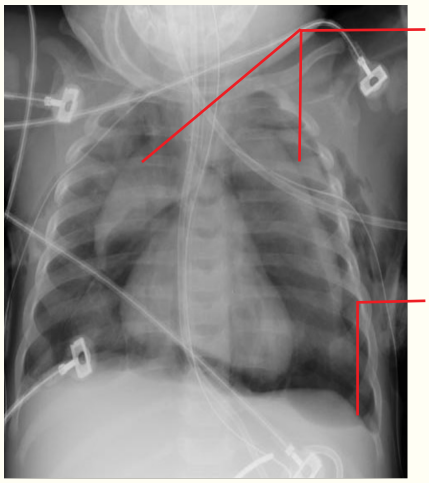
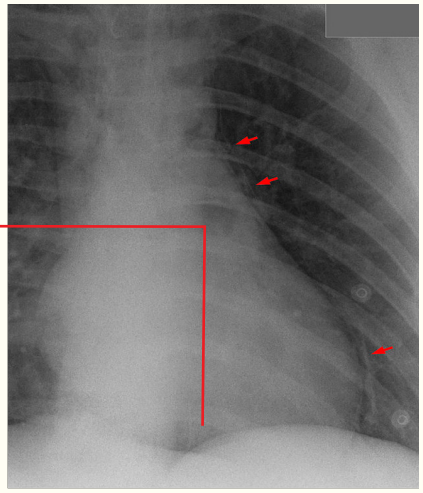


1. Spinnaker sail/ Angel wing sign : Sharp margins of lifted lobes of thymus (D/t air in mediastinum)

2. Continuous diaphragm sign : D/t air between heart and diaphragm.

3. Naclerio's V-sign : Lucency of air on left side outlining lateral margin of descending thoracic aorta and medial margin of hemidiaphragm.



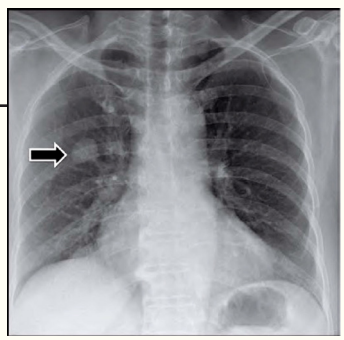
Lung Lesions

00:53:30

SOLITARY PULMONARY NODULE (<3 CM)

IOC : CECT > PET CT.

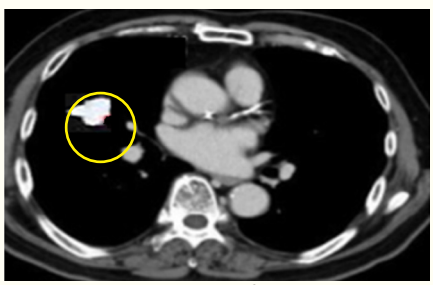
Chest X-ray : 1st investigation.



Pulmonary Hamartoma :

A/w Carney's triad :

- Multiple hamartomas.
- Gastro Intestinal Stromal Tumors (GIST).
- Functional extra-adrenal paragangliomas.



Popcorn calcification

LUNG TUMORS

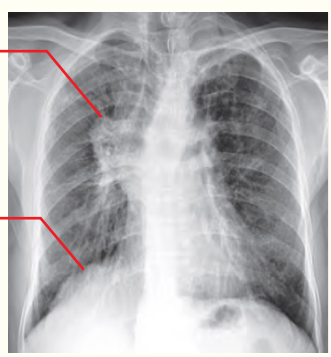
Initial investigation : Chest X-ray.

IOC : CECT.

Exception : Pancoast tumor (IOC : CE-MRI).

Corona radiata appearance : Spiculations into adjacent lung tissue

Elevated right hemidiaphragm (D/t phrenic nerve involvement)



----- Active space -----

Pancoast Tumor :

Clinical features :

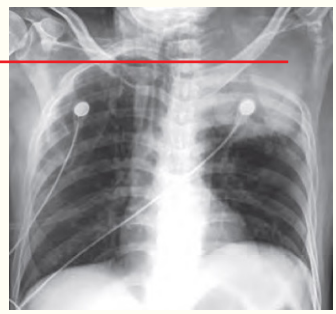
Common in elderly male smokers.

Presentation

- Cervical sympathetic ganglion involvement → Ipsilateral horner's syndrome :
  - Ptosis.
  - Anhydrosis.
  - Miosis.
- Brachial plexus nerve roots involvement → Ipsilateral upper limb pain, paresthesia, weakness.
- Cough + hemoptysis.

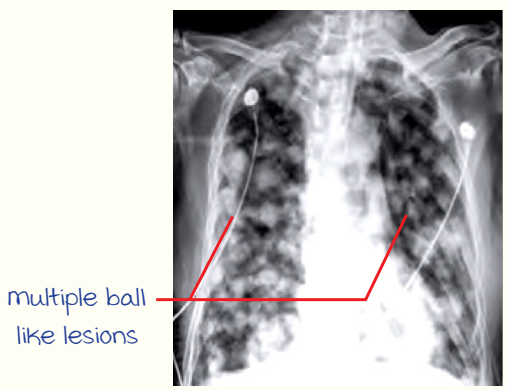
Investigations :

IOC : CE-MRI (To visualize neural invasion).



Cannonball Lung Metastasis :

- Ball-like secondary metastasis tumors in lung.
- Metastasize from aggressive primary tumors :
  - Renal cell carcinoma (m/c).
  - Scrotal mass (Eg. : Germ cell tumor).
  - Prostate cancer.
  - Endometrial carcinoma.



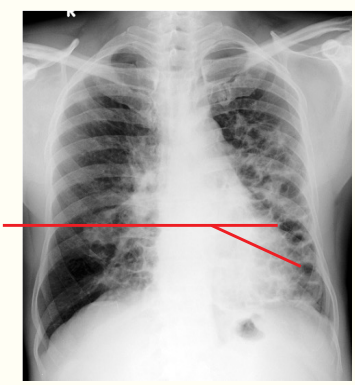
BRONCHIECTASIS

Clinical Features :

- Persistent cough + intermittent hemoptysis in a middle aged female.
- Recurrent chest infections.

Investigations :

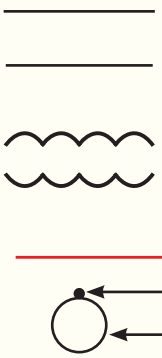
IOC : HRCT.



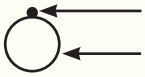
CXR

Signs :

1. Tram-track sign : Longitudinal dilatation.
2. String of beads sign : Varicose dilatations in long axis.
3. Cluster of grapes sign.
4. Signet ring sign.



CT



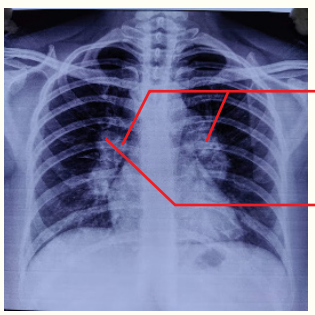
----- Active space -----

SARCOIDOSIS

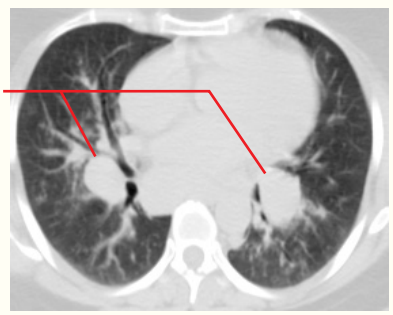
Clinical Features :

- Mild cough in a middle aged female.
- Increased ACE levels.

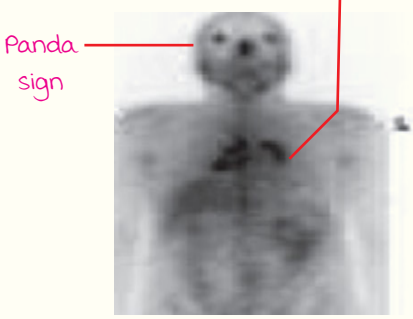
Investigations :



X-ray



CT



Gallium scan

Foreign Body Aspiration

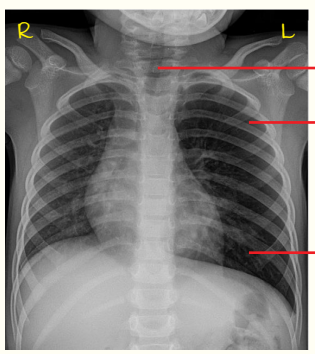
01:00:39

Acute onset respiratory distress (Usually in children).

Foreign body - Peanut :

- m/c aspirated foreign body.
- It is not radio-opaque.

Management : Bronchoscopy.



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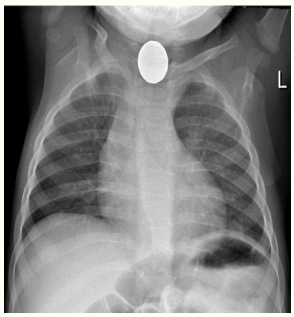
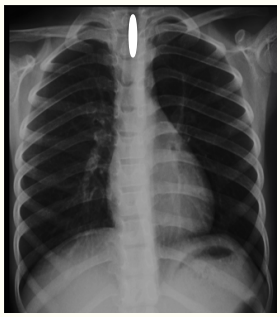
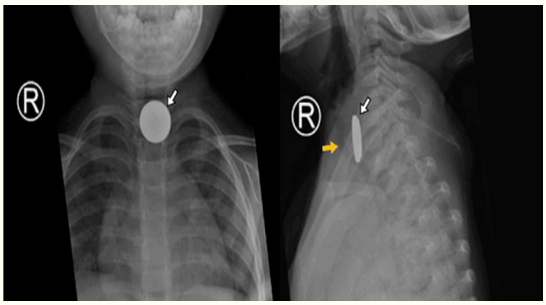
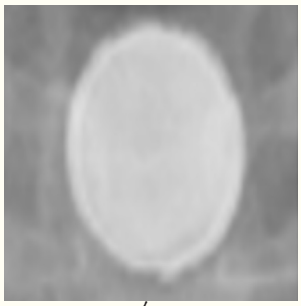
Foreign Body – Coin :

	Coin in esophagus	Coin in trachea
X-ray		
Plane of orientation	Coronal	Sagittal (D/t glottic folds and tracheal rings)
Appearance	Coin en face	Slit-like
Respiratory distress	Absent	Present
Management	Esophagoscopy	Bronchoscopy

Foreign Body – Button Battery :

Very dangerous, needs immediate intervention (Bronchoscopy/esophagoscopy).





Double ring/halo sign :

- Outer ring : Cathode.
- Inner ring : Anode (more damaging).

step-off sign

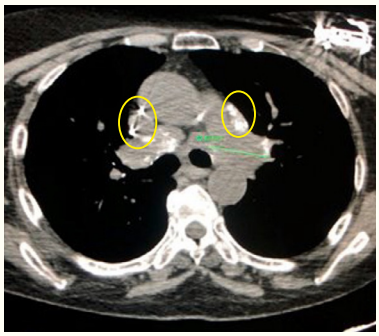
Egg-Shell Calcification

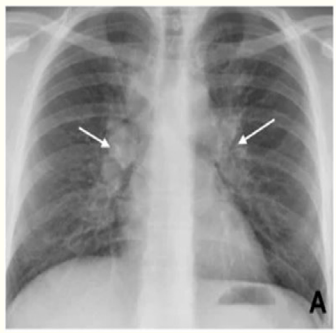
01:05:01

Causes :

mnemonic : SLAB of calcium.

- Sarcoidosis.
- Scleroderma.
- Silicosis.
- Lymph nodes post radiation.
- Amyloidosis.
- Blastomycoses.
- Coal worker's pneumoconiosis.





CARDIOVASCULAR AND NEUROLOGICAL IMAGING

----- Active space -----

Congenital Heart Conditions

00:00:08

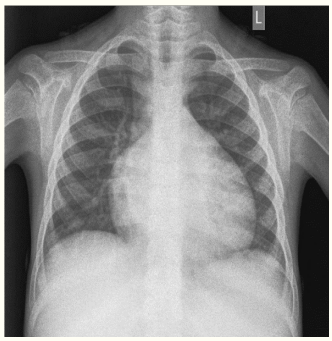
Transposition of great arteries (TGA)

Egg on side appearance

Tetralogy of Fallot

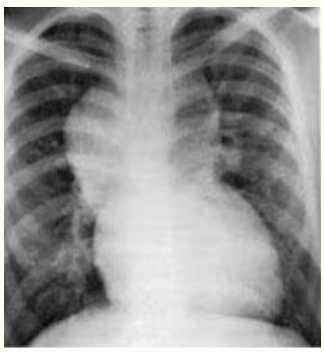
Boot shaped heart/ Coeur-en-sabot appearance

Ebstein's anomaly



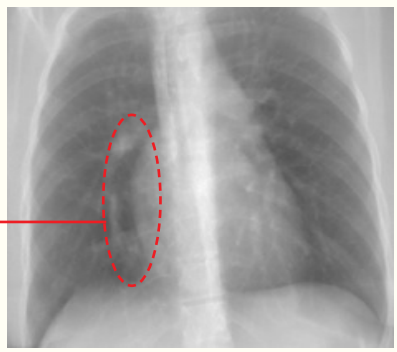
Box shaped heart

Total anomalous pulmonary venous circulation – Supracardiac type



Snowman/Figure of 8 appearance

Partial anomalous pulmonary venous circulation



Turkish sword/Scimitar sign

Scimitar/hypogenetic lung syndrome :

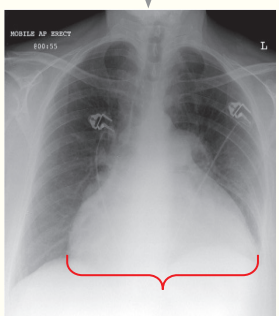
- Right lung hypoplasia.
- Hypoplastic pulmonary artery with anomalous supply from aorta.
- Scimitar vein : Anomalous vein draining into IVC.

----- Active space -----

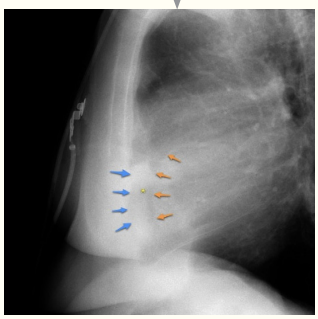
Pericardial Effusion

00:01:18

X-ray (Initial investigation) :



Water bottle/
money-bag/
flask shaped heart



Oreo cookie sign on lateral CXR : Effusion separating pericardial & epicardial fat

Echocardiography (IOC) :

Fluid surrounding heart

Coarctation of Aorta

00:03:41

m/c site : Distal to the site of origin of subclavian artery.

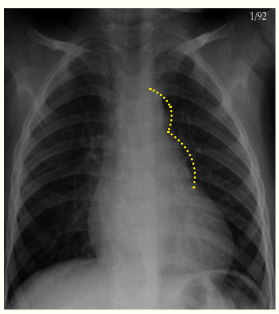
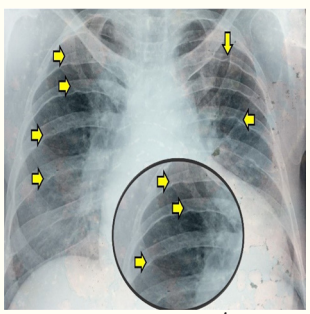


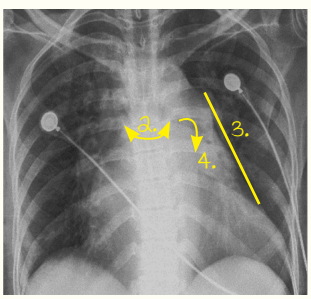
Figure of 3 sign

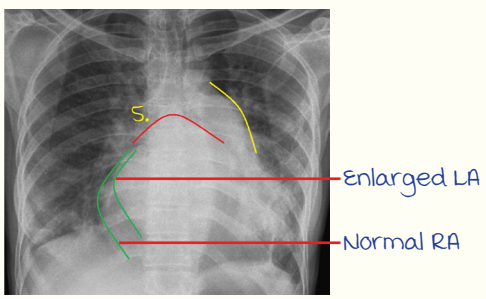


Inferior rib notching sign/Roesler's sign

Mitral Stenosis

00:04:42





Chest X-ray

Chest X-ray findings : D/t left atrial enlargement.

1. Fullness beneath the pulmonary artery shadow : Earliest finding.
2. Elevated left bronchus + splaying of carina >90°.
3. Straightening of left heart border.
4. Third mogul sign : Aorta + main pulmonary artery + Left Atrial (LA) appendage.
5. Double density sign : LA enlargement.
6. Walking man sign (Seen in lateral view) : Left bronchi pushed posteriorly.

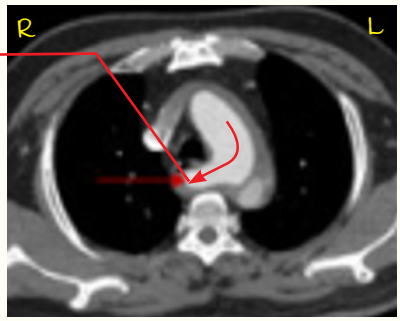
Echocardiography : IOC.

Aberrant Right Subclavian Artery (ARSA)

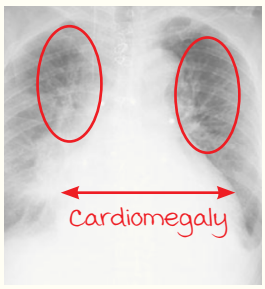
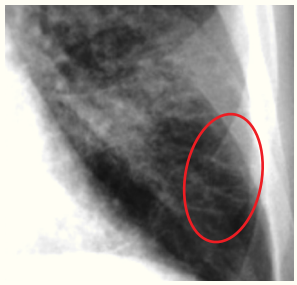
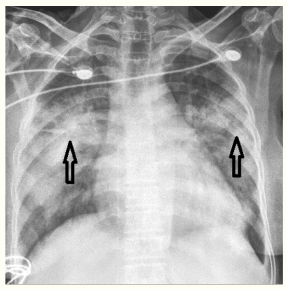
00:06:38 ----- Active space -----

AKA Arteria lusoria.

Right subclavian artery : Arises from distal part of aortic arch → Compresses esophagus → Dysphagia lusoria.



Congestive Heart Failure :

	Stage 1	Stage 2	Stage 3
PCWP	13–18 mmHg	18–25 mmHg	>25 mmHg
X-ray	 • Cephalization of blood flow/Stag antler sign/ Hands up sign/Inverted moustache sign	 • Interstitial edema • Kerley B line	 • Alveolar edema • Bat-wing opacities (Central perihilar opacities)

Aortic Dissection

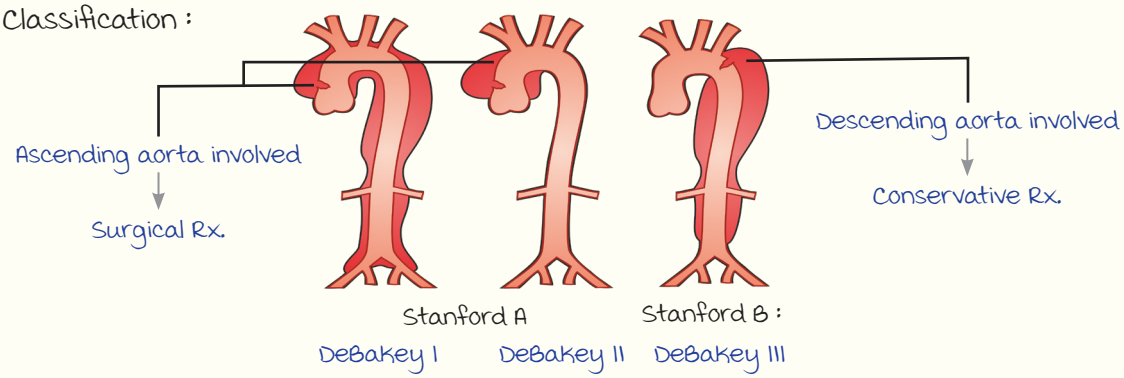
00:10:18

Presentation : K/c/o hypertension + severe tearing pain in lower chest/abdomen.

Investigations :

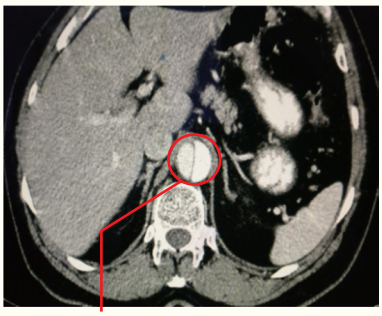
- Emergency : Transesophageal echo (TEE).
- IOC : CT angiography > MR angiography.
- Gold standard : Invasive angiography.

Classification :

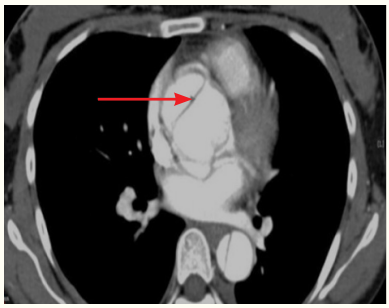


----- Active space -----

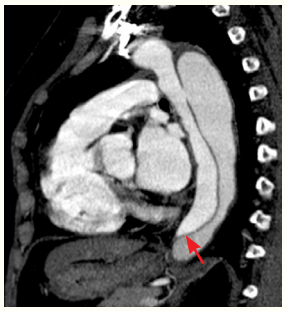
CT findings :



Intimal flap : Divides lumen into true & false lumen



Cobweb sign



Beak sign

Aortic Aneurysm

00:12:47

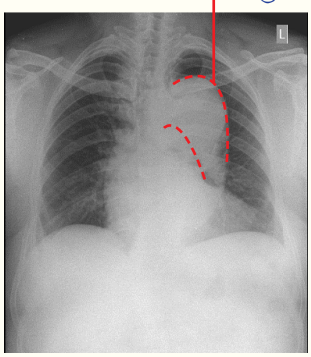
Diagnostic criteria :

- Absolute
  - Ascending aorta : >5 cm in diameter.
  - Descending aorta : >4 cm in diameter.
  - Abdominal aorta : >3 cm in diameter.
- Relative : >50% enlargement of lumen.

m/c site : Abdominal aorta (Infrarenal part).

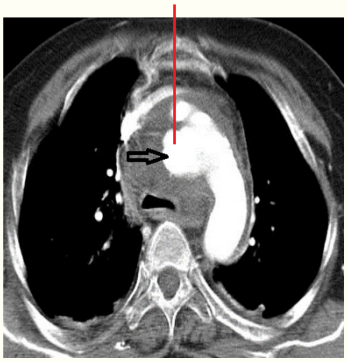
Imaging :

Non-specific mediastinal widening

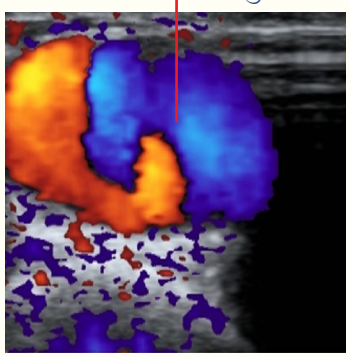


CXR

Focal saccular dilatation in aortic arch → Turbulent blood flow within the aneurysm



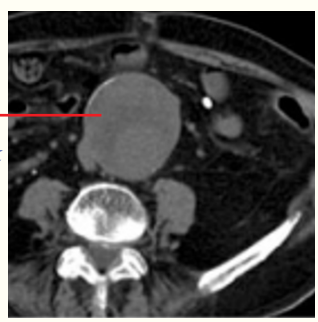
CT



Yin & Yang sign

Signs of impending rupture :

Crescent sign : Hyperdense blood clot



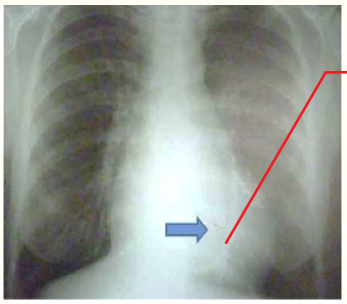
Draped aorta sign : Aorta draped around vertebral body

----- Active space -----

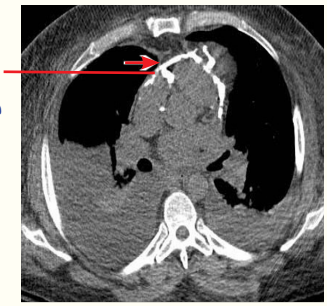
Constrictive Pericarditis :

Presentation : Dyspnea/orthopnea/hepatomegaly + ascites.

Imaging :



Rim of calcification around pericardium



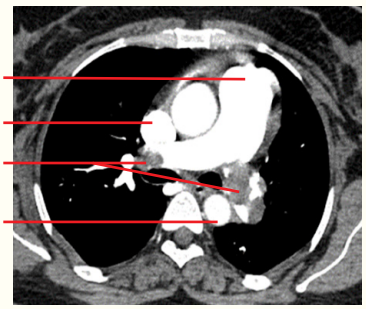
Pulmonary Embolism (PE)

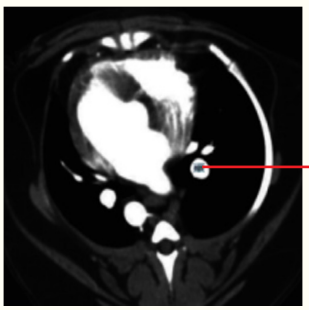
00:15:24

Presentation : Young + prolonged immobilization + acute breathlessness + chest pain + hemoptysis.

ECG : S1 Q3 T3 (Right ventricular overload).

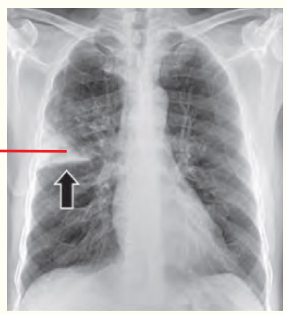
Imaging :





Polo mint sign : Central filling defect in artery

- Pulmonary signs :
  a. Hampton's hump : Wedge-shaped pulmonary infarct.
  b. Melting ice cube sign : Pulmonary infarct resolution from periphery to center.
- Vascular signs :
  a. Fleischner's sign : Enlarged Ⓡ main pulmonary artery (PA).
  b. Palla's sign : Enlarged Ⓡ descending PA.
  c. Chong's/Knuckle sign : Enlarged Ⓡ descending PA with abrupt cut off.
- Westermark sign : Focal oligemia in lung fields.



Investigations :

- D-dimer test : Screening test.
- CT angiography : IOC.
- V/Q scan : Not used.
- Invasive pulmonary angiography : Gold standard.

----- Active space -----

Agatston score (Screening) :

- Done on NCCT (Before coronary CT angiography).
- Semiquantitative method.
- Assesses calcium burden on coronary arteries.

Score

<100 : Good | 101–400 : Moderate. | >400 : Heavily calcified (Poor prognosis).

Neurological Imaging

00:20:00

CT vs. MRI

	CT	MRI
Indication	Acute neurological presentations (Requiring immediate intervention).	• IOC for most neurological abnormalities. • Disadvantage : ↑imaging time.
Application	• Acute stroke • Head trauma.	• Brain tumor. • Multiple sclerosis. • Child with developmental delay/mental retardation. • To evaluate h/o convulsions (1 wk ago).

Imaging in Stroke

00:22:56

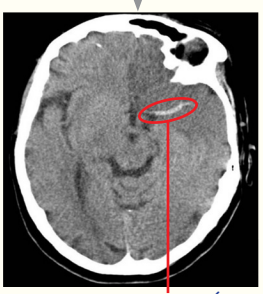
Indication	Investigation
Acute stroke	1st Ix : CT (To rule out hemorrhage)
Acute infarct	DWI MRI : Earliest diagnosis (Detectable 15–30 mins from onset)
Penumbra identification	Perfusion weighted : CT/MRI
Vascular imaging	TOF : MR angio > CT angio
Overall best	MRI + DWI

Key :

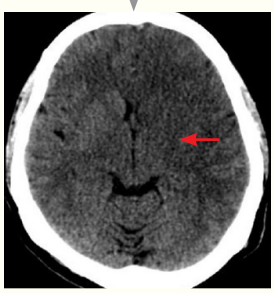
- TIA : Transient Ischemic Attack.
- DW MRI : Diffusion Weighted MRI.
- TOF : Time of Flight.

Hyperacute Stroke (<6 hours) :

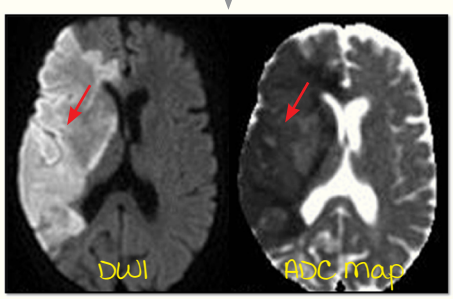
NCCT | DWI



1. Hyperdense MCA (middle Cerebral Artery) sign



2. Disappearing basal ganglia sign

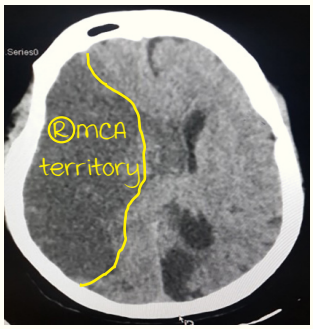


3. DWI with ADC map : Restricted diffusion

Acute Stroke (≥6 hours) :

----- Active space -----

Hemispheric infarct



Basal ganglia infarct

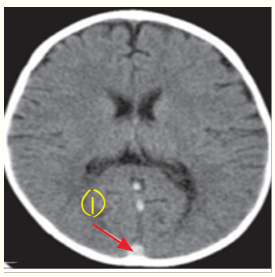
Features :

- Wedge shaped infarct.
- Diffuse hypodensity : D/t vasogenic edema.
- Grey and white matter involved with loss of differentiation.
- Mass effect : D/t edema.
  - Compression of frontal horn of lateral ventricle.
  - Midline shift of parenchyma.

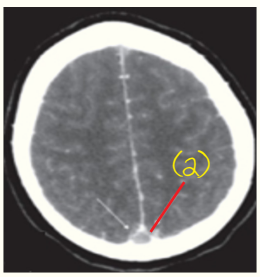
Central Venous Sinus Thrombosis (CVST) :

Presentation : Fever/dehydration/pregnancy + severe persistent headache.

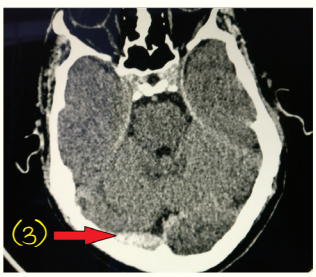
Imaging :



NCCT Brain : Delta sign



CECT Brain : Empty delta sign



NCCT Brain : Cord sign

1. Hyperdense triangular area.
2. Hyperdense walls with hypodense central area.

} Thrombus in superior sagittal sinus.

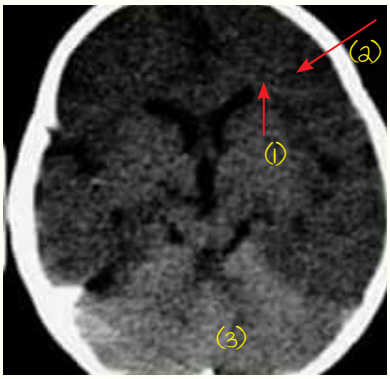
3. Hyperdense cord area → Transverse sinus thrombosis.

Global Cerebral Hypoperfusion (GCH) injury :

- Presentation :
  H/o cardiac arrest/severe hypotension/anoxia/hypoxia + altered sensorium.
- Poor prognosis.

----- Active space -----

Imaging :



CT Brain

1. White matter : Hyperdense.
2. Grey matter : Hypodense.

} Reversal sign.

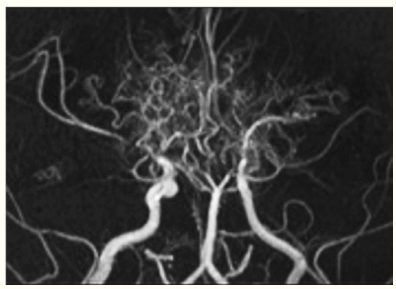
3. White cerebellum sign : Hyperdense cerebellum with respect to cerebrum (D/t relative sparing of posterior circulation).

Moya Moya Disease :

- Presentation : Child + multiple episodes of fainting + Ⓛ hemiplegia + focal neurological deficits.
- Pathology : Progressive narrowing of Internal Carotid Artery (ICA)

↓

Development of numerous collaterals.


MR Angiogram :
Puff of smoke appearance

Hypertensive Bleed

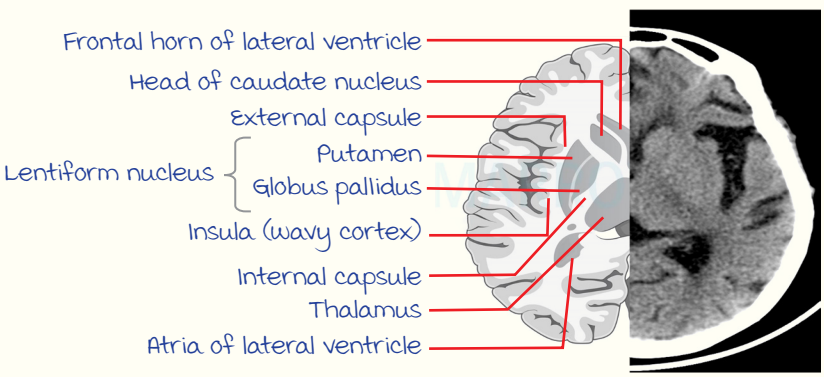
00:36:22

Seen mostly in basal ganglia.
m/c site : Putamen > thalamus > pons.

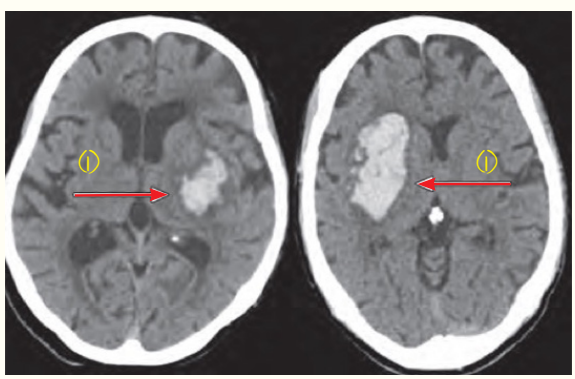
Clinical presentation :

- Uncontrolled hypertension.
- Deviation of eyes + focal deficit + altered sensorium.

Imaging :



Anatomy of the basal ganglia

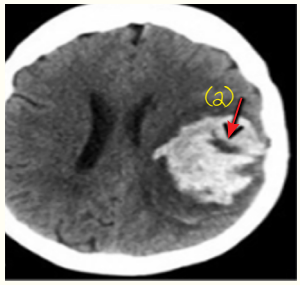


CT brain

(1) : Hyperdense/bright area (D/t bleed) surrounded by rim of hypodense area (D/t edema) in basal ganglia.

(a) : Swirl sign.

- D/t continuous ongoing bleed.
- Hypodense area within the hyperdense bleed (Clot).
- Indicates bleed expansion.



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Subarachnoid Hemorrhage (SAH)

00:39:05

Etiology : Rupture of berry aneurysm (Aneurysm of circle of Willis at basal cistern).

Clinical presentation :

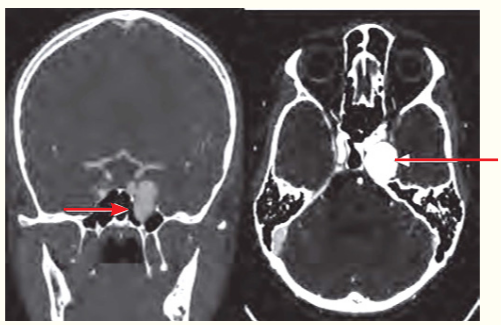
- Middle aged.
- Thunderclap headache (Worst headache of life).
- Altered sensation.

Radiological imaging :

- IOC → CT : Acute SAH.
  → MRI : Subacute/Chronic SAH.
- Gold standard : Digital subtraction angiography.

Note : IOC for berry aneurysm → CT Angiography.

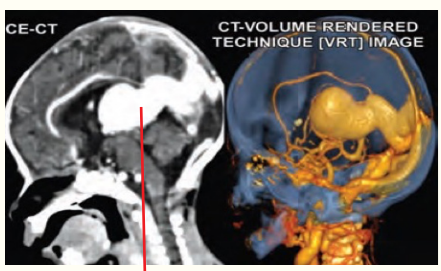
CT brain : Hyperdense basal cisterns



NCCT brain CT angiography

Vein of Galen Malformation :

- Presentation : Newborn male with congestive heart failure.
- O/E : Elevated fontanelles + loud cranial bruit.



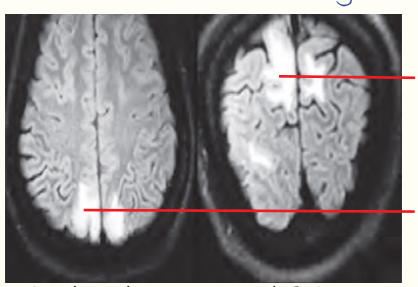
Dilated vein at center of straight sinus

Posterior Reversible Encephalopathy Syndrome :

Clinical presentation :

- Pregnant female with pre-eclampsia.
- Altered sensorium.

Pathology : Transiently affect posterior circulation (Reversible condition).



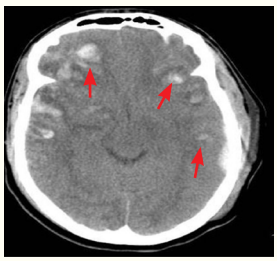
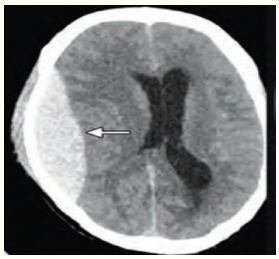
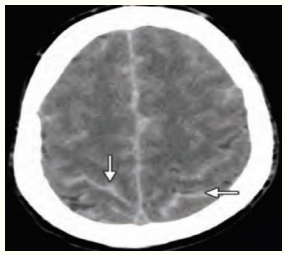
Axial section Coronal FLAIR-MRI

----- Active space -----

CT in Head Trauma & Brain Tumors

00:42:17

CT Interpretation Protocol :

	Hemorrhagic contusion	EDH	SDH	SAH
CT				
Location of bleed	Within brain parenchyma	Outside brain parenchyma	Outside brain parenchyma	Outside (Sulcal space)
Edema	Present	Absent	Absent	Absent
Shape	-	Biconvex	Crescent	Linear
Source	-	Middle meningeal artery	Bridging cortical veins	-
Association	-	• Lucid interval • Talk & die syndrome	-	-

Bleeding Stages on CT :

Intracranial bleed

Acute bleed

Hyperdense

- ↑density d/t clots.

Sub-acute bleeds

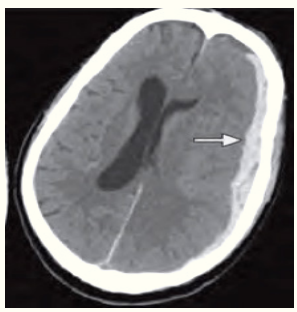
Isodense :

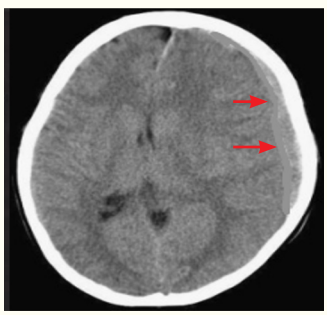
- Few days to weeks.
- ↓density d/t breakdown of clot.
- IOC : MRI.

Chronic bleed

Hypodense :

- Few weeks to months.
- ↓density d/t replacement of blood with fluid.





Diffuse Axonal Injury :

Clinical features :

- H/o head trauma with normal early CT brain.
- Non-improving altered sensorium.

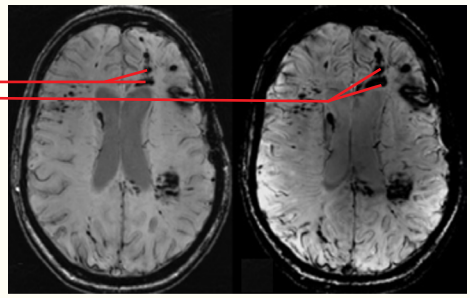
Investigations :

----- Active space -----

MRI (IOC) :

- Detection of petechial hemorrhages at site of axonal injury.
- Use blood sensitive sequences → Gradient echo images (GRE).
  → Susceptibility weighted imaging (SWI).
  Blood appears as
- Black spots

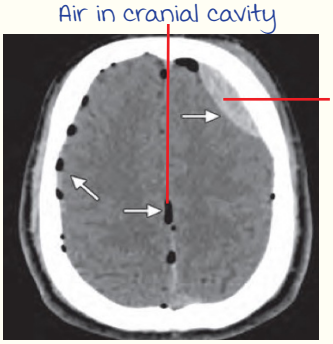
  Sites :
  - Gray-white matter junction (GWJ) : m/c.
  - Corpus callosum.
  - Brain stem.



SWI

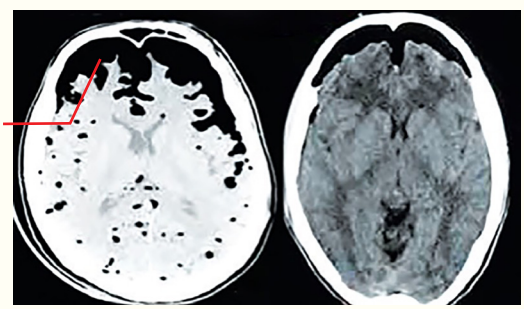
Tension Pneumocephalus :

- m/c cause : Trauma, post neurosurgery.
- Presentation : Asymptomatic/headache/↑ICT/bruit hydroaerique (Splashing sound on head movement).
- CT Imaging :



Pneumocephalus

Compression of brain d/t high pressure of air pockets
↓
Mount Fuji sign/ Peaking sign


Tension pneumocephalus

Brain Tumors

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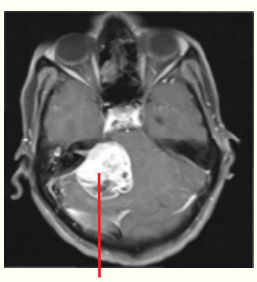
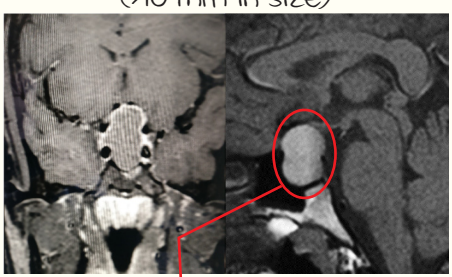
Acoustic/vestibular schwannoma :



Icecream cone appearance :

- Tumor at cerebello-pontine angle with extension into internal auditory meatus.

Pituitary macroadenoma (>10 mm in size)



Snowman/figure of 8 appearance :

- Bilobed tumor with constriction in sellar & suprasellar region.

Pituitary microadenoma (<10 mm in size)

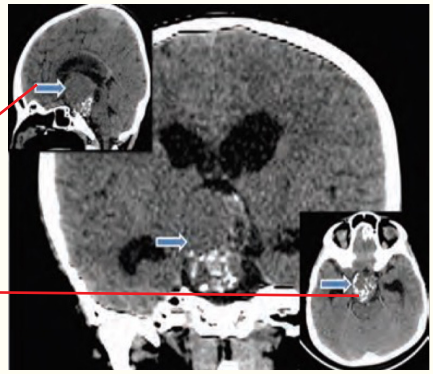
Small tumor in pituitary :

- Enhances less than adjacent pituitary gland.

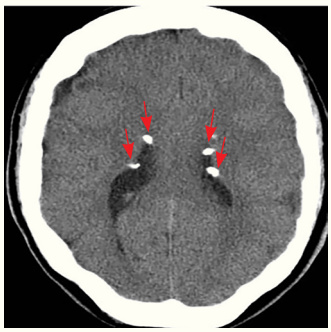
----- Active space -----

Craniopharyngioma :

- Affects children.
- Cystic + solid lesion.
- Site : Suprasellar region.
- Calcifications.

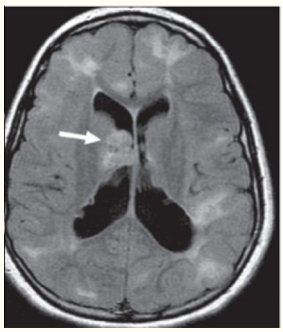


Tuberous sclerosis :



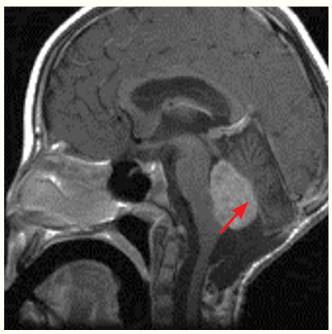
Subependymal nodules : Calcific nodules around lateral ventricular margins.

Converts (in foramen of monro)



Subependymal giant cell astrocytoma.

Ependymoma :



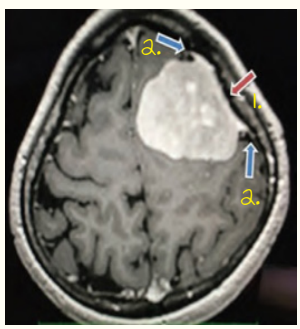
Arises from floor of 4th ventricle.

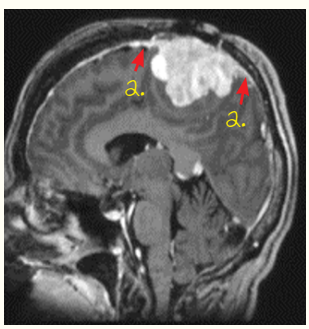
Medulloblastoma :

- Arises from roof of 4th ventricle.
- Aggressive : Drop metastasis to spine (Zuckerguss).

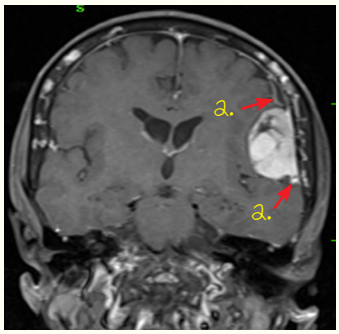
Meningioma :

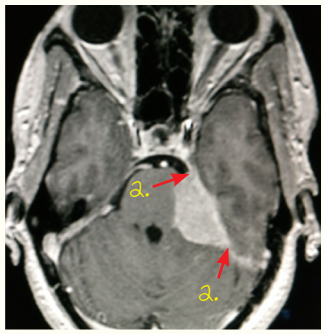
- CT findings :
  1. Broad base towards dura.
  2. Dural tails.
  3. Hyperdense on NCCT.
- A/w MISME (Multiple Inherited Schwannoma Meningiomas & Ependymoma) syndrome.



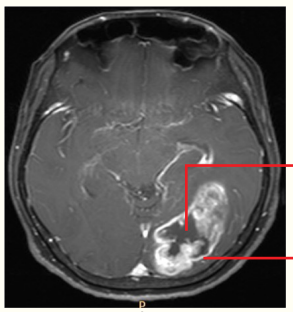


----- Active space -----





Glioblastoma :

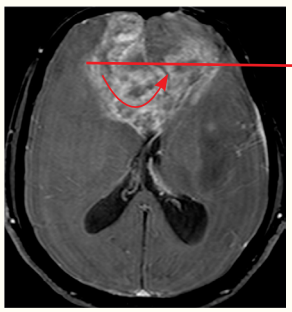


Heterogenicity enhanced

Central area of necrosis

Thick peripheral rim of enhancement

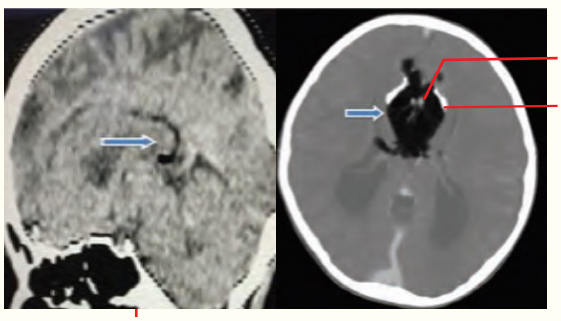
Grade IV (GBM) : Glioblastoma



Irregular peripheral rim

Butterfly glioma

Corpus callosum lipoma :



Fat

Bracket calcification

Curvilinear type Tubulo-nodular type

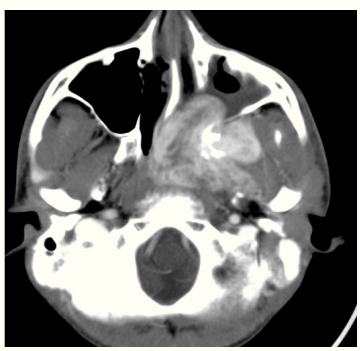
Oligodendroglioma :

Calcified cortical mass

Seen in young & middle aged

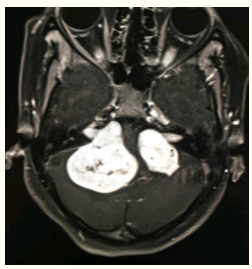
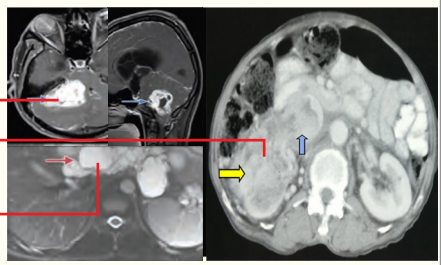
Juvenile nasopharyngeal angiofibroma (JNAF) :

- Presentation : Adolescent male + epistaxis + nasal blockade.
- Site : Sphenopalatine foramen.
- Spread :
  - Nose.
  - Paranasal sinus.
  - Infratemporal fossa.



----- Active space -----

Familial brain tumors :

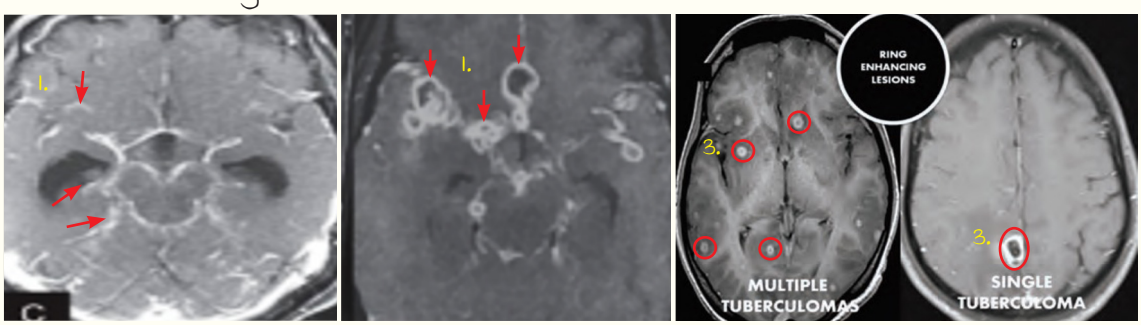
Tumor	Association	Imaging
Neurofibromatosis (NF) 1	• Optic glioma • Brain stem glioma • Plexiform NF	-
NF 2	MISME syndrome	 B/L acoustic schwannoma (NF2)
Von Hippel Lindau	• Hemangioblastomas of cerebellum, retina • Renal cell carcinoma • Pancreatic cyst adenomas • Cysts in : Liver, spleen	

Ring Enhancing Lesions & CNS Spotters

01:01:06

Ring Enhancing Lesions :

Tubercular meningitis :



1. Basal enhancing exudates.
2. Hydrocephalus.
3. Tuberculomas : Disc/ring enhancing lesions.
4. Vasculitic basal ganglia infarcts.

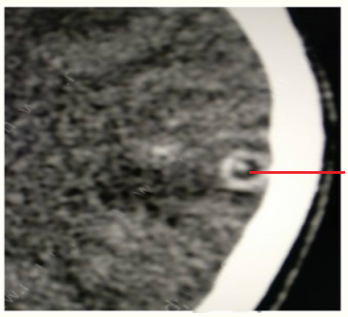
Neurocysticercosis :

Clinical profile :

- Headache.
- Seizures.

Imaging :

- Ring enhancing lesions.
- Cyst with a dot sign (Dot : Scolex).

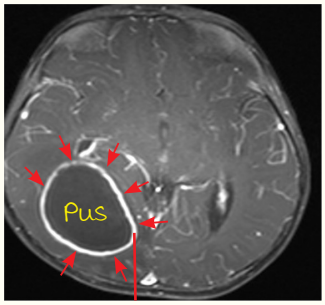


Ring enhancing lesions with eccentric dot

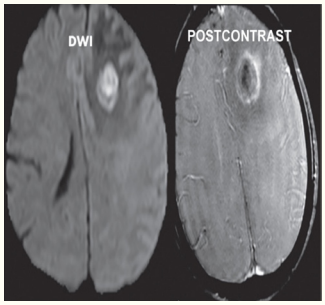
Brain abscess :

Clinical profile :

- Young-middle aged.
- H/O sinusitis/Chronic ear discharge (CSOM).
- Fever, headache, altered sensorium.
- Signs of meningitis.



Ring enhancing lesion



Restricted diffusion

----- Active space -----

Imaging : Temporal lobe ring enhancing lesion.

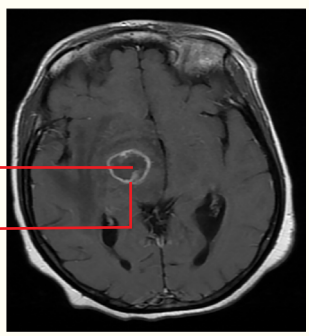
Toxoplasmosis :

Clinical profile :

- HIV +ve patient.
- CD4 count <200.
- Fever, malaise, headache.

Imaging signs :

- Ring enhancing lesion in basal ganglia, grey-white matter junction (GM-WM).
- Target sign/concentric/eccentric target sign.


Target sign
Ring enhancing lesion

Target sign
Ring enhancing lesion

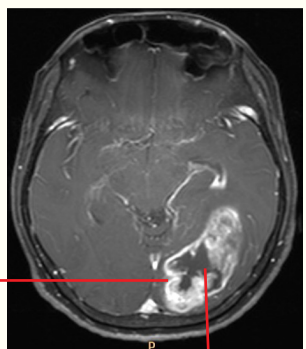
Glioblastoma/Grade 4 glioma :

Clinical profile :

- Middle aged : Elderly.
- Seizures.
- Focal deficits.

Imaging sign :

- Irregular ring enhancing lesion.
- Thick peripheral rim of enhancement with central necrosis.



Metastasis :

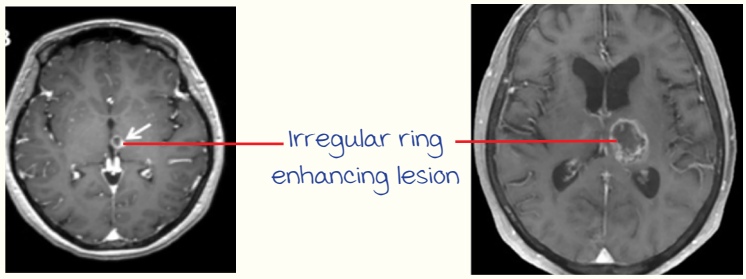
Clinical profile :

- Elderly.
- K/c/o 1° tumour.
- Seizure, focal deficits.

----- Active space -----

Imaging sign :

- Ring/diffusely enhancing lesion at GM-WM junction.
- Surrounding edema.



CNS Spotters :

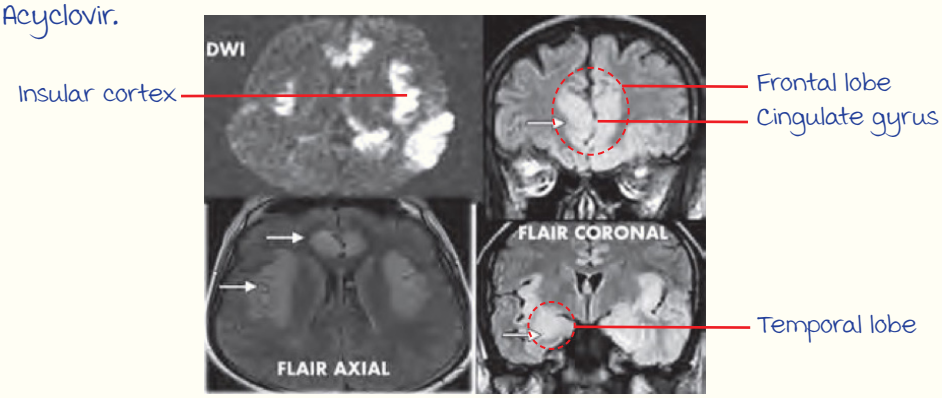
Herpes encephalitis :

Clinical profile : Headache, high grade fever, altered sensorium.

Structures involved : Cingulate gyrus
Insular cortex
Fronto-temporal lobe
} Limbic system.

IOC : MRI.

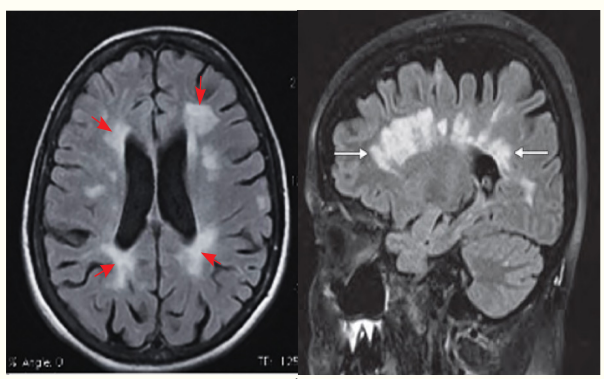
Rx : IV Acyclovir.



Multiple sclerosis :

Clinical profile :

- Young patient.
- multiple neuro deficits.
- Cranial nerve palsy.
- Relapsing - Remitting symptoms.



Dawson's fingers

Imaging :

MRI → Dawson's fingers (Longitudinal white matter plaques)

Post contrast MRI → Enhancing lesions are active

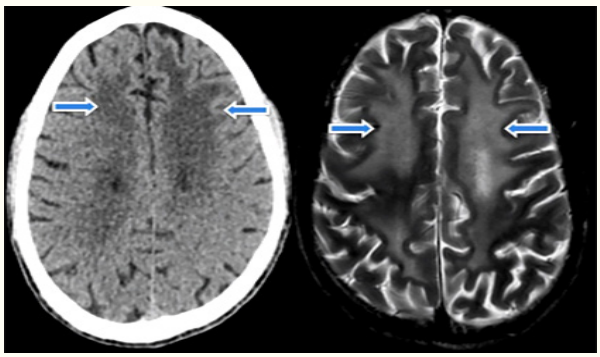
D/t demyelination

HIV :

----- Active space -----

HIV encephalopathy :
Atrophy of brain :
- Slowness, forgetfulness.
- Dementia.

Periventricular Multifocal Leukoencephalopathy :
Infection of oligodendrocytes with JC polyoma virus :
- Motor deficits.
- Ataxia.
- Seizures, altered sensorium.



Hypodensities along white matter

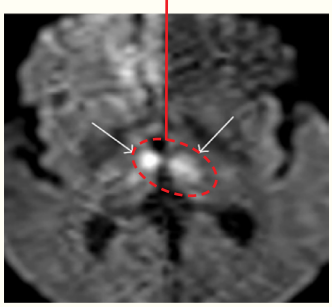
Alcohol related CNS manifestations :

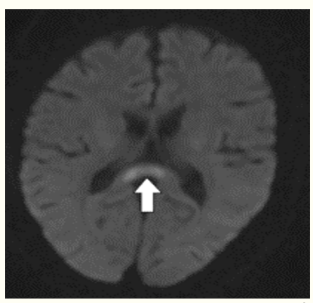
Wernicke encephalopathy/
Wernicke Korsakoff syndrome :
- Thiamine deficiency.
- Ataxia, acute confusion, ophthalmoplegia.

Marchiafava bignami disease :
- Seizures + motor.
- Cognitive disturbances.
- Altered sensorium.

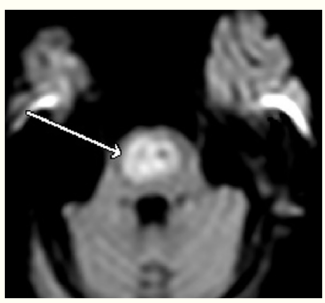
Central pontine myelinolysis/
Osmotic demyelination syndrome :
- Hyponatremia rapidly corrected.
- Altered sensorium.

Hyperintensities of mamillary bodies & tectal plate

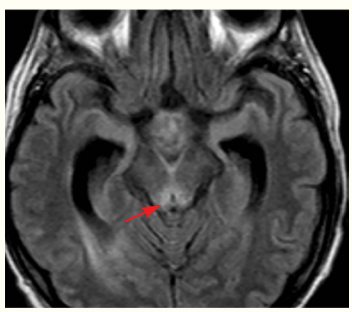




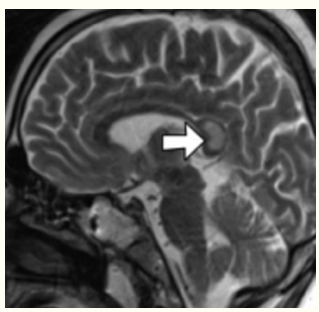
Corpus callosum (Splenium)

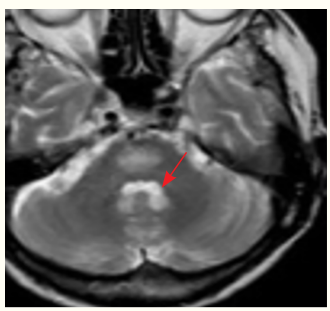


Pons



Periaqueductal white matter
(Thalamus & tectal region)





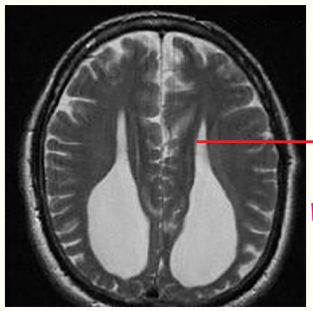
----- Active space -----

Arnold Chiari type 1 :

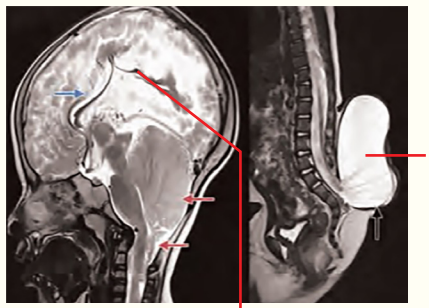
Cerebellar herniation
(Peg-shaped tonsil)

Syrinx formation

Arnold Chiari type 2 :



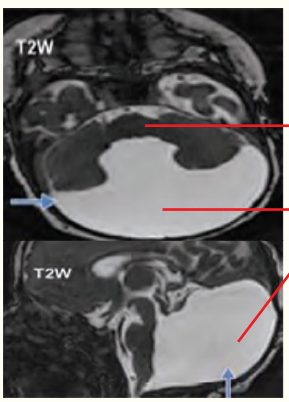
Colpocephaly
(Tear drop
lateral ventricle)



Meningomyelocele

Corpus callosum dysgenesis
(Small posterior fossa → Cerebellum pressed against pons)

Dandy-Walker malformation :



Pons

Cyst in posterior
fossa

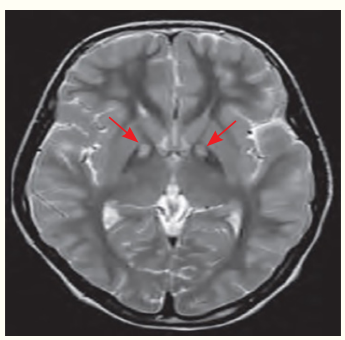
Joubert syndrome :

Molar tooth
appearance

Schizencephaly :

Cleft

Hallervorden Spatz syndrome :



Eye of tiger sign

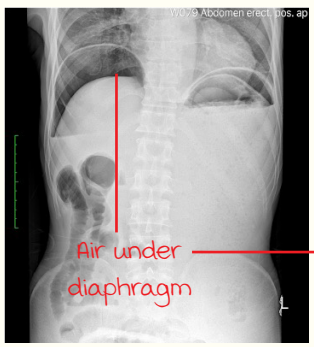
GASTROINTESTINAL AND GENITOURINARY TRACT IMAGING

----- Active space -----

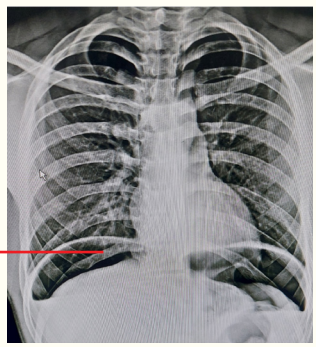
Differentials for Acute Abdomen

00:00:05

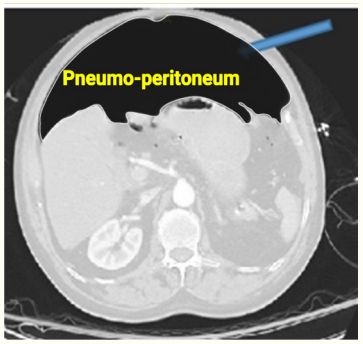
Pneumoperitoneum :



A. Erect abdominal xray



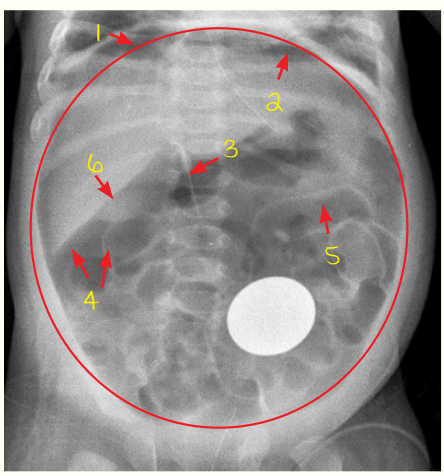
B. Erect chest xray



C. CT abdomen (IOC)

X-Ray : Erect chest x-ray (Best) > (L) lateral decubitus view.

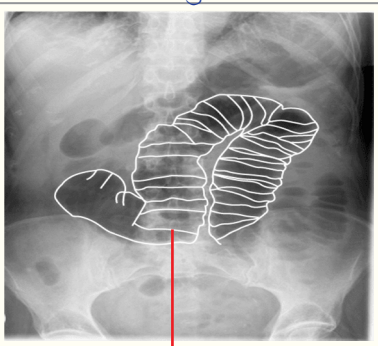
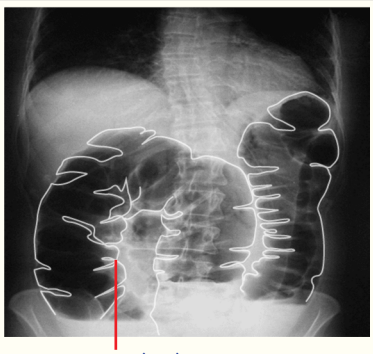
Signs	Appearance (D/t differential densities of air and tissues on radiograph)
1. Football sign	Collection of air in center of anterior abdominal wall → Oval lucency.
2. Cupola sign	Air along central tendon of diaphragm from below.
3. Falciform ligament sign	Sharp demarcated falciform ligament lined by air on either sides.
4. Liver/GB edge sign	Sharp margin of liver and sharp margin of outer serosal surface of gall bladder.
5. Rigler's double wall sign	Sharp margin between inner mucosal and outer serosal layer of bowel.
6. Doge's cap sign	Eccentric triangular shape d/t air trapped within Morrison's pouch.



D. Supine abdomen xray

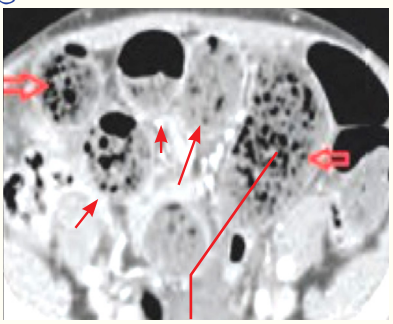
----- Active space -----

Bowel Obstruction :

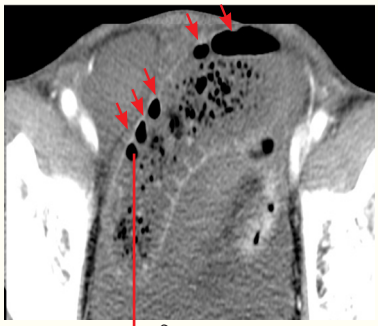
	Small bowel	Large bowel
Diameter of dilated loop	>3 cm	>5 cm
Location of bowel loop	Central	Periphery
Number of loops	Multiple	Few
Air fluid levels	Multiple & short	Few & long
Gas in large bowel	No gas	Dilated proximal to obstruction
Bowel wall markings	 Valvulae conniventes : Complete transverse mucosal folds extending across lumen	 Haustrations : Incomplete transverse folds

CT : IOC.

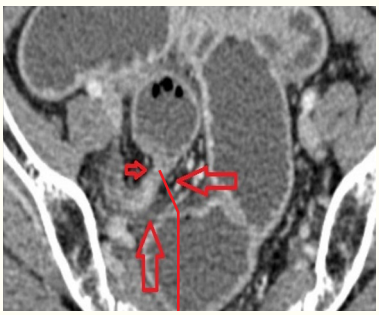
Signs :



Small bowel feces sign :
Fecal matter like appearance in small bowel (D/t prolonged stasis).



String of beads sign :
Air trapped in valvulae conniventes.



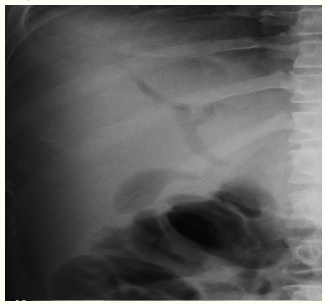
Transition point :

- Most reliable CT criteria.
- Point of sudden transition from dilation to narrowing.
- Site of obstruction.

Gall Stone Ileus :

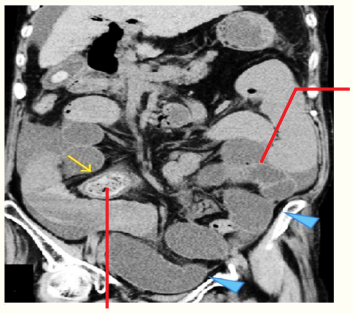
----- Active space -----

X-ray :



1. Pnuemobilia : Air in biliary tree

CT : IOC



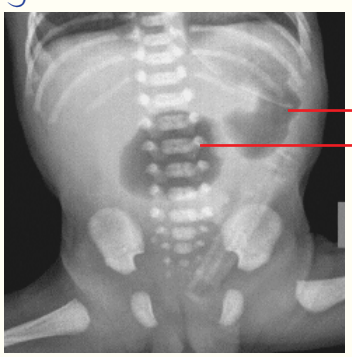
2. Gall stone impacted at terminal ileum (Right iliac fossa)

3. Small bowel obstruction : Dilates bowel loops

Rigler's triad

Duodenal Atresia :

- Presentation : Bilious vomiting at birth.
- X-ray :



Stomach

Proximal duodenum

Double bubble sign

Note :

Other bubble signs :

- Single bubble sign : Pyloric stenosis.
- Triple bubble sign : Jejunal atresia.

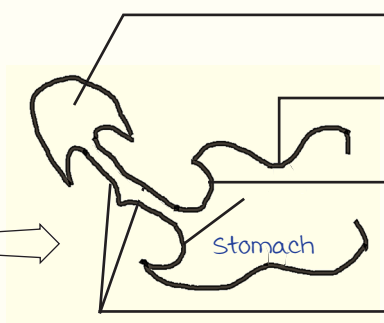
Infantile Hypertrophic Pyloric Stenosis (IHPS) :

- Presentation : Non bilious vomiting at 6-12 weeks.
- Imaging :

a. X-ray & barium meal study :

Hypertrophic pylorus

Narrowed pyloric canal



Mushroom sign : Mushroom like duodenum.

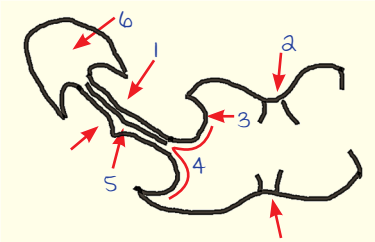
Caterpillar sign : Hypercontractile stomach.

Shoulder sign : Impression of hypertrophied pylorus on stomach.

Double tract/string sign : Narrowed pylorus.

----- Active space -----

1. Circumferential hypertrophy of pyloric muscle.
2. Caterpillar sign : D/t hypercontraction of stomach.
3. Shoulder sign : Extrinsic impression on pylorus.
4. Beak sign : At opening of pylorus.
5. String sign : Narrow lumen of pyloric canal.
6. Mushroom sign : Appearance of proximal duodenum.

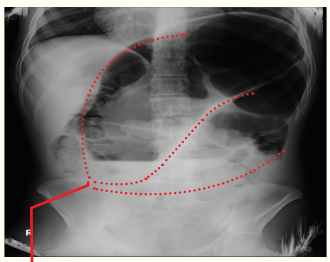
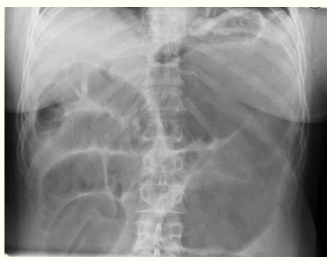


b. USG :

- IOC.
- Diagnostic criteria : Pylorus thickness >4 mm & length >16 mm.

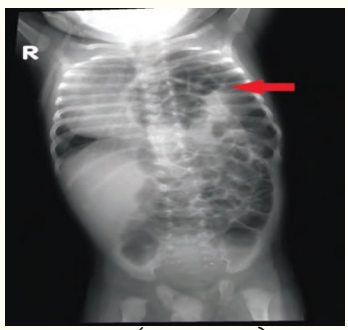
Volvulus :

- Presentation : Abdominal distension & absolute constipation.
- Risk factors : Elderly female, K/C/O psychiatric illness.
- Sites of volvulus : Sigmoid colon (m/c) > caecum, stomach.
- IOC : CECT.
- Sigmoid vs cecal volvulus :

	Sigmoid volvulus	Cecal volvulus
Age	Elderly	Young
Incidence	m/c	L/c
Haustrations	Lost	Present
X-Ray	 • Frimann – Dahl sign : Walls of sigmoid colon converge as 3 dense lines to the site of obstruction • 2 dilated loops (Coffee bean sign) without proximal bowel loop dilated	 1 dilated loop + few proximal bowel loops dilated

Congenital Diaphragmatic Hernia (CDH) :

- Presentation : Newborn with respiratory distress.
- Types → Bochdalek (m/c) : (L) sided.
  → Morgagni (L/c) : (R) sided.
- Prognostic factor : Degree of underlying pulmonary hypoplasia.



CDH (Bochdalek)

----- Active space -----

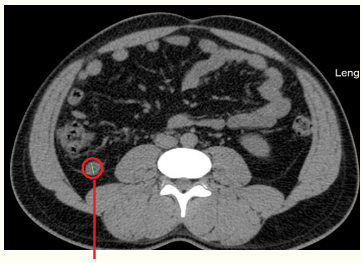
Acute Appendicitis :

- Presentation : Acute pain in RIF & tenderness at McBurney's point.
- Imaging :

a. USG

- Edematous blind ended loop & echogenic inflammed omentum.
- IOC in children.

b. CECT

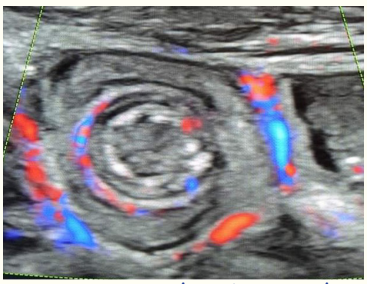


- Dilated appendix with periappendiceal inflammatory changes.
- IOC in adults.

Intussusception :

- Presentation : Child with intermittent pain + red currant jelly stools.
- m/c site : Ileocolic.
- Imaging

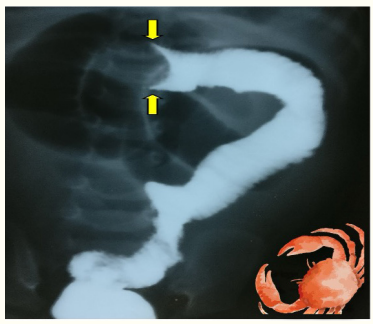
a) USG :



- Target/Bull's eye/ Doughnut sign.
- IOC in children.

b) Barium enema :

Coiled string appearance



Claw sign

c) CECT :

IOC in adults.

----- Active space -----

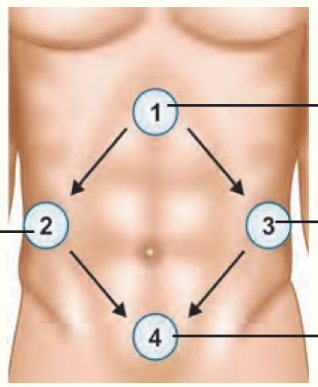
FAST & Barium Spotters

00:21:56

FAST

Focused assessment with sonography in trauma.

FAST Protocol :



1 — Subxiphoid view

2 — Longitudinal RUQ view : Best view (Morrison's pouch is visualised)

3 — Longitudinal LUQ View

4 — Suprapubic view

eFAST (Extended FAST) :

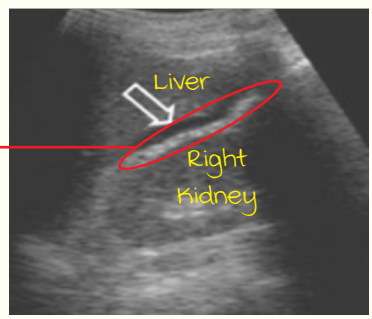
Assessment is extended to thoracic cavity :

- Posterior dependent part of thorax : To r/o hemothorax.
- Anterior non-dependent part of thorax : To r/o pneumothorax.

Management Algorithm in Abdominal Trauma :

Perform eFAST

- First investigation.
- Free fluid in hepatorenal/morrisons pouch



↓

FAST ⊕ : Hemoperitoneum

↓

Check hemodynamic status

↓

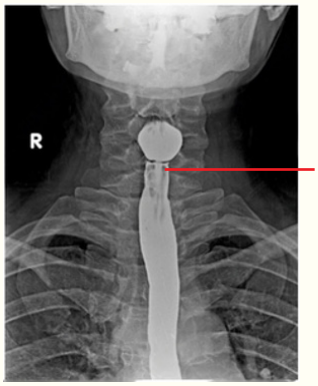
Pt stable	Pt unstable
↓	↓
CECT Abdomen : IOC for solid organ injury.	Emergency exploratory laparotomy.

POCUS (Point of care ultrasound) : Bedside ultrasound in emergency.

BARIUM SPOTTERS

----- Active space -----

Esophagus :



a) Esophageal web :

- Seen in Plummer-Vinson/ Paterson Brown Kelly syndrome :
  - Esophageal web
  - Dysphagia
  - Iron deficiency anemia

  } Triad.
- Complication : Hypopharyngeal squamous cell cancer.

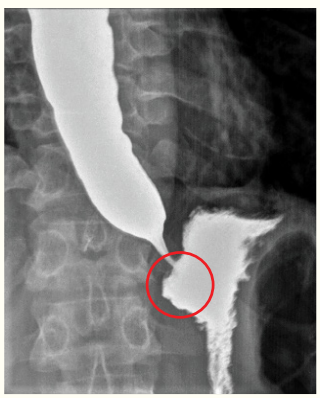
b) Ca Esophagus :

- Rat tail appearance.
- Dysphagia : Solids > liquids.
- IOC :
  - Overall : Esophagoscopy + biopsy.
  - For staging (mets) : PET-CT.
  - For T-N staging : Endoscopic USG.

c) Zenker's diverticulum (m/c) :

- Directed posteriorly.
- Complication : Aspiration (m/c).
- Site : Killian's dehiscence (B/w oblique & transverse fibres of cricopharyngeus).

d) Killian-Jamieson diverticulum : Directed antero-laterally.



e) Achalasia cardia :

- Birds beak sign.
- Dysphagia : Liquids > solids.

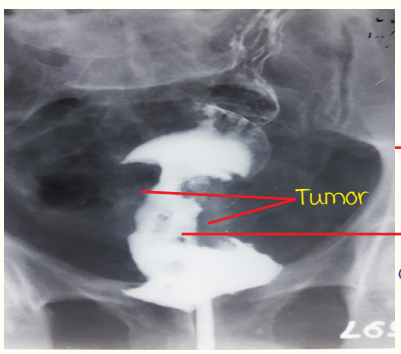
----- Active space -----

f) Diffuse esophageal spasm :
Cork screw/Rosary bead/
Curling esophagus.

g) Feline esophagus/Esophageal shiver :
- Striated appearance d/t muscularis mucosa contractions.
- Seen in :
  - Reflux esophagitis.
  - Hiatus hernia.
  - Eosinophilic esophagitis.

Colon :

a) Colonic diverticulosis :
- Presentation : Pain in LIF + fever.
- m/c site : Sigmoid colon.
- Barium enema : Sawtooth sign.
- CECT (Iodinated contrast) : IOC.



b) Ca colon :
- Presentation : Elderly + altered bowel habits + tenesmus + blood in stools.
- m/c site : Sigmoid colon (L > R).
- Barium enema : Apple core sign.

c) Ulcerative colitis :
- Presentation : Middle aged + pain/tenesmus + blood in stools.
- Lead pipe colon (Loss of haustrations).
- Complication : Toxic megacolon.
  - Site : Transverse colon.
  - Diameter : >6 cm.

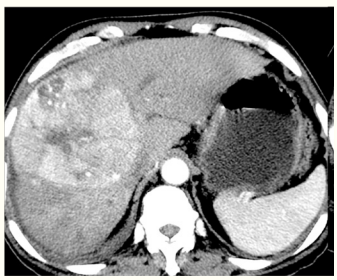
HEPATOBILIARY SYSTEM

----- Active space -----

Liver :

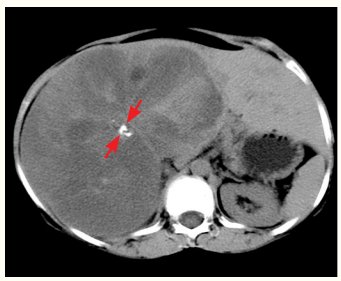
1. Hepatocellular cancer, fibrolamellar HCC & liver mets :

	HCC	Fibrolamellar HCC	Liver metastasis
Age	Elderly male	Young	Elderly
Presentation	• K/C/O cirrhosis • Hepatitis B	No comorbidities	K/C/O Ca colon : anorexia + jaundice
Tumor marker	AFP (Alpha feto protein)	↑Neurotensin B (Normal AFP)	-
Imaging	• Multiphase CECT (IOC for diagnosis) : – Arterial phase : Lesion enhancement – Delayed phase : Washout • USG (IOC for screening) : Done 6 monthly in cirrhosis	CECT : Heterogenous enhancing lesion in liver with central stellate scar	• CECT : – Multiple hypodense lesions (D/t hypovascular mets) • PET/CT : Hotspots
Prognosis	Poor	Better than HCC	-

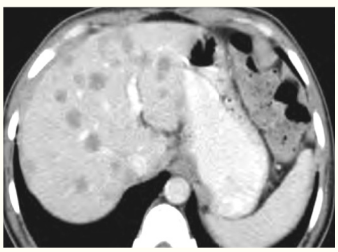


HCC : enhancing on arterial phase

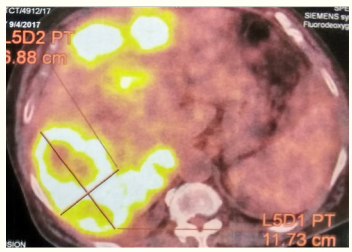
HCC : washout on delayed phase



Fibrolamellar HCC



CECT



PET scan

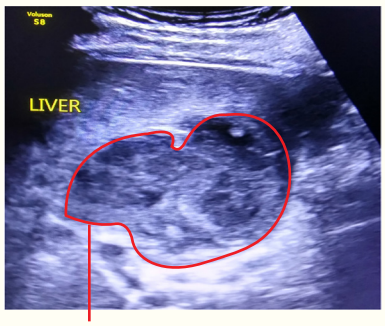
Liver mets

----- Active space -----

2. Liver abscess :

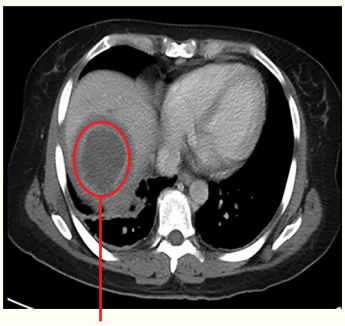
- Presentation : Fever + pain in right hypochondrium + jaundice + elevated TLC.
- Imaging :

USG

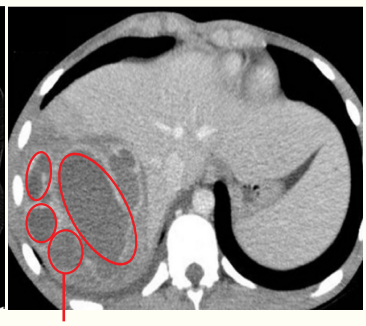


- Hypoechoic lesion with thick contents.
- Follow up USG, done after drainage.

CECT (IOC)



Hypodense lesion with peripheral rim of enhancement.



Cluster sign :

- Small abscess $\xrightarrow{\text{Cluster}}$ Large abscess.
- Seen in pyogenic abscess.

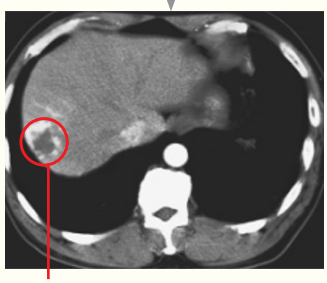
3. Liver hemangioma :

- Incidentally detected.
- Imaging :

USG

Well defined hyperechoic lesion in liver parenchyma

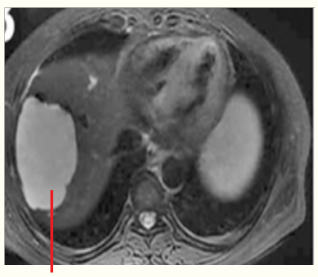
CT



Initially : Peripheral nodular contrast enhancement

Later : Centripetal filling in of contrast

T_2 MRI

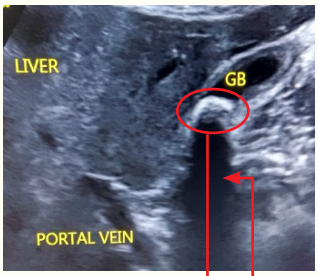
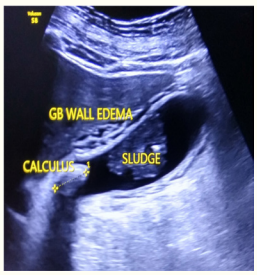
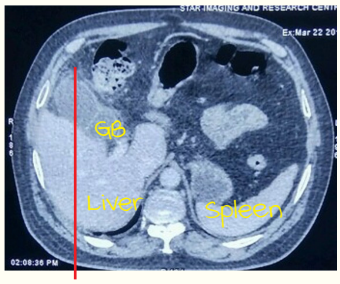


Light bulb sign

Gall Bladder Imaging

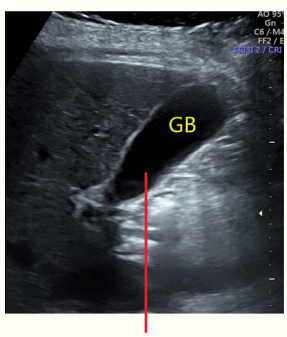
00:41:38 ----- Active space -----

Cholecystitis :

	Acute GB calculus	Calculous cholecystitis
Features	• Intermittent RHC pain • m/c type : mixed calculi ($\downarrow Ca^{2+}$)	• Severe pain in RHC + fever + elevated TLC • Murphy sign ⊕
Imaging (IOC : USG)	 • Hyperechoic area • Dense posterior shadow • Mercedes benz sign	  Fat strands around GB

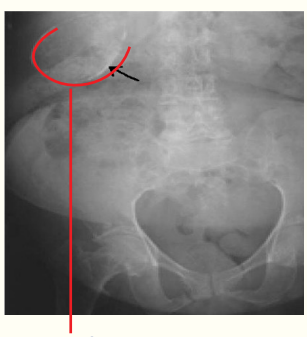
GB spotters :

1. Normal



Normal anechoic gall bladder

2. Porcelain GB

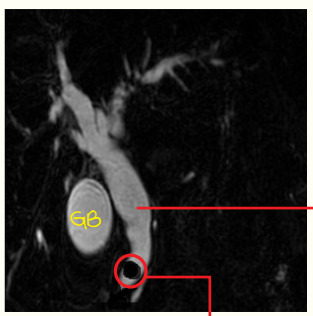


- Calcified GB wall.
- Predisposes to GB adenocarcinoma.

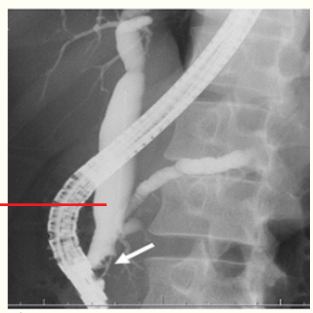
3. Phrygian cap

- Anatomical variant.
- Fundus folds over body of GB.

4. Choledocholithiasis



CBD



a) T_a MRCP : Impacted calculus in CBD (Filling defect).

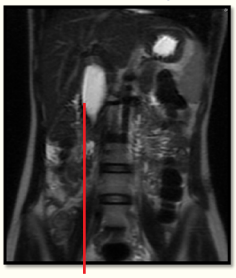
b) ERCP :

- Gold standard.
- Diagnostic + therapeutic.

----- Active space -----

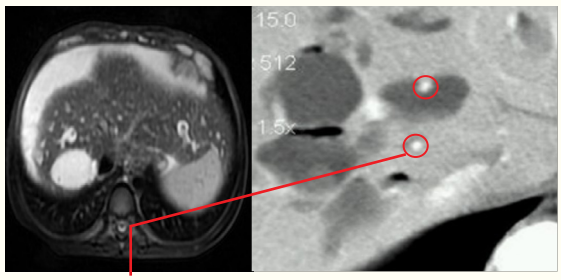
MRCP spotters :

a) Choledochal cyst – Type I :



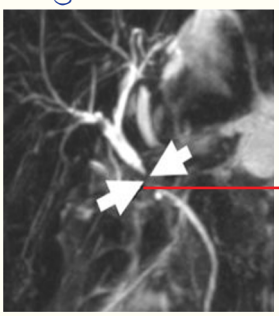
Fusiform dilation of CBD

b) Caroli's disease :



Central dot sign : multiple intrahepatic biliary dilatations, through which portal vessel passes

d) Benign stricture :



Smooth/elongated stricture

e) Malignant stricture :

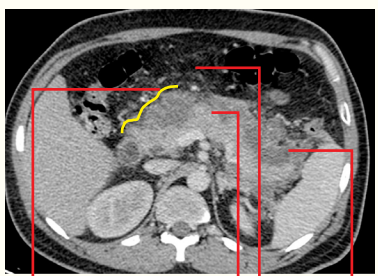
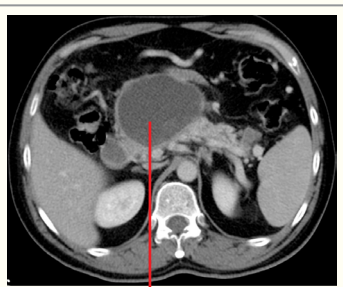
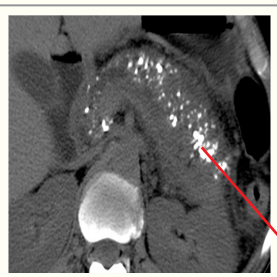
Abrupt stricture

Proximal dilation of biliary tree

Pancreas & Liver Imaging

00:47:40

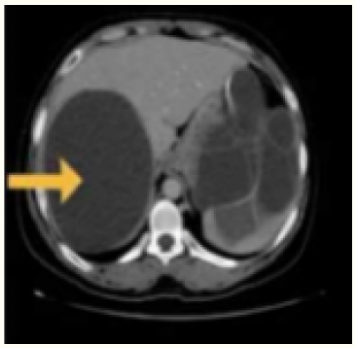
Pancreatitis :

	Acute pancreatitis	Pancreatic pseudocyst	Chronic pancreatitis
Features	Epigastric pain + radiating to back + ↑S. Amylase/lipase	• Around 6–8 weeks after pancreatitis • Heaviness/fullness in upper abdomen • m/c site : Lesser sac	H/o multiple episodes of pancreatitis + abdominal discomfort • IOC : MRCP with secretin stimulation • Gold standard : ERCP (Shows ductal dilatation)
CT/ X-ray	 a. Fuzzy margins b. Enlarged pancreas c. Hazy mesentery d. Hypodense areas (Fluid) Severity : Balthazar grading/ CT severity index • Determines prognosis.	 Fluid filled cystic collection in pancreas	  Calcification in pancreas

----- Active space -----

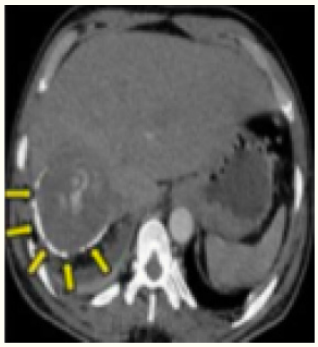
Hydatid Cyst :

Stages :

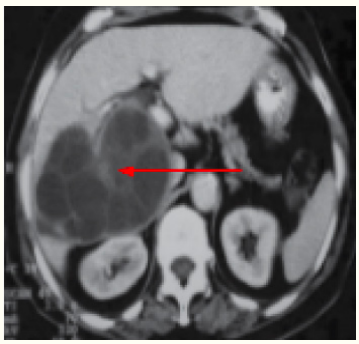


1. Simple cyst

2. Snowstorm sign
(D/t mobile hydatid sand).

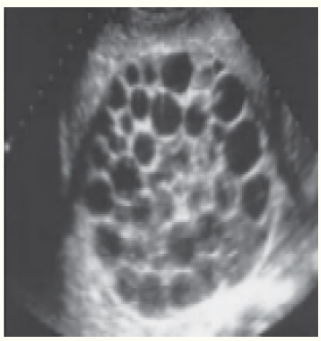


3. Peripheral curvilinear calcifications



4. Daughter cysts within mother cyst

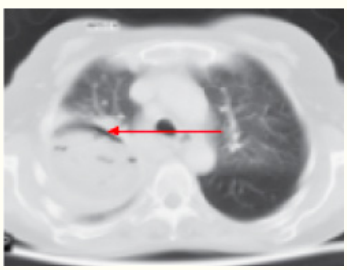
5. Wheel spoke sign
(Hydatid sand trapped in b/w daughter cyst).



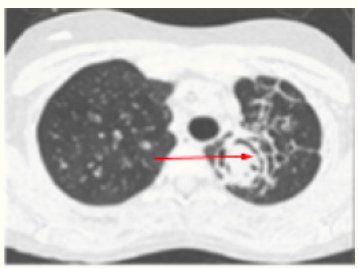
6. Honeycomb's sign
(Entire mother cyst filled up with daughter cyst).

7. Floating membrane sign
(Degenerated membrane floats within mother cyst).

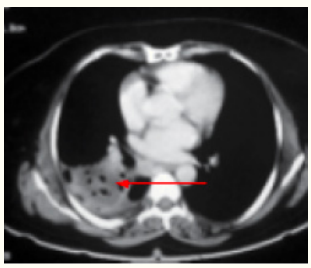
Hydatid Cyst in Lung :



1. Air crescent sign



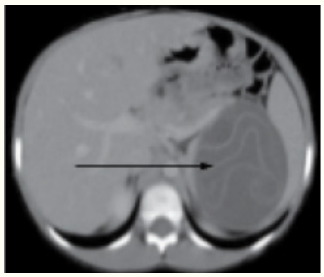
2. Inverse crescent sign.
Air on the dependent part of the cyst



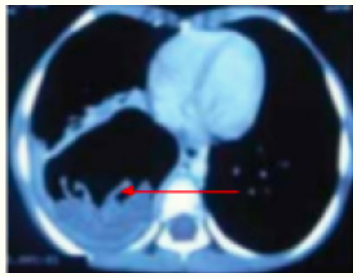
3. Air bubble sign

----- Active space -----

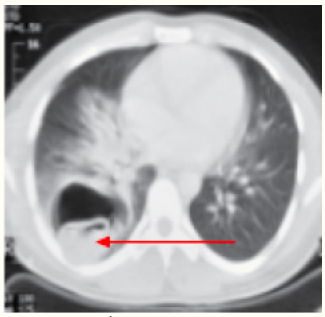
4. Cumbo sign :
2 air-fluid levels, one in the wall & one within the lumen of the cyst



5. Whirl/serpent sign :
(membrane degenerates & floats within the cyst)



6. Floating waterlily sign/ Camalote sign :
Few of the membranes float on the surface



7. Rising sun sign/mass within a cavity sign :
Contents clumped at the bottom of the cyst

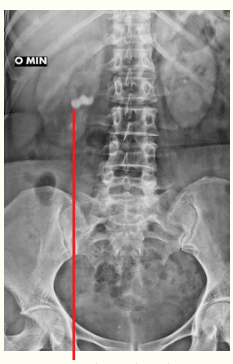
Empty cyst sign :
All contents expectorated out & cavity becomes empty

Genitourinary Tract

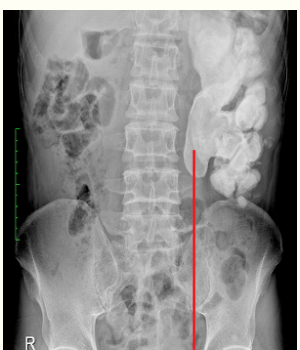
00:54:05

Acute Renal Colic :

- Presentation : Acute lumbar pain + radiating from loin to groin + burning micturition.
- Imaging :
  Initial : USG > X-ray KUB.

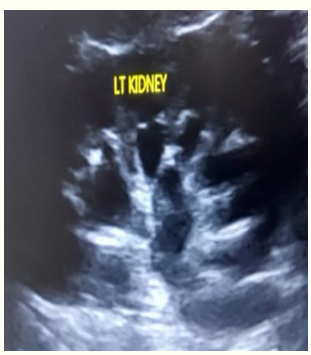


Renal calculus



Staghorn/Struvite/triple phosphate calculus

Non obstructive renal calculus :
A. Hyperechoic area.
B. Dense posterior shadow.

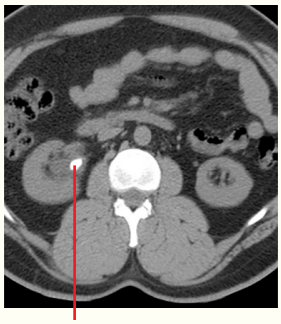


- Hydronephrosis.
- IOC : USG.

NCCT

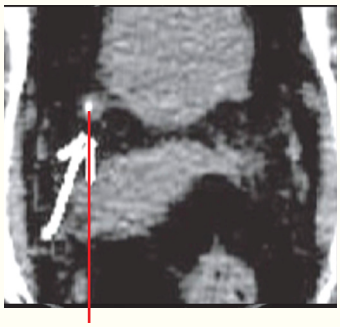
----- Active space -----

IOC for renal calculus :



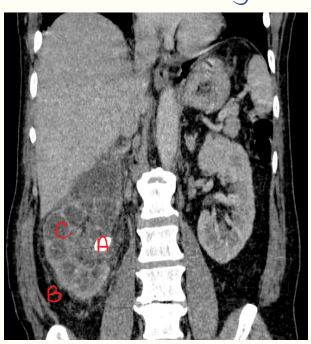
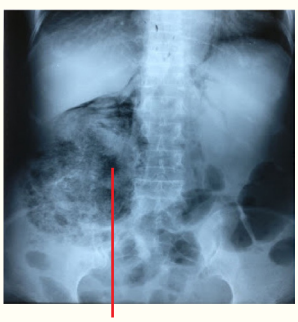
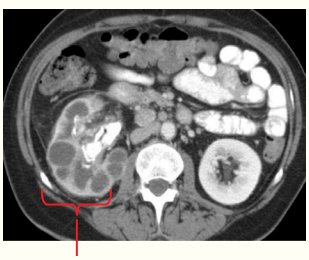
Renal calculus

Jackstone vesical calculus (Urinary bladder)



Ureteric calculus : Soft tissue rim sign
Helps differentiate ureteric calculus from phlebolith.

Complications of Obstructive Uropathy :

	Acute pyelonephritis	Emphysematous pyelonephritis	Xanthogranulomatous pyelonephritis
Presentation	Fever + ↑TLC + abundant pus cells in urine	Sepsis + diabetes/ Immunocompromised pt	Chronic calculus disease + Proteus/E.coli infection
Imaging	 Axial view A. Renal calculus B. Perinephric fat stranding C. Edematous kidney  Coronal view	 Air in renal parenchyma	 Bear paw sign : Impacted calculus at center + dilated calyces at periphery

Renal Tuberculosis :

- Presentation : Pulmonary Koch's + low grade fever + sterile pyuria.
- IOC :

  Overall : CECT ⟶ Renal parenchymal calcification.

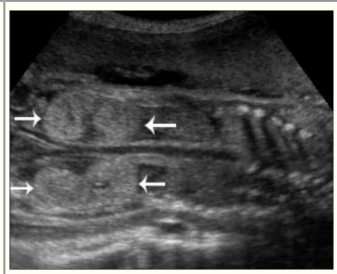
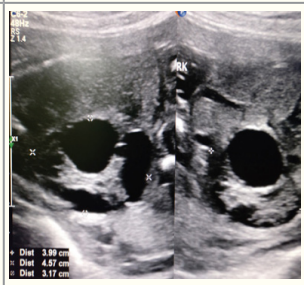
----- Active space -----

Moth eaten calyx :
Earliest finding on IVU
(IOC for earliest diagnosis).

Putty Kidney :
Kidney calcification in long standing cases → Autonephrectomy.

Thimble bladder :
Chronic inflammation → Small & contracted urinary bladder.

Polycystic Kidney Diseases (PCKD) :

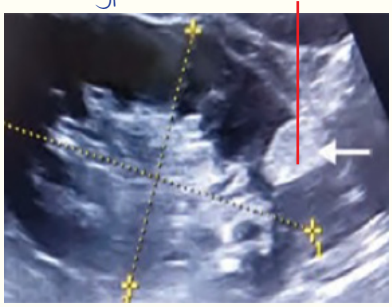
	Autosomal recessive PCKD	Autosomal dominant PCKD	multicystic dysplastic
Presentation	Child + enlarged kidneys + microcyst ± liver fibrosis	Gradual onset renal impairment in 4^{th}–5^{th} decade + macrocysts	Abdominal lump in neonates + macrocysts
Antenatal USG	 Echogenic enlarged kidneys	Normal	 Renal macrocysts

Renal & Bladder Imaging

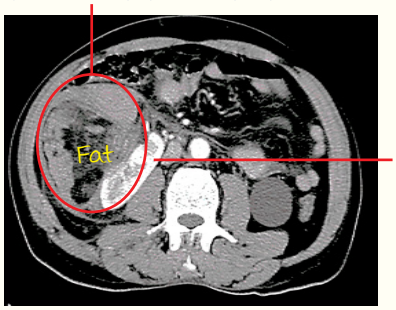
01:04:46

Renal Angiomyolipoma :

- Presentation :
  - Asymptomatic : Incidental finding.
  - Wunderlich syndrome : Pain + nausea + shock (D/t bleeding).
- A/w tuberous sclerosis.
- Imaging :



USG



CT

----- Active space -----

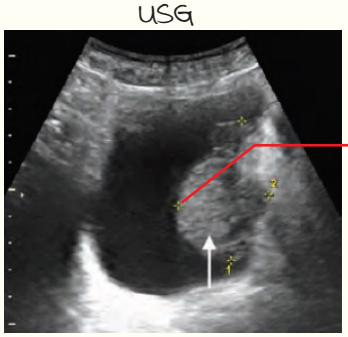
Renal Cell Carcinoma :

- Presentation : Elderly + gross painless hematuria.
- m/c subtype : Clear cell Ca.
- Staging :
  - Robsons staging.
  - TNM.
- IOC → Overall : CECT.
  → For renal vein/IVC invasion : CE-MRI.
- CT :

Transitional Cell Carcinoma :

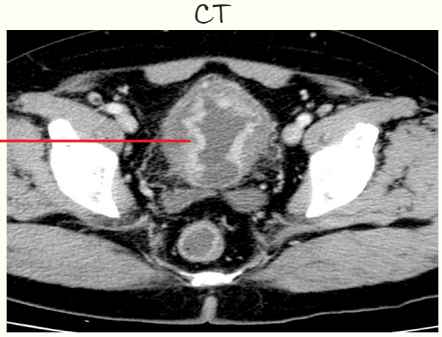
- Presentation : Elderly + gross painless hematuria + H/o smoking or cyclophosphamide treatment.
- Imaging :

USG



Diffuse nodular thickening along urinary bladder wall

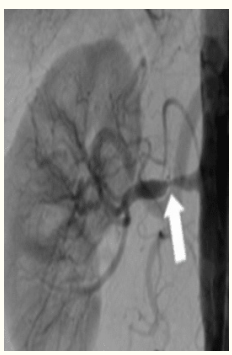
CT



- Retrograde pyelography : Goblet sign/champagne glass sign (Filling defect d/t tumor).

Renal Artery Stenosis (RAS) :

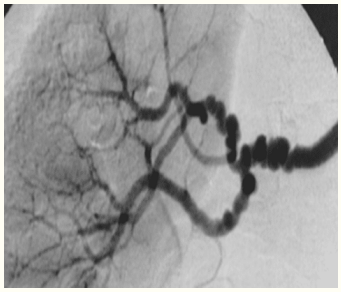
- Presentation : Young pt + hypertension.
- Investigations :
  - First : Renal artery doppler.
  - IOC : CT angiography > MR angiography.
  - Gold standard : Invasive catheter angiography.
  - To detect functional significance of RAS : Captopril-DTPA scan.



----- Active space -----

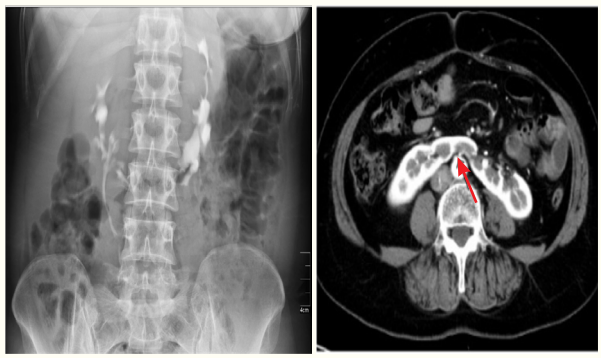
Fibromuscular Dysplasia :

String of beads appearance
(Alternate dilations & constrictions).



IVU Spotters :

a) Horseshoe Kidney :



- Flower vase appearance/Handshake sign : Kidneys fused across midline.
- A/w Turner syndrome (XO).
- Asymptomatic.

b) Cross fused ectopic left Kidney :

- Ⓛ Kidney fused with Ⓡ Kidney (Ⓛ renal fossa : Empty)
- Ⓛ Ureter crosses midline & drains into Ⓛ side of urinary bladder.

c) Duplex pelvicalyceal system :

- 2 pelvicalyceal systems on one side.
- Weigert-Meyer law :

Upper moeity (U-MI-U)
upper ureter
↓
Medial-Inferior
insertion into UB
↓
Prone to ureterocele.

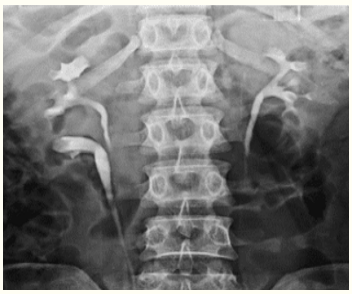
Lower moeity
(Lower-Lax-reflux) lower ureter
↓
Lax/Loose
insertion into UB
↓
Prone to vesicoureteric reflux.

Duplex pelvicalyceal system

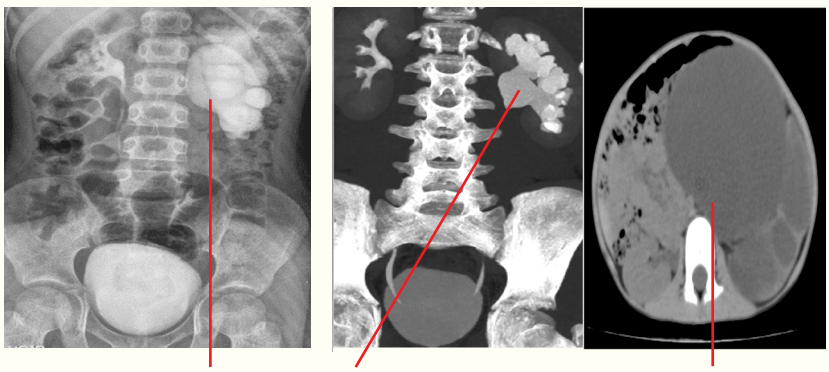
----- Active space -----

d) Duplex pelvicalyceal system with obstructed upper system :

Drooping lilly sign (D/t dilated obstructed upper urinary system).



e) Pelvi ureteric junction (PUJ) obstruction with hydronephrosis :



Dilated pelvicalyceal system

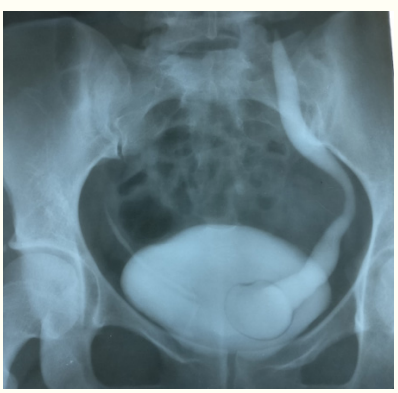
Dilated renal pelvis crossing midline

g) Vesicoureteric reflux :

- Presentation : Recurrent UTI in child + hydronephrosis on USG.
- IOC :
  - Initial : Micturating Cystourethrogram (MCU).
  - For follow up : Radionuclide cystogram.

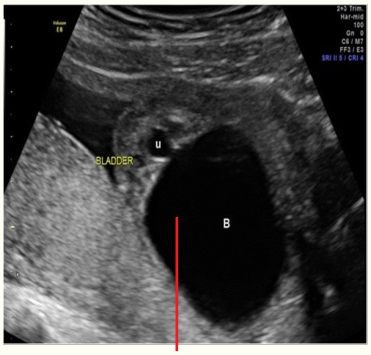
f) Ureterocele :

Cobra head/adder head/spring onion appearance : Focal cystic dilatation of terminal ureter.

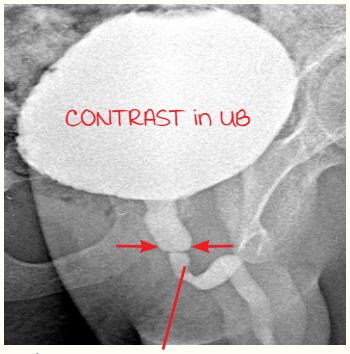


----- Active space -----

h) Posterior urethral value (PUV) :

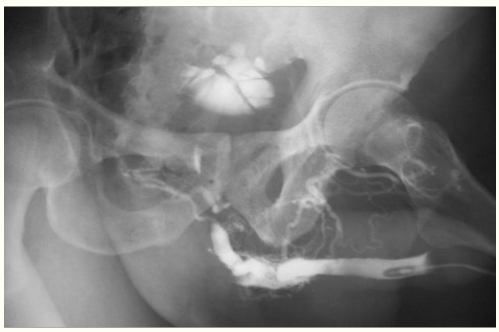


a. Antenatal USG : Keyhole sign
Overdistended UB with small posterior urethra.



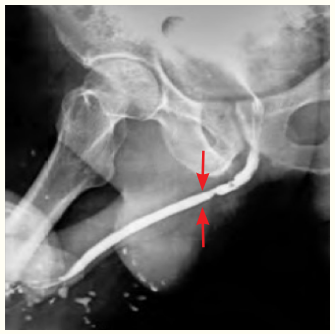
b. MCU : PUV

i) Urethral rupture :



- Presentation :
  - Trauma +
    - Unable to pass urine.
    - Blood at ext. meatus.
    - High riding prostate on DRE.
- Initial IOC : Retrograde urethrogram (RGU).
- Catheterization : Suprapubic (Transurethral C/I).

j) Urethral stricture :



Presentation : Recurrent UTI + incomplete & frequent micturition.

WOMEN AND MUSCULOSKELETAL IMAGING

----- Active space -----

Breast Imaging

00:00:18

IOC for Ca breast :

1. Imaging IOC (Overall) : Dynamic contrast enhanced (CE) MRI.
2. Diagnostic IOC (Overall) : Trucut biopsy (Bx).
3. Staging IOC : PET-CT.
4. Screening IOC for Ca breast : Mammography.

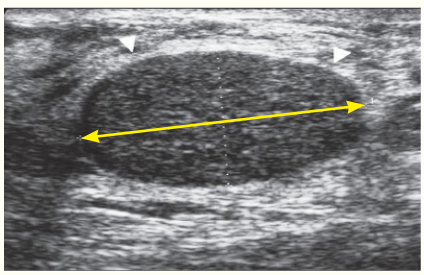
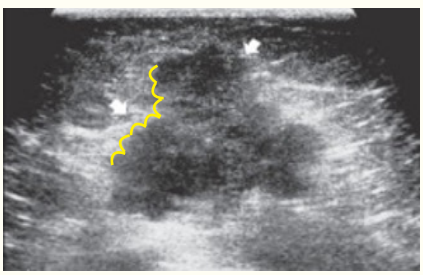
Mammography :

American society of Breast Surgeons recommendations for Ca breast – 2019 :

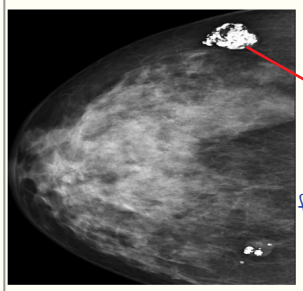
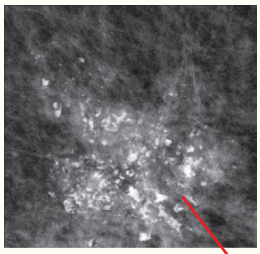
Formal clinical risk assessment at 25 years → Divided into groups based on risk.

Group based on risk	Investigation	Screening started at
BRCA 1 or 2 mutation carrier status/prior chest wall irradiation at 10–30 years age	MRI (Annually till 30 yrs age) ↓ Mammography	25 yrs 30 yrs
Strong +ve family history/ predicted lifetime risk >20%	Mammography	35 yrs
Average risk (No risk factors)	Mammography	40 yrs

Benign vs malignant lesions :

	Benign lesions	Malignant lesions
USG		
Shape	Oval (Wider > Taller)	Irregular (Taller > Wider)
Margins	Smooth	Irregular
Spiculations/Lobulations	None/few lobulations	Present
Architectural distortion & echogenic halo	Absent	Present

----- Active space -----

	Benign lesions	Malignant lesions
Calcifications	Microcalcifications  Popcorn calcification : Involuting fibroadenoma	Microcalcifications (<1 mm)  Pleomorphic clustered micro-calcifications

Breast Imaging Reporting And Data System (BIRADS) :

For USG, MRI & mammography.

Score	Category	Risk of malignancy (%)	Management
0	Incomplete evaluation	—	Additional imaging
1	Negative	0	Routine screening
2	Benign	0	
3	Probably benign	>0 to <2	Short interval follow-up (6 months)
4	Suspicious	2-10 (Low)	Tissue biopsy
		10-50 (Intermediate)	
		50-95 (High)	
5	Highly s/o malignancy	>95	
6	Biopsy proven malignancy	100	Plan Rx

Dynamic Contrast Enhanced MRI :

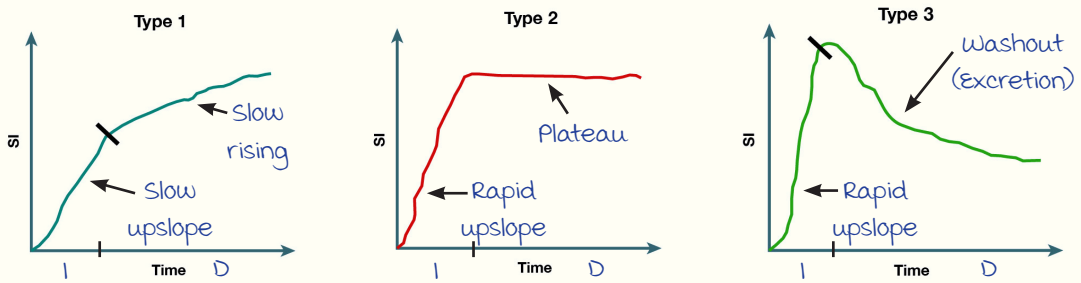
Steps :

Non-contrast MRI images obtained first → Rapid IV injection of Gadolinium using pressure injector → Rapid image acquisition (For 5-6 mins) → Dynamic enhancement curves (DEC).

Types of curves :

I : Initial phase (2 min)

D : Delayed phase



Benign lesion | Intermediate lesion | Malignant lesion

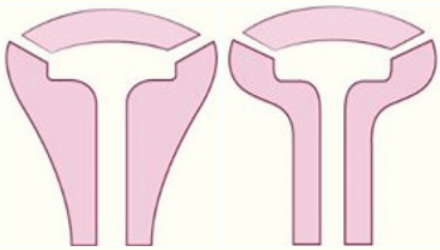
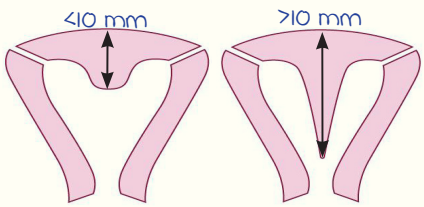
Gynecological Imaging

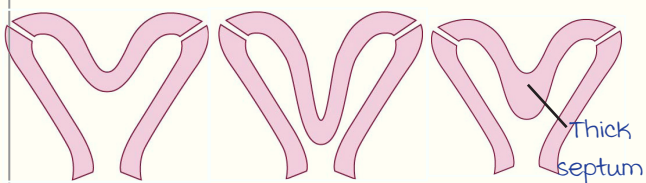
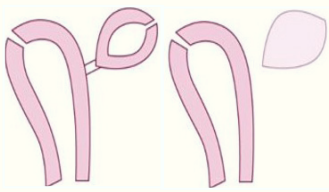
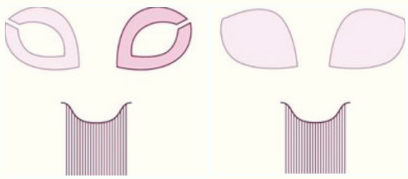
00:09:47 ----- Active space -----

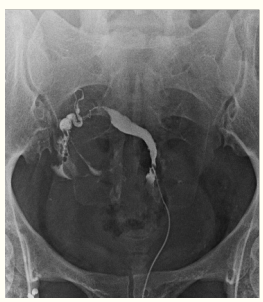
Mullerian Duct Anomalies :

- IOC : 3D-USG > MRI.
- Gold standard : Laparoscopy.

ESHRE classification : (Updated terminology)

Class U0/ Normal uterus	Class U1/ Dysmorphic uterus	Class U2/ Septate uterus
	 a. T-shaped b. Infantilis c. Others	 a. Partial b. Complete

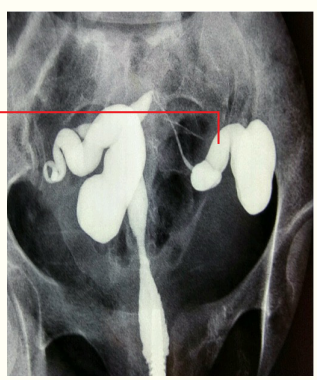
Class U3/Bicorporeal uterus	Class U4/Hemi uterus	Class U5/Aplastic uterus
 a. Partial b. Complete c. Bicorporeal septate	 a. With rudimentary cavity b. Without rudimentary cavity	 a. With rudimentary cavity b. Without rudimentary cavity



Hemiuterus (U4b) on hysterosalpingography (HSG)

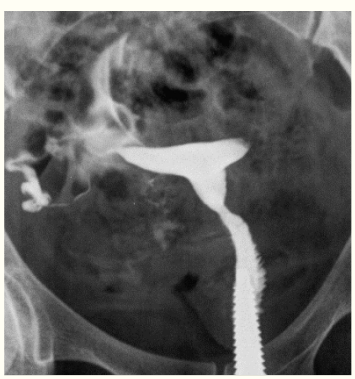
Bicorporeal uterus (U3b) on HSG

Infertility – HSG :



Retort shaped blocked fallopian tube

Hydrosalpinx



Left sided cornual block

Filling defect

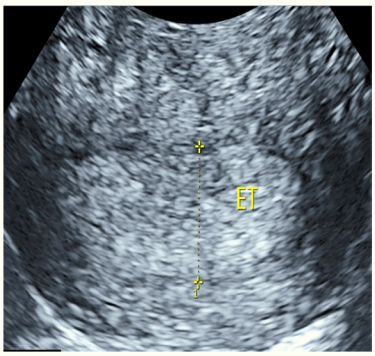
Uterine synechiae/adhesions

----- Active space -----

Obstetric Imaging

00:13:34

Early Pregnancy :



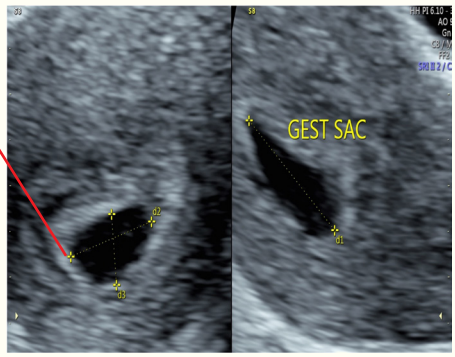
~4 weeks

- Thick endometrium.
- Gestational sac ⊖

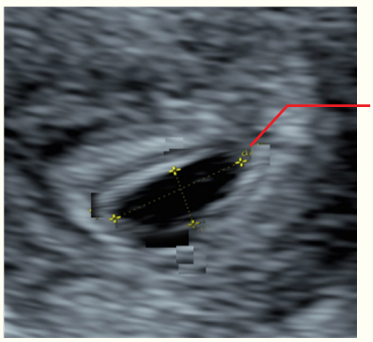
Intradecidual sac sign

↓

Single hyperechoic rim around gestational sac (GS)



4–5 weeks

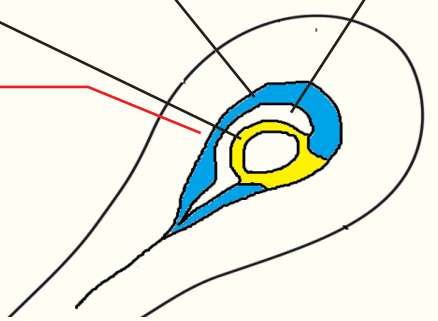


4–5 weeks

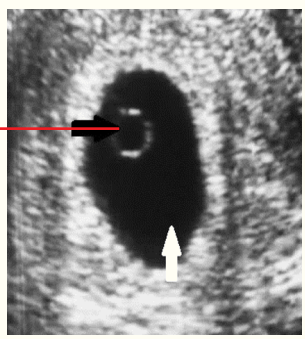
Double decidual sac sign

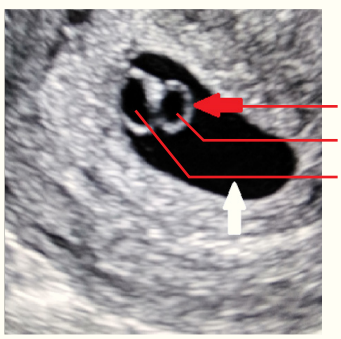
↓

Definitive sign of intrauterine (IU) pregnancy. (Differs from psuedogestational sac of ectopic pregnancy.)



Yolk sac : 1st structure seen in GS.

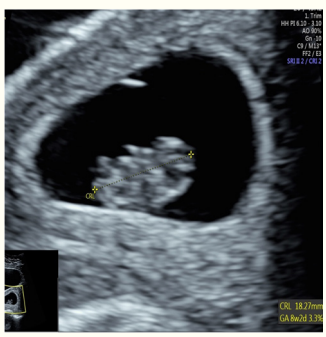




Double bleb sign :

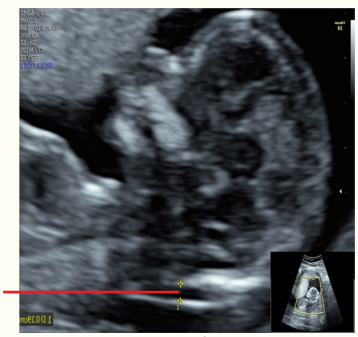
- Yolk sac
- Amnion

5–6 weeks



6 weeks

Embryo + cardiac activity ⊕



Nuchal translucency (NT) scan (Normal scan)

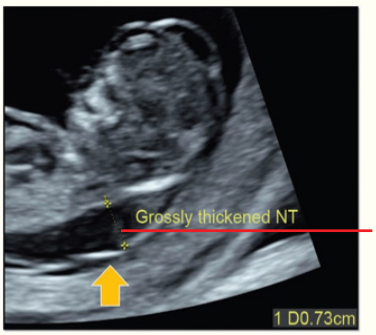
Done when CRL : 45–84 mm OR

11 weeks 0 days – 13 weeks 6 days.

Feature visualised	Transvaginal sonography (TVS)	Transabdominal sonography (TAS)
Gestational sac	4 weeks 0 days – 4 weeks 3 days	5 weeks 0 days
Yolk sac	5 weeks 0 days	5 weeks 3 days
Cardiac activity	5–6 weeks	6 weeks 0 days

----- Active space -----

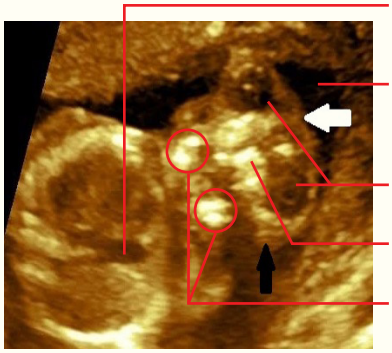
Fetal Anomalies :



Thickened NT

Aneuploidy

E.g. : Trisomy 21, 18, 13



Cardiac vessels

Lack of development above orbits

Orbits

Pre-maxillary triangle

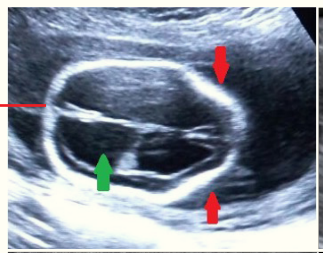
Mandible

Anencephaly

- Mickey-mouse/Frog-eyes sign
- Earliest anomaly detected on USG (10–11 weeks)

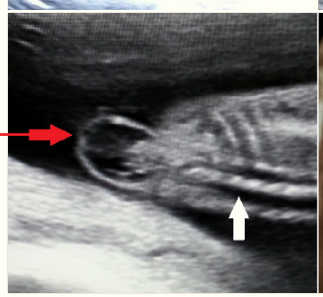
Lemon sign :

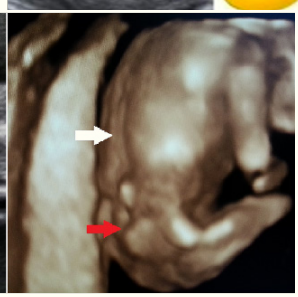
- Dilated ventricles.
- Frontal compression of skull.



Banana sign : Curved cerebellum wraps around brainstem in posterior fossa.

Lumbar meningomyelocele



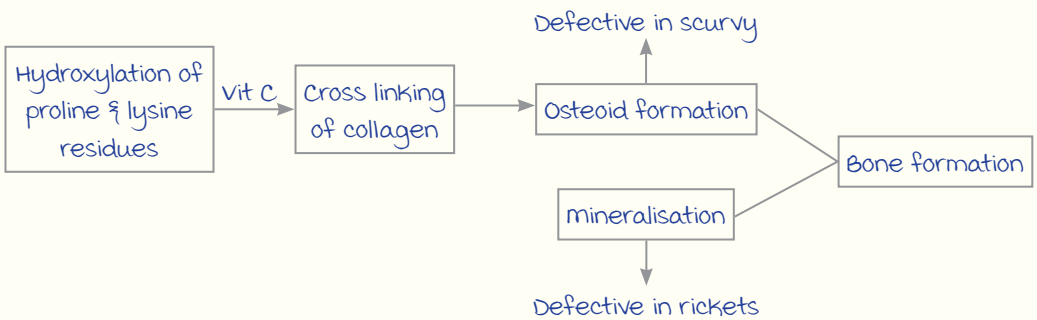


Arnold-Chiari malformation – Type 2

Vitamin Deficiencies & Hyperparathyroidism

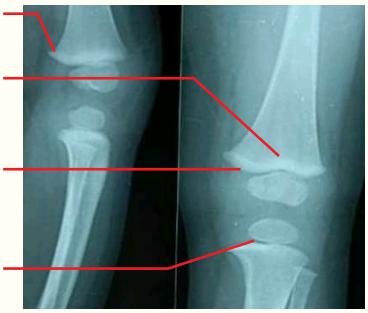
00:19:05

Vitamin Deficiency :



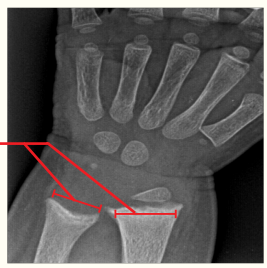
----- Active space -----

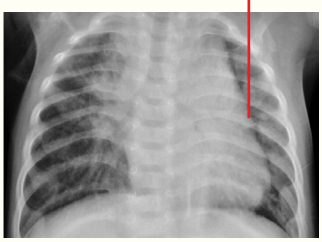
1. Scurvy (Vit C deficiency) :
Subperiosteal hematoma can also be seen.



2. Rickets (Vit D deficiency) :

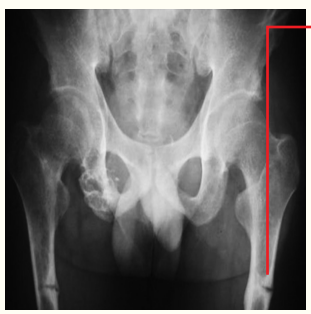
- Loss of provisional zone of calcification.
- Widening of physeal growth plate.
- Widening/splaying & cupping of metaphysis.
- Fraying of metaphysis.
- Rachitic rosary :
  Cartilage hypertrophy at costochondral junction.




Rachitic rosary

Healing rickets

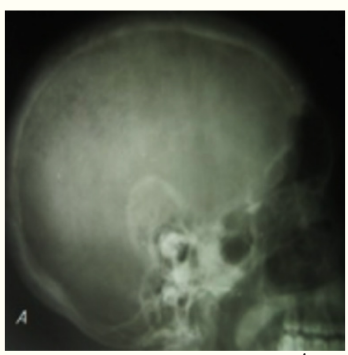
3. Osteomalacia :



Tri-radiate pelvis in osteomalacia

Hyperparathyroidism :


Rugger jersey spine
D/t 2° hyperparathyroidism in renal osteodystrophy.


Salt and pepper skull/ Pepper pot skull

Bone Tumors

00:24:53 ----- Active space -----

Age Distribution :

0–20 yrs	20–40 yrs	>40 yrs
Benign : • Simple bone cyst (SBC) • Aneurysmal bone cyst (ABC) • Eosinophilic granuloma (m/c cause of vertebra plana in children) • Fibrous dysplasia (FD) • Osteoid osteoma • Osteoclastoma Malignant : • Ewing's sarcoma • Osteosarcoma	• Enchondroma • Osteoblastoma • Osteoma • Giant cell tumor (GCT) • Parosteal osteosarcoma	• Chondrosarcoma (m/c site : Pelvis) • Metastatic tumors (m/c site : Skull, axial skeleton) • Multiple myeloma

Site Distribution :

Epiphysis	Diaphysis	Metaphysis
• Chondroblastoma (Children) • GCT (Adults)	• Ewing's sarcoma • Osteoid osteoma • Adamantinoma • Fibrous dysplasia	All other tumors

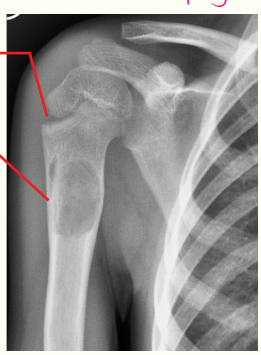
Spotters :

1. SBC/Unicameral BC

m/c site : Proximal humeral metaphysis.

Immature skeleton (Child)

Cystic lesion :
- If fracture ⊕ → Hinged fragment sign.
- If the fractured fragment falls → Fallen fragment sign.

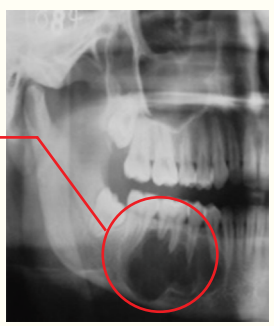


2. Adamantinoma :

m/c sites : Tibial shaft > Mandible

Tibial shaft

Soap bubble appearance



Mandible

3. Enchondroma

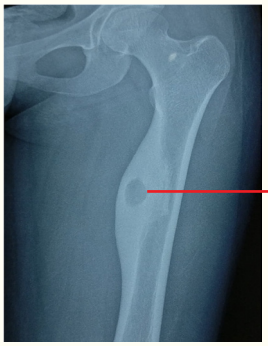
m/c site : Short tubular bones of hands & feet

4. Hemangioma

m/c site : Spine, skull

Striated/Corduroy cloth/ Polka dot vertebra : D/t resorption + thickened trabeculae.

----- Active space -----



'O'-shaped lesion in cortex + surrounding thick periosteal bone formation

5. Osteoid osteoma

m/c site : Femur, lumbar spine

Cortical lesion going away from adjacent joint :

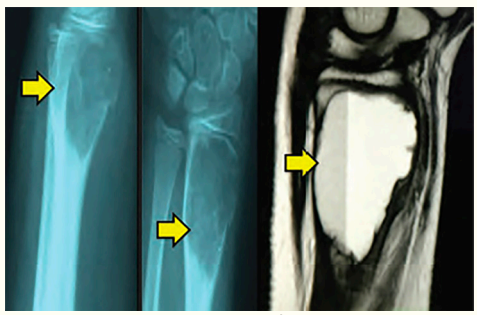
- Cartilage cap ⊕
- Multiple lesions → Diaphyseal aclasia/ hereditary multiple exostosis. (20% malignant risk)

6. Osteochondroma/Exostosis

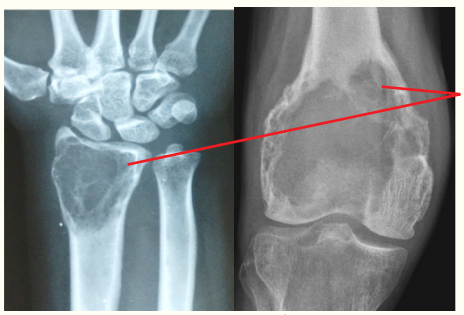
(m/c benign tumor)

Eccentric Lytic Bone Lesions :

Blown out appearance/ Finger in balloon sign



ABC (Child)

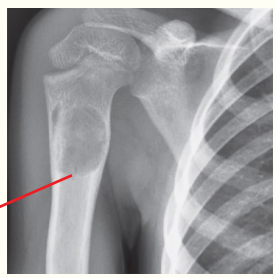


Soap bubble appearance

GCT (Adult)

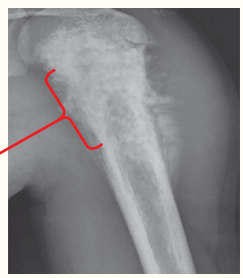
Reaches epiphysis

Lesions with Zone of Transition (ZOT) :



Benign lesion

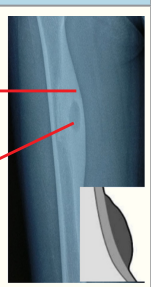
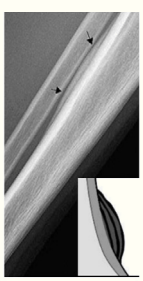
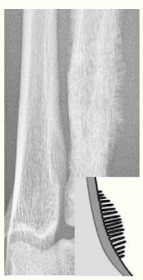
- Narrow ZOT (Well-defined margin)
- Exception : Mets/multiple myeloma (>40 yrs age)



Malignant lesion

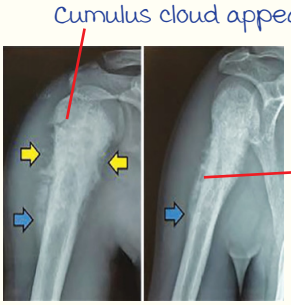
- Wide ZOT (Ill-defined margin)
- Exception : Infection/eosinophilic granuloma

Lesions with Periosteal Reactions :

	Solid	Lamellated	Sunburst/Spiculated	Codman's triangle
Imaging	 Periosteal thickening; Lesion at nidus			
Dx	Osteoid osteoma	Ewing's sarcoma	Osteosarcoma/Ewing's	Osteosarcoma
Malignancy risk	Increasing risk of malignancy →			

Ewing's sarcoma vs. osteosarcoma :

----- Active space -----

	Ewing's sarcoma	Osteosarcoma
Age	5-15 yrs	15-25 yrs
Location	Diaphyseal	Metaphyseal
Periosteal reaction	Lamellated/Onion-peel reaction	Codman's triangle
	Sunburst appearance ±	
Named appearances	Groomed/trimmed whisker appearance 	Cumulus cloud appearance  Codman's triangle
Spread	Bone to bone mets (Skip lesions ⊕)	Hematogenous spread (Cannon ball lung mets)

Multiple Myeloma :

Clinical presentation :

- Elderly patient.
- Weight loss.
- Generalized weakness.
- Vertebra plana.

Rain-drop skull

Bone Tumour Syndromes :

	Associations	Risk of malignancy
Ollier's disease	Multiple enchondroma	10%
Maffucci syndrome	Multiple enchondroma + hemangioma	25%
Diaphyseal aclasia	Multiple exostosis	20%
Gardener's syndrome	GI polyposis + multiple osteoma + epidermal cyst + desmoid tumors	-

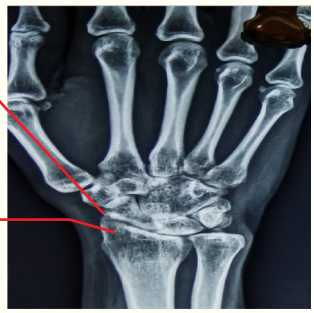
Inflammatory & Spine Lesions

00:36:28

Rheumatoid Arthritis (RA) :

- Earliest joint involved : Metacarpophalangeal (MCP) & proximal interphalangeal (PIP) joints.
- Earliest finding at wrist joint : Erosion of ulnar styloid process.
- RA factor : ⊕ in 70% cases.
- Deformities : Seen in advanced RA.

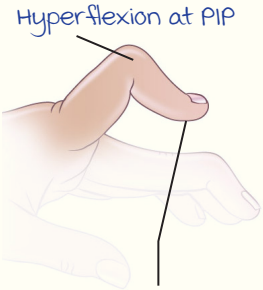
----- Active space -----



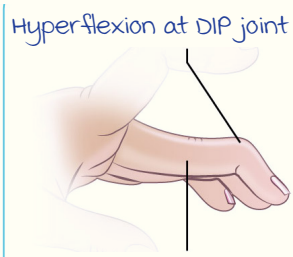
Early RA

Advanced RA

Erosions & deformities ⊕

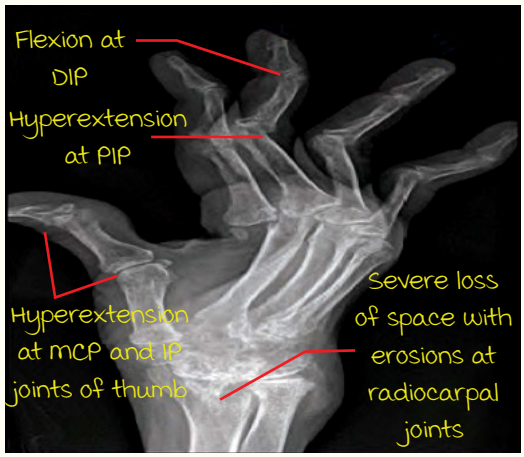


Boutonniere deformity



Swan neck deformity

Mallet finger



Hitchhiker's thumb

Ankylosing Spondylitis :

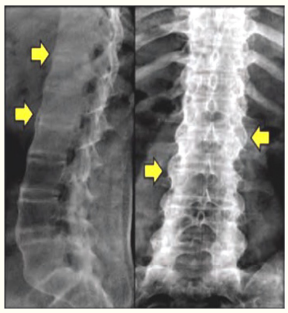
- Young adult with back pain.
- RA factor ⊖ (Seronegative arthritis), HLA-B27 ⊕.

Signs in AS :

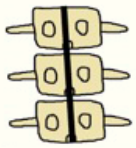
1. Shiny corner sign : Sclerotic corners of vertebral bodies d/t enthesitis.
2. Romanus lesion : Erosions of vertebral bodies at the corners.
3. Squaring of vertebra.
4. Bamboo spine/Poker's spine : Fusion of adjacent vertebral bodies d/t bridging syndesmophytes resulting in a bamboo-like appearance.
5. Carrot stick fracture : Fracture of the fragile vertebra.
6. Anderson's lesion : Pseudoarthrosis at the fractured site d/t poor healing.
7. Dagger sign : Calcification of interspinous ligaments.
8. Railroad track sign : Calcification of B/L paraspinous ligaments.
9. Trolley track sign : Calcification of both interspinous & paraspinous ligaments.

----- Active space -----

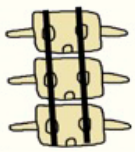
Sacroilitis (Earliest joint)
Early detection : MRI



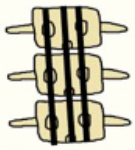
Bamboo spine



Dagger sign



Railroad track sign



Trolley track sign

Gout :

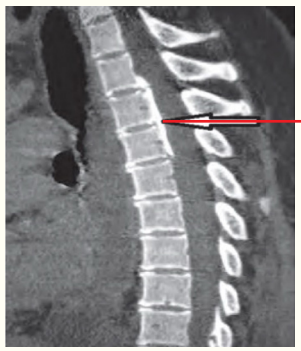
- Middle-aged patient with severe pain & swelling of 1st MTP (m/c).
- Hyperuricemia.

Martel's 6 sign

Spine Lesions :

Dripping candle wax appearance/ flame-shaped osteophytes : Hyperostosis along anterior longitudinal ligament of cervical spine

Diffuse idiopathic skeletal hyperostosis (DISH)



Ossified posterior longitudinal ligament

Japanese disease

Osteomyelitis

00:42:09

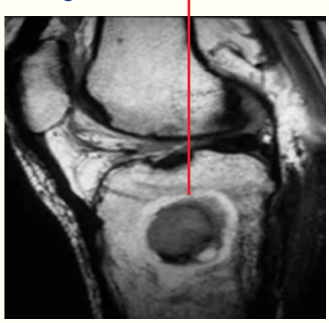
Role of imaging modalities :

Imaging	Features
X-Ray/CT	Latent period : 10 days (Limbs), 21 days (Spine)
99m Tc MDP bone scan	Earliest but non-specific
MRI	IOC

Chronic Osteomyelitis :

Pathophysiology :

Bone destruction → Healing → Periosteal reaction.

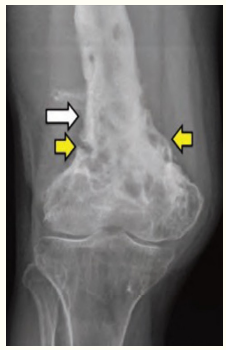


Penumbra sign on MRI
Sign of infection.

----- Active space -----

Features :

- Sequestrum : Dead bone d/t infection (Reservoir of infection).
- Involucrum (White arrow) : Thick periosteal new bone formation (Tries to isolate sequestrum).
- Cloaca (Yellow arrows) : Defects in involucrum (Empyema necessitans).



Chronic osteomyelitis

Subacute Osteomyelitis/Brodie's Abscess :

- m/c presentation : Male child with nocturnal proximal leg pain (Relieved by analgesics).
- m/c site : Proximal tibia.
- m/c organism : S. aureus.

Cystic lesion with dark sclerotic rim

MRI image

Lesion with white sclerotic rim

X-Ray image