NEET - SS

RADIOLOGY

LMR | Notes

(LAST MINUTE REVISION NOTES)



RADIOLOGY GROUP · COMPLETE NOTES

NEET-SS Radiology LMR Notes

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Chapters included

- Large Airway Disease and Chronic Airflow Obstruction
- Pulmonary Neoplasms
- High-Resolution CT of Interstitial and Occupational Lung Disease
- Thoracic Trauma and Related Topics
- Airspace Diseases

1. Large Airway Disease and Chronic Airflow Obstruction

Core framework

Obstructive physiology reflects loss of elastic recoil, small-airway narrowing, or both. Emphysema is the major imaging correlate of loss of recoil; airway inflammation, wall thickening, mucus and/or irreversible bronchiolar fibrosis contribute to obstruction.

Mind map: chronic airflow obstruction

CORE PATTERN / CLINICAL QUESTION
→ Large airway: Look for focal/long-segment narrowing, wall thickening, intraluminal or extrinsic mass, dynamic collapse
→ Bronchiectasis: Permanent bronchial dilatation; assess distribution, mucus plugging, associated small-airway disease
→ Small airways: Centrilobular nodules/tree-in-bud, mosaic attenuation, expiratory air trapping
→ COPD/emphysema: Low attenuation, vascular pruning, bullae; quantify distribution and severity
→ Asthma: Airway wall thickening and air trapping may occur; imaging can be normal between episodes

Tracheal disorders: imaging approach

- Chest radiographs can miss tracheal disease; inspect frontal and lateral views carefully.
- MDCT with multiplanar reformations defines site, length, degree of narrowing, wall thickening and luminal contour.
- Expiratory CT helps assess tracheal collapsibility; virtual bronchoscopy can be useful in selected cases.
- Post-intubation stenosis commonly relates to cuff or stoma injury. Post-tracheostomy stenosis typically begins just distal to the stoma.
- Active infectious tracheobronchitis may show irregular wall thickening and narrowing; healed/fibrotic disease tends to have smooth narrowing with a normal-thickness wall.
- Primary tracheal malignancies are uncommon; squamous cell carcinoma and adenoid cystic carcinoma are the principal types

Problem	Key imaging clue / approach	trap
Post-intubation stenosis	Often concentric narrowing; MPR defines length and degree	Do not assess only one axial slice
Tracheobroncho malacia	Dynamic expiratory acquisition assesses collapse	Static inspiratory CT may understate dynamic disease
Active infection	Irregular circumferential wall thickening; possible mediastinal inflammatory change	Can progress to fixed stenosis
Tracheal tumour	Soft-tissue mass; assess longitudinal extent and adjacent structures	Do not confuse focal tumour with benign stenosis

1. Oesophagus

1.1 Carcinoma: imaging and staging

- Normal wall (distended): <5 mm on CT. SCC dominates upper/mid oesophagus; adenocarcinoma dominates lower third/GOJ (Barrett, GERD, obesity).
- Modality roles: barium = stricture morphology; EUS = best for T and regional N; CT = T4 vs T1–3, distant disease; PET-CT = M staging (upstages ~15–20%); MRI rarely used.
- CT limits: cannot separate T1/T2/T3 (wall layers invisible). Rely on EUS for this.
- EUS: 5 layers; T1 = mucosa/submucosa, T2 = hypoechoic muscularis propria disrupted, T3 = adventitia breached, T4 = adjacent organ. If the echoendoscope cannot pass the stricture, assume advanced T3/T4. Nodes: round, hypoechoic, sharp border, >1 cm = malignant features.

- Regional nodes (TNM 8): any periesophageal node from the cervical region to the coeliac axis (includes paratracheal, subcarinal, para-aortic-hilar, paraesophageal, left gastric, coeliac). Older editions called coeliac/cervical nodes M1a for upper/lower tumours: be aware of the edition your source uses.
- Fistula: oesophago-airway fistula = T4b → stent/palliation. Aorto-oesophageal fistula = herald bleed after stenting.
- Post-treatment: FDG-PET response guides after neoadjuvant chemoradiotherapy; post-radiation wall thickening and fibrosis mimic residual tumour.

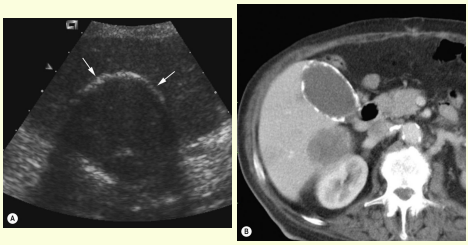
Category	Definition (AJCC/UICC 8)	Imaging point
T1a / T1b	Lamina propria–muscularis mucosae / submucosa	T1a → EMR/ESD candidate; EUS or mini-probe
T2	Muscularis propria	cT2N0 → upfront surgery vs neoadjuvant (centre dependent)
T3	Adventitia	Wall >5 mm with periesophageal fat stranding
T4a	Pleura, pericardium, azygos vein, diaphragm, peritoneum	Potentially resectable
T4b	Aorta, vertebral body, trachea/bronchus (other adjacent structures)	Unresectable. Aortic contact >90° (Picus), loss of the fat triangle, airway indentation/fistula
N1 / N2 / N3	1–2 / 3–6 / ≥7 regional nodes	Count matters, not size. CT node >1 cm short-axis suspicious; EUS more sensitive
M1	Distant (incl. non-regional nodes)	Liver, lung, bone, adrenal; PET for occult disease

Important

Do **not** use CT to separate T2 from T3. EUS is the answer. For distant M1 detection the answer is PET-CT. For a tight stricture that blocks the scope, think T3/T4 and N+.

1.2 Benign tumours, cysts and structural lesions

Entity	Key imaging	Pearl
Leiomyoma	Smooth intramural soft-tissue mass; 'bowed' lumen; may calcify	Most common benign oesophageal tumour; lower two-thirds. Biopsy not needed; EUS-guided FNA/core distinguishes from GIST
Fibrovascular polyp	Long, pedunculated, upper oesophagus; fat + soft tissue on CT	Arises near cricopharyngeus; may regurgitate into mouth/asphyxia
Duplication cyst	Round fluid-attenuation, T2 bright, no enhancement	Foregut cyst, usually right posterior mediastinal; no communication with lumen



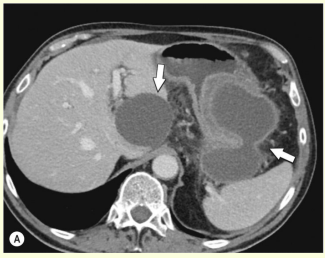
Porcelain Gallbladder.

(A) US—echogenic wall with marked shadowing (arrows) . (B) Portal venous phase CT with mural calcification. Note an adjacent liver metastasis from a coincidental colorectal carcinoma.



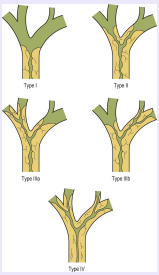
Primary Sclerosing Cholangitis.

Endoscopic retrograde cholangiopancreatography shows strictures and characteristic diverticula-like outpouchings affecting the common duct.



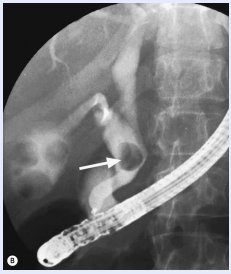
Pancreatitis.

(A) CT shows two unilocular fluid collections, one extending into the fissure of the ligamentum venosum and the other in the omental bursa (arrows) .

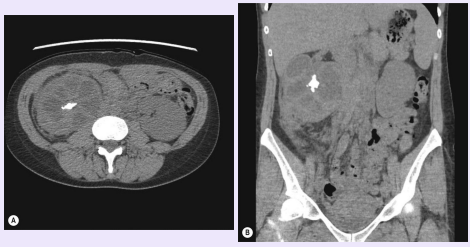


Modified Bismuth classification of malignant hilar biliary obstruction based on proximal extent of tumour.

Even with modern imaging techniques, it can be difficult to accurately differentiate benign from malignant strictures. Serum bilirubin levels have an association with malignancy, with levels over 100 μmol/L being 71.9% sensitive and 86.9% specific, while levels over 250 μmol/L are 97.1% specific for malignancy.



Mirizzi Syndrome.



Xanthogranulomatous Pyelonephritis.

Unenhanced axial (image A) and coronal (image B) computed tomography shows an enlarged right kidney with a staghorn calculus, multiple renal parenchymal collections and perinephric fat stranding.

Bone Tumours (1): Benign Tumours and Tumour-Like Lesions

Systematic approach to a focal bone lesion

- Age: primary bone tumours are uncommon below 5 years and over 40 years; in older adults, metastases and myeloma dominate the differential.
- Location: axial vs appendicular; epiphysis, metaphysis or diaphysis; medullary, cortical or surface-based.
- Margins/zone of transition: narrow, well-defined transition suggests slower growth; wide, ill-defined transition suggests aggressive growth.
- Cortex and periosteum: intact, thinned, expanded, scalloped, breached; identify soft-tissue mass and periosteal response.
- Matrix: chondroid rings/arcs; osteoid cloud-like mineralisation; fibrous dysplasia ground-glass.
- Multiplicity and context: solitary vs multiple; known primary cancer; pain; prior infarct; syndromic associations.

Pattern	Radiographic appearance	Implication
Geographic 1A	Well-defined lytic lesion with sclerotic rim	Usually slow-growing
Geographic 1B	Well-defined lytic lesion without marginal sclerosis	Often non-aggressive but interpret in context
Geographic 1C	Less sharply defined, non-sclerotic margin	More concerning than 1A/1B
Moth-eaten	Multiple 2–5 mm lucencies with intervening bone	Aggressive pattern
Permeative	Tiny coalescing ill-defined lesions, broad transition zone	Most aggressive pattern

- Periosteal reaction reflects growth rate but is not tumour-specific: solid/continuous often slower; laminated/onion-skin indicates repeated periosteal elevation; Codman triangle indicates an interrupted periosteal response; sunburst/spiculated reaction is classically aggressive.
- Chondroid matrix: rings-and-arcs, curvilinear or punctate mineralisation. Osteoid matrix: cloud-like, dense mineralisation. Fibrous dysplasia: ground-glass matrix.
- CT is excellent for subtle matrix mineralisation, cortical detail and osteoid osteoma nidus. MRI is central for local staging and marrow/soft-tissue extent. Fluid-fluid levels are common in aneurysmal bone cyst but are not alone diagnostic.

Benign and intermediate lesions: exam pattern table

Lesion	Typical location / age	Key imaging clue
Osteochondroma	Metaphysis of long bone; growing skeleton	Exostosis with cortex and medulla continuous with parent bone; cartilage cap is assessed on MRI if concerning for malignant transformation
Enchondroma	Medullary cartilage lesion, often hand or long bones	Chondroid rings-and-arcs; pain, deep endosteal scalloping, cortical breach or soft-tissue mass raises concern for atypical cartilaginous tumour
Periosteal chondroma	Surface lesion, often small bones/long-bone metaphysis	Cortical saucerisation with sclerotic rim; distinguish from aggressive surface lesion
Osteoid osteoma	Usually young patient; cortex of long bone	Small nidus, often <1.5–2 cm, with surrounding sclerosis; CT best depicts nidus; classically nocturnal pain relieved by NSAID
Osteoblastoma	Often posterior elements of spine; usually larger than osteoid osteoma	Expansile lesion, less dramatic surrounding sclerosis and less reliable NSAID response
Chondroblastoma	Epiphysis/apophysis in skeletally immature patient	Well-defined lytic epiphyseal lesion with sclerotic margin; may have extensive oedema
Giant cell tumour	Skeletally mature young adult; epiphysis extending to subarticular bone	Eccentric lytic lesion, usually no sclerotic rim; locally aggressive and may rarely metastasise

Non-Tumoural Spinal Cord Lesions

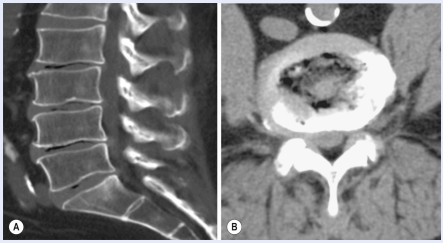
Inflammatory and demyelinating lesions

Disorder	Typical cord MRI pattern	Differentiating clue
Multiple sclerosis	Usually focal, short-segment oval/wedge T2 hyperintensity; often lateral/posterior; may enhance subtly	Cord lesion commonly occupies less than half the cord cross-sectional area; atrophy correlates with disability
Acute disseminated encephalomyelitis (ADEM)	Multifocal, often poorly marginated brain lesions; cord lesions can be long or skip lesions; often resolves on follow-up	Typically monophasic post-infectious/post-vaccination context; MOG-IgG may be relevant
Acute transverse myelitis	Long intramedullary T2 hyperintensity with cord swelling; enhancement may occur	Often involves more than two-thirds of cord cross-sectional area, unlike typical MS cord plaques
NMOSD	Longitudinally extensive transverse myelitis; central cord involvement may be prominent	Consider AQP4-IgG context; optic nerve and area postrema involvement are useful associated clues
MOG-associated disease	Can show longitudinally extensive cord lesions and conus involvement	Clinical/serological context and follow-up are important; may resolve substantially
Neurosarcoidosis	Cord swelling, longitudinal lesions and leptomeningeal or surface enhancement can occur	Dorsal subpial enhancement and "trident" pattern are classic teaching clues; systemic findings help

IMPORTANT A short, peripheral, dorsolateral cord lesion suggests MS; a long central lesion involving much of the cord raises NMOSD, MOG-associated disease or transverse myelitis in the differential.

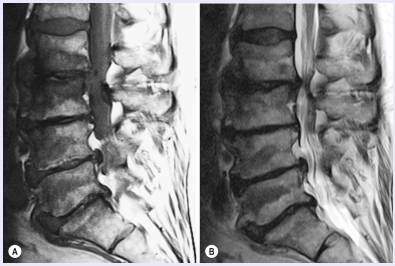
Vascular, developmental and metabolic patterns

Condition	Imaging clue	Exam note
Spinal cord infarction	Acute onset; T2 signal may be initially subtle; DWI can help but is technically challenging	Anterior spinal artery territory may produce anterior cord pattern; correlate with abrupt clinical deficit
Spinal dural AV fistula	Long-segment cord oedema, often lower thoracic/conus, with serpiginous perimedullary flow voids	Important treatable cause of progressive myelopathy in older adults; angiography confirms
Syringomyelia	Central CSF-like intramedullary cavity, often longitudinal	Look for Chiari malformation, tumour, trauma or other cause; distinguish from solid intramedullary lesion
Hydromyelia	Dilatation of central canal, often small and central	May be incidental; assess for associated obstruction or hindbrain abnormality
Tethered cord	Low-lying conus and thickened/fatty filum; associated dysraphism	Assess conus level, filum, lipoma and posterior elements
Subacute combined degeneration	Symmetric posterior-column T2 hyperintensity, sometimes lateral columns ("inverted V" on axial image)	B12 deficiency classically; correlate with labs and clinical context
Osmotic/metabolic/toxic myelopathy	Pattern depends on cause; may be symmetric or tract-selective	Clinical history and laboratory data are essential



Vacuum Phenomenon in a 56-Year-Old Man.

Sagittal (A) and axial (B) computed tomography-reformatted images. Intradiscal gas at the levels L2-L3 to L5-S1. This so-called vacuum phenomenon is a sign of advanced degeneration.



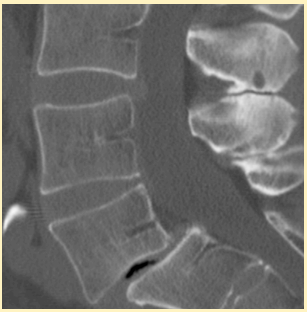
Modic Type 2 Changes.

Sagittal T 1 weighted (A) and T 2 weighted (B) images. There is an increased signal intensity on T 1 weighted and on T 2 weighted images at L3 to L4, L4 to L5 and L5 to S1, indicating replacement of normal bone marrow by fat. There are also more acute Modic type I changes at L2 to L3.



Modic Type 1 Changes.

Sagittal T 1 weighted (A) and T 2 weighted (B) images. There is a decreased signal intensity on T 1 weighted images and increased signal intensity on T 2 weighted images in both end plates at level L5 to S1 and also in the upper end plate at L4 to L5, indicating bone marrow oedema associated with acute or subacute inflammation.



Baastrup's Phenomenon.

Sagittal reformatted computed tomography image in the midsagittal plane. Grade 2 degenerative spondylolisthesis at the L5 to S1 level, malalignment of the spinous processes with anterior slip of the L4 spinous process relative to L5 indicates a type 3 degenerative spondylolisthesis and allows differentiation from isthmic spondylolisthesis. There is collision of the spinous process of adjacent vertebra with progressive interspinous degenerative changes (Baastrup's phenomenon).

66. Bone Marrow Disorders: Non-Neoplastic Conditions

Normal marrow distribution and reconversion

- By adulthood, active red marrow is concentrated in the axial skeleton, flat bones and proximal femora/humeri. Increased haematopoietic demand can cause reconversion from fatty yellow marrow to red marrow.
- Common associations: chronic anaemia, heavy smoking, obesity, endurance/high-altitude training, chronic respiratory disease and G-CSF treatment.
- MRI reconversion: T1 signal is lower than fatty marrow but generally remains higher than skeletal muscle; STIR/fat-suppressed signal is mildly increased. Symmetry and a geographic interface with normal fatty marrow support reconversion.
- Focal nodular marrow hyperplasia can mimic metastasis. Compare T1 signal with muscle/fat, check distribution and symmetry, and use clinical context; atypical focal lesions may require further imaging or follow-up.

IMPORTANT: Marrow reconversion is usually T1-low relative to fatty marrow but not as low as muscle; diffuse or symmetric pattern and clinical haematopoietic stress are useful discriminators.

Thalassaemia

- Chronic anaemia causes marked marrow hyperplasia and extramedullary haematopoiesis. Untreated severe disease can produce bony expansion, cortical thinning and coarse trabeculae.
- Classic patterns: Erlenmeyer-flask deformity; widened diploë with "hair-on-end" skull; rib-within-a-rib appearance; club-like anterior rib ends; expansion of metacarpals/phalanges and facial bone changes ("rodent facies").
- MRI: diffuse reduction in T1 marrow signal from red marrow reconversion; EMH may form paraspinal, presacral or mediastinal masses and may extend epidurally causing cord compression.
- Repeated transfusion causes iron overload and endocrinopathy; osteopenia/osteoporosis and fractures may occur. Modern early transfusion has reduced the frequency of classic skeletal deformity.

Sickle cell disease

- Bone infarction and osteonecrosis are major skeletal complications. Infarction can cause medullary sclerosis and serpiginous margins; osteonecrosis classically affects femoral and humeral heads.
- Vertebral endplate infarction can produce central endplate depression and the "H-shaped" vertebra; this is a classic but not universal finding.
- Infection can mimic infarction and vice versa. Salmonella is a classic association in sickle cell osteomyelitis, but Staphylococcus aureus also occurs; MRI and clinical/laboratory correlation are essential.

Myelodysplastic syndromes and aplastic anaemia

- MDS can cause nodular, patchy or diffuse marrow T1 signal reduction with corresponding STIR/fat-suppressed hyperintensity. Patchy/diffuse involvement may correlate with more advanced disease in the chapter description.
- Aplastic anaemia generally does not cause reactive skeletal radiographic changes; MRI may show increased fatty marrow signal.

Dynamic contrast-enhanced MRI (DCE-MRI)

- DCE-MRI follows signal change after gadolinium contrast and uses kinetic modelling to estimate tissue perfusion/permeability. Unlike CT, signal is not directly linearly proportional to contrast concentration without sequence/model assumptions.
- Ktrans is a volume transfer constant influenced by blood flow, permeability and extracellular space; its exact physiological interpretation depends on the model and tissue context.
- DCE-MRI can assess tumour vascularity and early treatment effect, particularly for therapies targeting angiogenesis. Reproducibility depends on acquisition, contrast dose/timing, motion correction and model selection.
- Model-free parameters include initial area under the enhancement curve and wash-in/wash-out descriptors; model-based parameters estimate transfer rates and extracellular volume.
- Gadolinium safety: use agent class and renal function context appropriately; the chapter discusses restrictions associated with some linear agents. Avoid treating all gadolinium agents as equivalent.

Diffusion-weighted MRI

- DWI reflects random motion of water; restricted diffusion commonly produces high signal on high-b-value images with low ADC, as in many cellular tumours, abscesses and some acute infarcts.
- ADC is affected by cellularity, necrosis, perfusion, b-values and technical factors. Low ADC is not specific for malignancy: pus and some benign/high-cellularity lesions can also restrict.
- Response to therapy may increase ADC as cellular membranes break down and extracellular water mobility rises, sometimes before tumour shrinkage.

PET and PET/CT

Tracer	Main biological target / use	Important caveat
18F-FDG	Glucose metabolism; common for staging and response in many cancers	Inflammation, infection and activated immune cells can be avid; some low-grade tumours are less avid
18F-FLT	Cell proliferation/thymidine kinase pathway	Proliferation tracer; uptake and clinical role vary by tumour and protocol
18F-FMISO / hypoxia tracers	Hypoxic tumour regions	Useful biologically, but availability and standardisation limit routine use
PSMA-targeted tracers	Prostate-specific membrane antigen expression; prostate cancer staging/recurrence	Uptake may occur in non-prostate conditions and expression is heterogeneous
Somatostatin-receptor tracers (e.g., 68Ga-labelled analogues)	Neuroendocrine tumour receptor expression; staging and selection for receptor-targeted therapy	Interpret uptake with physiologic sites and tumour grade
Amyloid/other specialised tracers	Selected biological targets rather than generic tumour metabolism	Indication-specific; not interchangeable with FDG

- FDG uptake reflects glucose utilisation and is often reported using SUV, but SUV depends on acquisition time, glucose level, body-size normalisation, scanner calibration and reconstruction.
- Partial-volume effect can underestimate uptake in small lesions. Motion (especially lung/liver), hyperglycaemia and recent treatment can affect quantification.
- Non-FDG tracers may target proliferation, hypoxia, receptor expression or specific antigens. Tracer selection must match tumour biology and the clinical question.

71. Paediatric Abdominal Imaging

Approach and modality

- Ultrasound is generally first-line for paediatric abdominal symptoms; fluoroscopy remains important for selected luminal questions. CT is reserved for selected trauma, complications or unresolved urgent questions; MRI is useful for complex liver/pelvic/soft-tissue problems.
- Age and symptom pattern matter: bilious vomiting in a neonate requires urgent evaluation for obstruction/malrotation; a palpable mass, bloody stool, distension and failure to pass meconium direct the differential.

Neonatal abdominal wall and bowel emergencies

Condition	Key imaging pattern	High-yield distinction
Gastroschisis	Antenatal US shows bowel loops freely floating in amniotic fluid; postnatal bowel protrudes through a small defect, classically right of a normally positioned umbilicus, without covering membrane	Associated anomalies are less frequent than in omphalocele; complex cases include atresia, perforation, volvulus or necrosis
Omphalocele	Midline herniation through umbilical ring with a covering sac; cord inserts into sac	Look carefully for associated cardiac/chromosomal anomalies
Duodenal atresia	"Double-bubble" stomach and proximal duodenum with little/no distal gas in complete obstruction	Association with trisomy 21; partial obstruction may be less classic
Jejunoileal atresia	Multiple dilated small-bowel loops with air-fluid levels; distal gas depends on level/completeness	Consider associated volvulus, meconium ileus or other causes of obstruction
Necrotising enterocolitis (NEC)	Pneumatosis intestinalis, portal venous gas, dilated loops; pneumoperitoneum suggests perforation	Serial abdominal radiographs and US may help assess bowel wall/perfusion and free fluid
Meconium ileus	Distal small-bowel obstruction with granular/soap-bubble appearance; microcolon on contrast enema	Strong association with cystic fibrosis
Hirschsprung disease	Contrast enema may show transition from narrow distal aganglionic segment to dilated proximal bowel; rectosigmoid ratio may be reversed	A normal early contrast enema does not exclude disease; histology confirms diagnosis

Malrotation and volvulus

- Upper GI contrast study is a key test for malrotation in a stable infant with bilious vomiting; the duodenojejunal junction should normally lie left of the spine at approximately the level of the duodenal bulb.
- Midgut volvulus: corkscrew configuration of duodenum/jejunum on upper GI study; US may show a whirlpool of mesentery and vessels around the SMA. Suspected volvulus is a surgical emergency.
- Do not reassure based on a non-specific abdominal radiograph if the clinical concern is malrotation/volvulus; use the appropriate targeted study urgently.

Intussusception

- Usually ileocolic in young children. Ultrasound: transverse target/doughnut sign and longitudinal pseudokidney sign; Doppler helps assess perfusion but does not alone determine viability.
- Pneumatic or hydrostatic enema can be diagnostic and therapeutic in appropriate stable children without perforation/peritonitis; monitor for recurrence and complications.

Salter–Harris classification

Type	Fracture path	Key point
I	Through physis only	May be radiographically subtle; epiphysis separated from metaphysis
II	Physis + metaphysis	Most common; metaphyseal fragment (Thurston–Holland fragment)
III	Physis + epiphysis, intra-articular	Articular congruity matters; often distal tibia
IV	Metaphysis → physis → epiphysis	Intra-articular; risk of growth arrest and articular incongruity
V	Crush injury to physis	May be occult initially; diagnosed later by growth arrest

- Types III–IV cross the epiphysis/articular surface; accurate reduction is important. Higher-grade injuries increase risk of premature physeal closure, deformity and limb-length discrepancy.
- The physis is weaker than surrounding ligaments in children; injuries that cause ligament tears/dislocation in adults may cause physeal injury or avulsion in children.

Region-specific traps

- Elbow: use CRITOL sequence for ossification centres—Capitellum, Radial head, Internal (medial) epicondyle, Trochlea, Olecranon, Lateral epicondyle. Timing varies; sequence is more reliable than exact age.
- A posterior fat-pad sign after elbow trauma suggests an occult fracture even if no fracture line is visible. Assess anterior humeral line and radiocapitellar alignment.
- Proximal humeral physis contributes about 80% of humeral longitudinal growth. In young children fractures tend to be metaphyseal; adolescents more often have physeal injuries.
- Simple bone cyst fracture: a cortical fragment may fall dependently into fluid ("fallen fragment sign").
- Pelvic apophyseal avulsions occur at muscle/tendon insertions, especially in sports; chronic repetitive traction can cause apophysitis (e.g., medial epicondyle in throwing athletes).

Cervical spine and serious injury

- Use age-appropriate clinical clearance rules and radiographic technique. Normal variants and incomplete ossification can mimic injury; compare alignment, prevertebral soft tissues and vertebral body morphology.
- MRI is valuable when spinal cord, ligamentous or cartilaginous injury is suspected despite equivocal radiographs/CT, particularly in younger children.

Aortic Intervention

Endovascular aortic repair: planning

- EVAR/TEVAR reduce the physiological insult compared with open repair in appropriately selected patients, but require lifelong surveillance and do not suit every aneurysm morphology.
- Preoperative planning: thin-section arterial-phase CTA covering the whole aorta and access vessels; multiplanar/centreline measurements are used to select device diameter, length and landing zones. MRA is an alternative in selected patients.
- Stent-graft is commonly oversized by approximately 15–20% relative to the aorta to obtain a seal.
- Abdominal proximal neck length commonly required: about 8–15 mm; thoracic proximal landing zone: about 20 mm. Short, angulated, thrombus/atheroma-lined or conical/barrel-shaped necks increase risk of poor seal and endoleak.
- Conventional EVAR is unsuitable in a substantial proportion of AAAs because of adverse morphology; fenestrated, branched or parallel-graft techniques may extend eligibility in complex anatomy.

Device types and terminology

Device/technique	Core concept
Straight tube graft	Used when anatomy allows a straight segment to be excluded.
Bifurcated/trouser graft	Main body with ipsilateral limb and contralateral gate; restores aortoiliac flow.
Fenestrated graft	Fabric openings align with visceral/renal branch ostia; used for juxta-/pararenal or complex aneurysms.
Branched graft	Branches maintain flow to target vessels when seal zone crosses branch origins.
Chimney/snorkel/parallel graft	Branch stent runs parallel to the main aortic endograft to preserve branch perfusion.
Endoanchors	Fixation adjuncts that can help address proximal seal problems/type I endoleak in selected cases.

Acute aortic syndrome and trauma

- Acute aortic syndrome encompasses aortic dissection, intramural haematoma and penetrating atherosclerotic ulcer.
- CTA is generally the rapid first-line cross-sectional examination in suspected acute aortic pathology; define extent, branch-vessel involvement, rupture/haemorrhage and landing zones.
- Blunt traumatic thoracic aortic injury commonly involves the isthmus near the ligamentum arteriosum. Endovascular stent-grafting is used in suitable lesions; associated injuries and aortic anatomy influence timing and technique.
- Treatment choice for dissection/aneurysm depends on location, rupture/complication status, morphology, comorbidity and multidisciplinary assessment.

Tip position and insertion pearls

- Fluoroscopy guides the wire into the IVC/SVC; an angled catheter may help direct the wire if required.
- For a tunnelled catheter, the tip should lie near the atriocaval junction; the chapter describes approximately 2–3 cm below the carina / around the inferior border of the right main bronchus as a fluoroscopic landmark.
- Keep the subcutaneous tunnel smooth and wide to avoid kinking or traction; the cuff of a tunnelled catheter is usually placed several centimetres from the venous entry point within the tunnel.
- Use full aseptic technique, cardiac monitoring and pulse oximetry; verify aspiration, flushing and tip position before use.

Complications and troubleshooting

- Immediate: arterial puncture, haematoma, pneumothorax/haemothorax, air embolism, arrhythmia, malposition, guidewire-related complications.
- Delayed: catheter-related bloodstream infection, venous thrombosis/stenosis, fibrin sheath, occlusion, fracture, pinch-off syndrome (particularly with subclavian route), migration and catheter-related right atrial thrombus.
- Failure to aspirate may reflect tip against vessel wall, kink, fibrin sheath, thrombus or malposition; assess before forceful flushing.
- Suspected catheter infection requires clinical assessment and cultures; device removal depends on organism, severity, tunnel/pocket involvement and whether access is essential.

Skeletal Interventions

Image-guided bone biopsy

- Indications: characterise an indeterminate solitary bone/soft-tissue lesion; confirm suspected metastasis if results alter management; identify unknown primary; evaluate suspected infection/spondylodiscitis; assess selected vertebral compression fractures or before vertebral augmentation.
- Do not biopsy a typical benign 'do-not-touch' lesion without a management-changing reason; correlate radiographs and MRI.
- Bleeding diathesis is the key absolute contraindication to spinal biopsy in the chapter; other contraindications/limitations include unsafe access, uncooperative patient, hypervascular cervical/thoracic lesion and risk of spreading infection.
- Platelets <50,000/μL should be corrected; INR around >1.3–1.5 may require reversal according to local protocol. Antiplatelets are described as stopped at least 5 days before spinal interventions.
- Transpedicular/posterolateral approach is common for lumbar vertebral body biopsy; intercostovertebral approach for thoracic spine; anterolateral approach for cervical spine; oropharyngeal approach for C1/dens.
- Needle must not breach medial pedicle (epidural haematoma/thecal sac injury) or inferior foramen (nerve injury).
- For multiple skeletal metastases, select the largest/easiest accessible lesion while considering structural integrity of weight-bearing bone.
- Target mixed lytic-sclerotic or enhancing portions where feasible; avoid necrotic areas. If sarcoma is possible, coordinate tract with the surgeon to avoid contaminating uninvolved compartments.