CT imaging in TBI

- On CT, low grade gliomas may appear as subtle non-enhancing masses while higher grade gliomas often present as heterogeneous & vasogenic oedema.

- On CT, metastatic lesions may be low density and enhancing masses as seen with lung carcinoma or they be high density with haemorrhagic components as seen with renal cell carcinoma, melanoma & thyroid tumours.

- MRI has high sensitivity but low specificity in evaluation of neoplasms.

General:
- The most widely used imaging modality for evaluation of critically ill patients with CNS pathology. It is widely available, rapid & accurate and has virtually no contraindications in the acute setting - although MRI is more sensitive in detecting intracranial traumatic lesions, it is limited by a longer examination time, less conspicuity of hyperacute haematomas & difficulty in monitoring patients.

Advantages of CT:
(i) useful for diagnosis of CNS trauma, SAH, ICH, haemorrhagic and ischaemic stroke, hydrocephalus, cerebral oedema and the presence of space occupying lesions
(ii) lower cost than MRI
(iii) readily available with short examination time
(iv) safe in the presence of pacemakers, surgical clips & ferromagnetic substances
(v) need to transfer the patient to a site where resuscitation & monitoring facilities are limited
(vi) the need to sedate and possibly intubate patients who are agitated
(vii) low sensitivity for detecting brainstem lesions
(viii) potential need for contrast in patients with renal failure

Advantages of MRI:
(i) provide superior contrast and resolution of grey & white matter compared with CT facilitating easy identification of deep structures within the brain & visualisation of the brainstem & posterior fossa
(ii) use of non-ionising energy

General:
- uses magnetic field gradients and radiofrequency pulses rather than ionising radiation
- many sequences that vary the MRI signal parameters are obtained allowing tissue characterisation based on the tissue's inherent response to magnetic field & radiofrequency pulses
- contrast based contrast agent can be injected intravenously which allows better visualisation of intracranial and intraspinal pathology
- diffusion weighted MRI is based on the evaluation of free versus restricted movement of water molecules. Diffusion weighted MRI is now considered the standard sequence in evaluation of acute stroke because it is more sensitive than standard MRI for identification of acute stroke and for differentiating stroke for other pathologies

Disadvantages of MRI:
- MRI is contraindicated in patients with:
  - pacemakers
  - certain cardiac valves
  - intracranial metal fragments
  - cashew screening is required for the presence of cerebral aneurysm clips
  - other metallic devices, such as surgical implants
  - respirators and physiological monitors must be MRI compatible & one may be introduced into the scanner
  - delays result from all of the above precautions and modifications
  - basic medical instruments such as stethoscopes, haemostats, & scissors must remain outside the scanner

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angiography:
- percutaneous transluminal catheterisation is used to evaluate cerebral and spinal vascular anatomy and integrity
- cerebral angiography is an invasive procedure & imposes some risks. The overall complication rate is 2-4% with most complications being minor and transient such as groin haematoma infections and minor allergic reactions. More severe complications such as cerebral infarction, haemorrhage & death occur infrequently
- cerebral angiography remains the gold standard for establishing the presence of cerebral aneurysms, occlusive or vasomotor
- intervention neuroradiology techniques include embolisation of vascular tumours, aneurysms, and AV malformations; stent placement; angioplasty and thrombolytics

nuclear medicine studies:
- evaluation of CNS pathology with nuclear medicine techniques is still undergoing investigation.
- the major use for this technique is in demonstrating absence of cerebral blood flow in patients in whom clinical brain death testing and cerebral angiography are precluded

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