Role Of Computed Tomography In Head Injuries

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Abstract

The advent of CT has revolutionized the management of head injuries. A speedy diagnosis and a speedy management have only be possible after this marvelous invention. CT demonstrates many of the effects of head injuries better than any other imaging technique and in fact it obviates the need for any other radiographic study.

Extradural Haemorrhage

An extradural haemorrhage produces a biconvex extra-axial abnormality which falls within the absorption range of blood 20- 45 EMI units. Secondly mass effect may produce displacement of the mid-line structures. The intimate attachment of dura to the inner table of skull does not allow diffuse spread of blood, as seen in subdural haematoma. This adherence is greatest in infancy and old age, so extradural haemorrhage is not common in extremes of life. A positive CT scan showing extradural collection, with or without demonstrable fracture on skull films, is all that is radiographically necessary for diagnosis. The extradural haemorrhage is a surgical emergency. Angiography may demonstrate a bleeding meningeal artery, but this is not the practice as the patient may deteriorate neurologically during additional time needed for this procedure. Secondly the bleeding point is usually surgically accessable.

Subdural Haematoma

Acute subdural haematoma shows a convex configuration along the inner table of skull with a concave inner margin. It is more diffuse than

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extradural haematoma. The blood may settle to the dependant portion of subdural com-partment and midline shift is present if collection is large enough. Underlying cerebral oedema also contributes to mass effect. Occasionally the haematoma may involve inter-hemispheric or infra-tentorial subdural space.

A contra-lateral subdural haematoma may first become evident or enlarge after a subdural haematoma is evacuated.

Rarely a subdural haematoma may result from a ruptured aneurysm or a fall sustained by patients suffering from other ailments such as hypertension or related intra-cerebral haematoma.

In subacute or chronic stage and in bilateral subdural haematoma, sometimes false negative scan is encountered. In such cases the subdural collections and associated oedema are equal on both side, hence no shift is seen. The clue may be the small size of the ventricles. Subdural collection can become isodense usually in 15-90 days or in patients with severe anaemia.

A sizeable isodense subdural haematoma although shows midline shift but it is more readily depicted by angiography than a CT scan. Contrast injections may enhance the surouding brain a few EMI units. It may also collect in the subdural haematoma making it more conspicuous.

The fluid in chronic subdural haematoma has a low absorption range. The subdural empyema may show low absorption but the shape is more bicovex and dura often has elevated absorption values after contrast medium enhancement.

A false positive CT scan for recurrent subdural haematoma may occur following evacuation of a large longstanding chronic subdural haematoma when there has not yet been re-expansion of the brain. A recent re-bleed should show higher absorption values, 20-45 EMI units, compared to the usual postoperative residual collection. Cortical atrophy may also simulate chronic subdural haematoma. The adjacent sulci are often enlarged in atrophy. When the question of chronic subdural haematoma on CT scane can not be resolved and the diagnosis is suggested clinically, an isotope scan or ultimately angiography may be indicated.

Hygroma (Arachnoid Cyst)

A hygroma usually associated with hypoplastic lobe (temporal) may have a typical appearance on CT. In cases of temporal hygroma the sphenoid wing on the plain X-rays may be elevated. This form is probably associated with trauma in infancy. If injury occurs later, the findings are analogous to those in subdural haematoma.

Intracerebral Haematoma

Superficial or deep intracerebral haemorrhage may occur following trauma. A small cryptic arterio-venous malformation may be the cuase in certain cases but not ordinarily detected by angiography. Spasm of nearby vessels occurs. The haematoma may later enlarge and further neurological deterioration can occur. Without a CT an intracerebral haematoma may be overlooked even though a subdural haematoma is recognised clinically and evacuated at surgery.

Haemorrhage into a tumour like glioblastoma or metastatic malignant melanoma may occur. An area of irregular contrast enhancement due to neoplasm helps in differential diagnosis. Low absorption abnormality due to oedema or contusion around a traumatic haematoma may be difficult to differentiate on plain CT scan from oedema around a bleeding tumour but the enhancement scan may be helpful. A recent hypertensive thalamic or putaminal haemorrhage shows little surrounding low absorption change whereas haemorrhage into an area of infarction is surrounded by a much wider and irregular area of low absorption.

Intraventricular Haemorrhage

A small intraventricular haemorrhage may not produce significant neurological problems. A large haematoma will produce signs of increased intracranial pressure due to its size, site, associated oedema and production of hydrocephalus. The findings are also due to specific area of brain damage.

Brain Contusion

Brain contusion may initially be not visible on CT because it may contain only small petechial haemorrhages unless these are confluent. It might show an area of low absorption due to associated oedema. Sometimes only cerebral oedema is seen as ventricular compression without low absorption abnormality. Serial scans are necessary to appreciate re-expansion of the ventricles; however, post-traumatic hydrocephalus may also develop. Brain stem swelling due to injury is difficult to visualise on current CT. Metrizamide contrast may help in some cases.

Depressed Skull Fractures

Evaluation of the amount of depression of fracture fragments may be assessed by CT scan. Localization of a superficial fragment as well as a deep fragment may be achieved.

Foreign Bodies

Penetrating bullets produce haemorrhage, contusion and oedema; and CT will show these features as well as localise the bullet fragments.

Intra-orbital localisation of an object is easy with CT and it is more sensitive to many objects that are poorly seen on radiographs, while also displaying the adjacent structures. A secondary abscess may be identified.

Pneumocephalus

Open head injuries may produce air in the cranial cavity. Traumatic perforation of the ethmoidal, frontal or sphenoidal sinuses and adjacent dura may produce pneumocephalus.

Sequelae of trauma and delayed complications

1. Communicating Hydrocephalus:

This may require a shunt. The ventricles are readily depicted and the hydrocephalus is apparent on the CT.

2. Pneumocephalus:

This may develop late due to communication with a sinus or infection, and better seen on CT than on plain skull films.

3. Re-bleed:

Further bleeding can occur after initial injuries particularly when blood pressure fluctuations are out of control. After evacuation of a large subdural on one side a subdural haematoma may become visible on the opposite side, possibly by releasing a temponade effect.

4. Cortical Atrophy:

Atrophy may result following trauma. Ipsilateral ventricular shift and enlargement and cortical atrophy may be seen. Following evacuation of a chronic subdural the brain may be slow to re- expand.

5. Brain Abscess:

An abscess may occur after a penetrating or open injury. Plain and contrast CT enhancement scans will generally depict a high absorption capsule after a sufficient time interval.

6. Leptomeningeal Cyst:

This may follow a fracture. CT will show the intracranial extent of the cyst and bone defect, while the skull films show bone changes only.

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