Space-occupying Lesions of the Brain

Description

A space-occupying lesion of the brain is usually due to malignancy but it can be caused by other pathology such as an abscess or a haematoma. Almost half of intracerebral tumours are primary but the rest have originated outside the CNS and are metastases.

The effect of the tumour may be local, due to focal brain damage and the presentation may give an indication of the location of the lesion but not its aetiology. There may be more general symptoms related to raised intracranial pressure or seizures, behavioural changes, or false localising signs. Large lesions in some regions, such as the frontal lobe, may be relatively silent whilst a small lesion in the dominant hemisphere may devastate speech.

A tumour may infiltrate and destroy important structures, it may obstruct the flow of cerebrospinal fluid (CSP) and cause hydrocephalus or it can induce angiogenesis (new blood vessels) and break down the blood brain barrier, causing oedema.

Presentation

Presenting features may include localising signs, generalised signs and false localising signs. A rapid onset of symptoms suggests a cerebrovascular lesion whilst a space-occupying lesion of the brain will usually be more gradual. However, a space-occupying lesion of the brain can mimic a stroke.

Features of a headache indicating a high risk of a space-occupying lesion of the brain or idiopathic intracranial hypertension include:¹

- A new headache with features suggestive of raised intracranial pressure, including papilloedema, vomiting, posture-related headache, or headache waking the patient from sleep.
- A new headache with focal neurological symptoms, or non-focal neurological symptoms such as blackout, and change in personality or memory.
- An unexplained headache that becomes progressively severe.
- A new onset of epileptic seizures. See separate Epilepsy in Adults and Epilepsy in Children and Young people articles.

Generalised symptoms and signs

Many of these features may be due to raised intracranial pressure.

- Headache:²
  - The classic brain tumour headache (eg, worst in the morning and worse on bending or Valsalva manoeuvre) is not as common as a tension-type presentation or migraine.
  - A change in the pattern or frequency of headaches is a cause for concern.
  - Headache is more common in posterior fossa tumours and rapidly growing tumours.

- Vomiting may occur. This may be without accompanying nausea.
- Nausea may be a feature.
- A change in mental status or a behavioural change is a cause for concern.
- There may be weakness, ataxia or disturbance of gait.
- Even deficits of speech or vision may be poorly localising signs.
- There may be generalised convulsions.

If there are generalised convulsions, try to get a good history. As described in the diagnosis of epilepsy, they may start with focal signs and then progress to a generalised convulsion as in Jacksonian epilepsy. The first features of the episode may be a good localising sign.

If raised intracranial pressure is suspected it is imperative to use the ophthalmoscope to look for papilloedema. This may be more marked in children than in adults.

If epilepsy starts in middle age or beyond, a space-occupying lesion of the brain is one of the possible diagnoses that should be considered.

Many patients have headaches. Very few have brain tumours. A meticulous approach is required to identify those few.²

False localising signs and lateralising signs
• The abducent nerve (cranial VI) has a long and tortuous intracranial path that makes it vulnerable. Abducent nerve palsy is not a useful localising sign. It supplies the lateral rectus muscle and its action is to move the eye laterally - as described in diplopia and cranial nerve lesions.
• Horner's syndrome is not a good localising lesion, as the path of the sympathetic nerves is also long but, as there is no chiasma (fibres don't cross the midline), it is a good lateralising sign. The lesion may also be outside the skull.
• If a headache is unilateral, this is often a good indicator of the side of the lesion. Cerebellar signs do not help to localise the lesion.

Cerebellum
Cerebellar ataxia is described rather more fully elsewhere. Space-occupying lesions represent only a small part of the differential diagnosis.

• Ataxia may present as general clumsiness.
• Intention tremor is worst at the end of a movement and leads to past-pointing. Ask the patient first to touch their nose with the index finger, and then your index finger, held about 50 cm away and back to their nose again. A sign is positive when the patient tends to point beyond your finger.
• Dysdiadochokinesia is tested by asking the patient to hold up their hands and rapidly pronate and supinate repetitively. Ask them to tap the back of their hand as fast as possible.
• Nystagmus may be seen.
• If truncal ataxia is worse when the eyes are closed, the lesion is in the dorsal columns, not the cerebellum.
• Cerebellar speech is described as staccato.
• Causes of cerebellar signs include acoustic neuroma, Friedreich's ataxia, stroke, haemangioma, tumours, multiple sclerosis, chronic alcohol excess and abscess.

Localising signs

Temporal lobe
Temporal lobe lesions often present with rather vague psychological problems.

• There may be depersonalisation, emotional changes and disturbances of behaviour.
• Temporal lobe epilepsy - there can be hallucinations of smell, taste, sound and sight. There may be déjà vu in which there is a feeling of familiarity as if the present has happened before.
• Dysphasia may be noted.
• Visual field defects involve the contralateral upper quadrant.
• Other psychological problems include forgetfulness, fugue (a disturbed state of consciousness in which the patient seems to perform acts in full awareness but upon recovery cannot recollect them), functional psychosis and fear or rage. There may be inappropriate sexual behaviour but the Kluver-Bucy syndrome is extremely rare.
Frontal lobe
- Frontal lobe tumours can cause anosmia. This is especially significant if it is unilateral.
- There may be a change in personality with the person becoming indecent, indiscreet or dishonest.
- Dysphasia can occur if Broca’s area is involved.
- Hemiparesis or fits may affect the contralateral side.

Parietal lobe
Parietal lobe lesions can produce a very interesting neurological picture:
- There may be hemisensory loss.
- Decreased two-point discrimination.
- Astereognosis is the inability to recognise a familiar object placed in the hand.
- Extinction can be demonstrated by asking the patient to close their eyes and touch one side of their body. Ask the patient to point to where you touched. Repeat this but touching both sides simultaneously. The patient will acknowledge only one side.
- The patient may systematically ignore one side of their body, called sensory inattention. If you ask them to draw a clock face, they omit the half contralateral to the lesion.
- Dysphasia may occur.
- Gerstmann's syndrome can be congenital or acquired. The four components are:
  - Agraphia or dysgraphia
  - Acalculia or dyscalculia
  - Finger agnosia
  - Left-right disorientation

Occipital lobe
A lesion in front of the optic chiasma will affect just one eye. A lesion at the optic chiasma, such as a pituitary adenoma, classically causes a bitemporal hemianopia (as decussating fibres are affected). A lesion posterior to the optic chiasm will cause a crossed homonymous field defect (eg, left optic tract lesion causing a right homonymous hemianopia). A lesion in the visual cortex will cause congruent contralateral visual field defects. A visual field defect from the eye or optic nerve will be seen as a black area but loss of the visual cortex often leads to ignoring the affected area.

See also separate Visual Field Defects article.

Cerebellopontine angle
The most common pathology here is an acoustic neuroma. Common features include:
- Ipsilateral deafness.
- Tinnitus.
- Nystagmus.
- Reduced corneal reflex.
- Facial and trigeminal nerve palsies.
- Ipsilateral cerebellar signs.

Corpus callosum
This is an interesting part of the brain that communicates between the two sides. Lesions usually cause severe rapid intellectual deterioration with focal signs of adjacent lobes. There may be signs of loss of communication between the lobes, such as inability of the left hand to carry out verbal commands.

Midbrain
The following features suggest a midbrain lesion:
- Unequal pupils.
- Inability to direct the eyes up or down.
- Amnesia for recent events, with confabulation.
- Somnolence.

Pituitary tumours
If pituitary tumours are large they can cause homonymous hemianopia but the most obvious presenting features may be related to their endocrine effects.

Investigations
- Routine blood tests will include FBC, U&E and LFTs. Na+ may be low due to inappropriate ADH secretion.
- Skull X-ray is usually unrewarding; however, if the pineal gland is calcified, a shift may be seen.
- Imaging studies may include CT scan and MRI scan. Both are very good but MRI is better at delineating soft tissue.
- Biopsy of the lesion may be indicated.
- A known primary tumour may exist or it may be sought by CXR or mammography.
Imaging may indicate the site of a lesion but usually it will not indicate the nature, including whether it is a tumour or an abscess.

Causes of space-occupying lesions

Malignancy
- Metastases, gliomas, meningiomas, pituitary adenomas and acoustic neuromas account for 95% of all brain tumours.
- In adults, two thirds of primary brain tumours are supratentorial; however, in children, two thirds of brain tumours are infratentorial.
- Primary cerebral tumours include astrocytomas, glioblastoma multiforme, oligodendrogliomas and ependymomas. See also separate Brain Tumours in Children and Brain Tumours in Adults articles.
- Primary brain tumours do not usually metastasise.
- About 30% of brain tumours are metastatic and of these about 50% are multiple. About 15-20% of people with metastatic cancer develop cerebral metastases. See also separate Carcinomatosis and Malignancy of Unknown Origin articles.
- The most common primary is lung cancer followed by breast cancer, carcinoma of the colon and malignant melanoma.

Other space-occupying lesions
- A haematoma may follow a head injury. Risk factors include old age and anticoagulation.
- Hydrocephalus.
- Cerebral abscesses are uncommon but risk factors include chronic obstructive pulmonary disease (COPD) that may be a source of infection to the systemic circulation and a right-to-left shunt that permits infection to bypass the lungs that would normally filter it out. Cerebral abscesses are multiple in 25% of cases.
- Cysts that may occur in the brain include arachnoid cysts (in the subarachnoid space), colloid cysts, dermoid cysts and epidermoid cysts.
- Cerebral amoebiasis and cysticercosis are rare.
- Both infection and lymphomas of the CNS are more common with HIV infection.
- Granuloma and tuberculosis can occur.

Differential diagnosis

Other causes of focal CNS signs include:
- Stroke.
- Head injury.
- Vasculitis including systemic lupus erythematosus, syphilis, polyarteritis nodosa and giant cell arteritis.
- Multiple sclerosis.
- Encephalitis.
- Post-ictal state (Todd’s palsy)

Management

Management includes treatment of the underlying lesion, management of raised intracranial pressure, and treatment for any other complications (eg, anticonvulsants) and symptomatic treatment (eg, for headaches and for nausea and vomiting).

Further reading & references

1. Headache assessment; NICE CKS, May 2013 (UK access only)

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