TUMOURS OF THE FRONTAL REGION

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The Frontal Lobe Syndrome

Lesions in this region give rise to personality changes which may be obvious to the clinician, or may be revealed only after searching enquiry. More important facts may be elicited from near relations than from patients. Apathy is the keynote of the syndrome. Thus there may be loss of interest in work or hobbies. There is a special type of incontinence associated with a frontal lobe lesion: patients although fully alert pass urine and faeces anywhere without shame. Mental euphoria is a common feature; patients are not impressed by the seriousness of the situation; and tend to regard the prospect of a major operation with unusual equanimity. A generalized blunting of mental processes may occur; this is, however, sometimes observed with lesions in other situations when marked hydrocephalus is present. Tumours in the dominant frontal lobe may cause motor aphasia.

Tumours extending backwards in the frontal lobe involve the motor cortex or pyramidal fibres. Epilepsy, generalized or focal, is a common manifestation of frontal lesions. Some frontal tumours produce a grasp reflex on the opposite side. The fingers automatically close around an object placed in the palm, and the grip is tenacious. Contralateral hypotonia and inco-ordination sometimes occur with frontal tumours, and occasionally there is nystagmus. This is of considerable practical importance, for tumours of the cerebellum tend to produce minimal localizing signs. Signs of increased intracranial pressure are common with frontal tumours, but their absence does not exclude such tumours.

Differential Diagnosis

Posterior Fossa Tumours

Slowly growing tumours in the posterior fossa tend to produce minimal or no cerebellar signs, and sometimes tumours of the frontal lobe may cause unilateral hypotonia, inco-ordination and even nystagmus.

Temporal Lobe Tumours

Anteriorly placed tumours of the temporal lobe are unlikely to cause defects of the visual fields, and may, therefore, be confused with tumours of the frontal lobe.

Intraventricular Tumours

Tumours in the ventricular system cause hydrocephalus without localizing signs, and may, therefore, be mistaken for frontal tumours.

Hypertensive Encephalopathy

This is suggested by the presence of vascular hypertension, 'nipping' of retinal veins, cardiac enlargement and albuminuria. However, a patient with these signs is not excluded from having a cerebral tumour.

Presenile Cerebral Atrophy (of the Pick type)

In this condition dementia is likely to be more advanced than with most frontal tumours.

Cerebral Syphilis

Other signs of the disease, including a positive Wassermann's test, establish the diagnosis. Nevertheless, patients with a positive Wassermann and evidence of a space-occupying lesion, should be completely investigated as tumour suspects, and it is noteworthy that cerebral gummas do not respond to antisyphilitic treatment.

Investigations

Radiography

Plain radiographs may show evidence of raised intracranial pressure (e.g. erosion of the posterior clinoid processes) and occasionally calcification in a tumour.

Angiography

The anterior cerebral artery is often displaced towards the opposite side, and the middle cerebral artery and its branches may be deflected down-
ward. Parasagittal meningiomas tend to produce a semicircular downward curve in the anterior cerebral artery as seen in lateral views. Olfactory groove meningiomas cause backward displacement of the anterior cerebral arteries.

**Ventriculography**

The anteroposterior view shows displacement of the ventricles towards the opposite side and deformity or absence of filling of the anterior horn on the affected side. The third ventricle usually remains in the same anteroposterior plane as the septum lucidum, whereas temporal tumours tend to cause angulation of these two structures.

**Pathology of Tumours of the Frontal Region**

**Gliomas**, as the name suggests, arise from the glia. Tumour cells infiltrate between the neurons and their processes, tending to produce no neurological disturbance until degeneration, haemorrhage, or cyst formation occurs. A cyst is suspected when the onset of symptoms is sudden or when remissions occur. The commonest glioma in any region of the cerebrum is the glioblastoma multiforme (syn, spongioblastoma multiforme). The glioblastoma is a malignant tumour. On macroscopical examination, some glioblastomas appear to be circumscribed, whereas others have ill-defined limits and may involve two or more lobes of the brain. The opposite hemisphere may be invaded through the corpus callosum, or tumours arising in the corpus callosum may spread into both hemispheres. The cut surface of glioblastomas reveals characteristic dark areas of haemorrhage and sometimes cystic degeneration. The microscopic appearance often varies from one part of a tumour to another. The most characteristic feature is the great variation in the size and shape of the cells. Multinucleated neoplastic giant cells and mitosis are frequently observed. Some areas may have the appearance of an astrocytoma, supporting the current view that glioblastomas arise from astrocytomas. Thus many neuropathologists have abandoned the term glioblastoma and describe gliomas according to the Kernohan classification (grades 1, 2, 3 and 4). Grade 1 corresponds with the astrocytoma, a relatively benign tumour, and grade 4 with the glioblastoma multiforme. Intermediate grades are indefinite and tend to vary with the sections examined. The grade 1 gliomas occur somewhat infrequently in the cerebrum. They are usually of firmer consistency than normal brain. They sometimes appear circumscribed although tumour cells penetrate beyond the apparent plane of cleavage. These gliomas may give rise to cysts. The fluid in the cysts is yellow, and contains a large amount of protein. Cysts may arise within tumours or on their outer surface. In the latter case, most of the cyst wall is smooth and free from tumour cells, and removal of the tumour is all that is necessary to prevent reaccumulation of cystic fluid.

**Oligodendrogliomas**, as the name suggests, are thought to be derived from oligodendrocytes (so named because of their paucity of dendritic processes). They are rare tumours (less than 2 per cent. of all intracranial tumours), with a maximum incidence in the fourth and fifth decades. They occur in the cerebral hemispheres (especially the frontal lobes) more often than in any other part of the brain. They are composed of closely packed cells with spherical darkly staining nuclei, each surrounded by a ring ('halo') of feebly staining cytoplasm. Calcification is common and can usually be demonstrated radiologically. The importance of this tumour is that there is a good prospect of long survival after removal.

**Meningiomas** (syn. dural endotheliomas)

About 15 per cent. of all primary intracranial tumours are meningiomas and they are found more often in the frontal compartment than elsewhere in the cranium. They are almost always attached to the dura mater, but they are enveloped by the brain from which some of their blood supply may be derived. The majority of meningiomas are benign, but recur if their dural attachment is not completely excised. Although attached to the dura mater, meningiomas are thought to arise from arachnoid cells. The growth of meningiomas appears sometimes to be initiated by trauma, for an overlying scar or fracture line may be found. Some meningiomas cause hyperostosis, whereas some cause destruction of adjacent bone. The hyperostosis may be invaded by tumour cells and should, therefore, be removed at operation.

There are several histological varieties of meningiomas. The commonest is the *endotheliomatous meningioma* which is composed of whorls of polygonal cells separated by bundles of reticulum fibres. Numerous small calcified bodies (calciospheres) may be present. The term *psammoma* (psammo = sand) applies to meningiomas containing calcified bodies; it has no other histological significance. Calcification is sometimes sufficient to be revealed radiologically. In the *angioblastic meningiomas* consist of masses of capillary spaces, and *myxomatous meningiomas* are composed of a mixture of spindle and stellate cells separated by mucin and reticulum fibrils.

**Parasagittal meningiomas** are those which arise from the superior sagittal (longitudinal) sinus or falx. Some of them are bilateral. Ligation and excision of the affected part of the venous sinus is
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permissible when the tumour arises from the anterior half of the sinus, but the posterior ligature must be well anterior to the veins draining the motor cortex. A thin layer of tumour tissue is left attached to the sinus when tumours arise further back. Angiography shows downward and sometimes lateral displacement of the anterior cerebral artery, and a vascular pattern is produced by some tumours. Meningiomas which arise from the falx without involving the superior longitudinal sinus can be completely removed with their dural attachment.

**Olfactory Groove Meningiomas.** In addition to the frontal lobe syndrome, and perhaps raised intracranial pressure, these tumours invariably cause anosmia on one or both sides. Backward extension may affect one or both optic nerves and sometimes the chiasm. When only one of the optic nerves is compressed there may be optic atrophy with loss of visual acuity on the affected side, and papilloedema on the other side (*Foster-Kennedy syndrome*). In the early stages of compression of an optic nerve, examination of the visual fields shows a central scotoma. Plain radiography may show thickening of the floor of the anterior fossa, and angiography demonstrates upward and backward displacement of the anterior cerebral arteries. Olfactory groove meningiomas tend to envelop these arteries which are, therefore, liable to injury at operation. Clipping of one anterior cerebral artery may have no neurological effect, or it may cause fatal spasm or thrombosis extending into the circle of Willis. Clipping of both anterior cerebral arteries causes fatal coma or marked dementia and paralysis of both legs.

**Suprasellar Meningiomas** (syn. meningiomas of the tuberculum sellae). These tumours arise from the tuberculum sellae and grow upwards and backwards, elevating the optic chiasm. Large tumours of this kind envelop the internal carotid arteries and their branches. The syndrome is characterized by bilateral diminishing visual acuity, optic atrophy, and bitemporal hemianopia. There is, however, no ballooning of the pituitary fossa as with pituitary tumours. Plain radiography may show hyperostosis of the tuberculum sellae and erosion of the posterior clinoid processes. Ventriculography shows deformity of the anterior end of the third ventricle. Bilateral carotid arteriography should be done to show the relationship of the arteries to these tumours. A bifrontal approach is indicated for suprasellar meningiomas. Any part of the capsule adherent to the internal carotid arteries and its branches, or the optic nerves and chiasm, is left undisturbed.

**Secondary Tumours**

Intracranial metastasis may occur from primary malignant tumours anywhere in the body, although carcinoma of the bronchus is the tumour most often responsible for intracranial metastasis. About one-third of secondary tumours of the brain are solitary, they are, therefore, removed if accessible and if the prognosis of the primary tumour is reasonably good.

**Frontal Extensions of Pituitary Tumours**

Chromophobe adenomas of the pituitary gland occasionally grow into the frontal region and produce the frontal syndrome. This may happen even without compression of the optic chiasm.

**Epidermoid Tumours** (syn. pearly tumours of Cruveilhier, or cholesteatomas)

These rare tumours sometimes occur in the frontal region (other sites are the cauda equina, the skull and the posterior fossa). There is a capsule of epidermal tissue, without dermal appendages, enclosing a mass of epithelial debris and cholesterol crystals. In ventriculograms the air in the deformed ventricle has a characteristic mottled appearance. All debris and crystals must be removed at operation, otherwise a fatal aseptic meningitis may occur.

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