made use of in the treatment of cases of sterility with ovarian hypoplasia, in amenorrhoea, and other minor menstrual disturbances. In a series of cases treated at St. Mary's Hospital and elsewhere the procedure has been to give one-tenth of the erythema dose to the skin over each ovary through an anterior port at intervals of one month, and repeated three or at the most four times. The treatment can do no harm, and has proved successful, so far as I can judge at the moment, in a little under 25 per cent. of cases; it is therefore well worth trying. I shall be very interested to hear if anyone present has tried the treatment, and with what results.

There is another minor, but sometimes most distressing, complaint, which frequently responds very favourably to small doses of x rays, and that is pruritus vulvae. A large number of patients get relief, and not a few are cured, but some, for reasons unknown, do not respond at all. My practice has been to give $1/2$ B.S.N., $1/2$ to 1 mm. aluminium filter, 120 kV, once a week for three doses, followed by a further dose of $4/5$ B.S.N. through 3 mm. aluminium some three weeks later. This latter dose I have used also in cases of leucoplakia, but the results, on the whole, have not been very encouraging. Cases of carcinoma of the vulvae referred for radiation treatment are best treated, I think, by radium, followed by a thorough irradiation by x rays of the inguinal glands.

I realize that this communication is incomplete, and deals with the subject in a somewhat scrappy manner, but I hope some points have been raised which will lead to discussion.

THE DIAGNOSIS OF INTRACRANIAL TUMOUR*

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There is no doubt that many members of the medical profession still consider cerebral tumour to be a rare disease which hardly ever occurs in the ordinary run of general practice, and that its manifestations are obscure and unlikely to be recognized. In fact, however, cerebral tumour is rather common, and gives rise to signs and symptoms which are often easy of interpretation. Although the exact localization of the tumour within the brain may be a matter of considerable difficulty, and indeed it may be impossible, the fact that the cranium does contain a tumour can often be diagnosed at an early stage.

Frequency of Cerebral Tumours

It is always difficult to arrive at a figure which expresses with any accuracy the incidence of a disease in the general population, as there are always so many variable factors which affect such a figure; but in conjunction with Mr. Armitage I have made an attempt to reach some conclusion as to the frequency of cerebral tumour, though these figures are still admittedly open to criticism. We have analysed the records of 13,000 necropsies performed at the General Infirmary at Leeds during the last twenty years, and this series consists of cases of all possible types. We have published a detailed analysis elsewhere,¹ but we were able to draw the following conclusions. There were 3,533 cases in which the brain had been examined (27 per cent.), and of these 264 contained a tumour. Now the brain is examined in any patient who showed cerebral symptoms during life, so that most of the cerebral tumours must have

been discovered; on the other hand, a certain number of symptomless tumours may have been missed. The percentage of brains examined which contained a tumour is 7.45 and the incidence of cerebral tumour in the whole series of 13,000 cases is 2.02 per cent. These figures relate to pathological masses within the skull, and of course a number of these were tuberculomata; the incidence of actual neoplasms is 1.34 per cent. Table I shows the number of cases of cerebral tumour compared with the incidence of other common lesions of the nervous system in the 3,533 cases examined.

TABLE I

Disease Condition	Number of Cases
Purulent meningitis	373
Tuberculous meningitis	356
Cerebral tumour	264
Cerebral haemorrhage	211
Cerebral abscess	165

For the figures contained in Table II I am indebted to Dr. Georgiana Bonser; they are taken from the same series of necropsies. In this table the number of cases of cerebral tumour is compared with the number of cases of other common tumours.

TABLE II

Cancer of colon	26 per cent.
Cancer of stomach	2.5 "
Cancer of lung	1.2 "
Cerebral tumour	2.0 "
Cerebral neoplasm	1.3 "

The conclusion one can draw from this table is that a mass inside the skull is almost as common in the post-mortem room as a cancer of the stomach or of the colon, and that 66 per cent. of these are true neoplasms. These figures, then, give some idea as to the frequency of cerebral tumour, and it is interesting to compare them with some clinical figures from the National Hospital, Queen Square, published by Walshe⁴: of 1,309 cases admitted in one year cerebral tumour heads the list of classified diseases with 163 examples, disseminated sclerosis being second with 133, and neurosyphilis, of all forms, third with 113.

The third table shows the relative frequency of the different pathological types of tumour compared with similar figures quoted by Walshe,⁴ which refer to cases operated on at the National Hospital and by Cushing at Boston.

TABLE III

Type	Leeds	London	U.S.A.
Glioma	35.9	40.5	41.5
Metastases	11.3	6.4	4.0
Meningioma	5.6	13.5	12.2
Neurofibroma	1.5	11.5	8.5
Pituitary	3.3	13.1	25.2
Tuberculoma	33.8	2.6	2.8

It will be seen that in all cases the glioma is the commonest type of tumour, but the most striking difference between the lists is with regard to the tuberculoma. The reason for this has been pointed out¹; it is because tuberculoma does not give rise to physical signs until it is complicated by tuberculous meningitis, and for this reason practically never reaches the surgeon's hands. It appears that tuberculoma of the brain cannot

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be diagnosed during life. I do not propose to discuss the other pathological types save to say that there was only one example of gumma, which serves to emphasize how uncommon this condition is.

Symptoms of Increased Pressure

The manifestations of cerebral tumour can be discussed under four headings—namely, those due to increased intracranial pressure, focal symptoms, epilepsy, and mental changes.

With regard to the first group I would like to mention briefly the reasons why a cerebral tumour produces an increase of intracranial pressure. Owing to the skull being rigid the volume of the brain must remain constant, and this volume depends on the mass of the brain, and the volume of the blood and of the cerebro-spinal fluid. The mass of the brain is increased by tumours, but in the slowly growing types this may be very slight. Pressure of a tumour on surrounding veins produces oedema as well as congestion of more distant veins, and, lastly, the circulation of the cerebro-spinal fluid may be obstructed directly—for example, by a tumour compressing the aqueduct of Sylvius. Now the pressure of the cerebro-spinal fluid can be measured very easily by means of a simple graduated glass tube and a lumbar puncture needle. With the patient lying on his side the pressure in a normal person varies from about 80 to 120 mm. of water; this figure, of course, represents the pressure within the skull, and in cases of cerebral tumour it may be 500 mm. or more.

Headache.—The commonest manifestation of increased intracranial pressure is headache, which occurs in nearly 90 per cent. of cases. The headache is paroxysmal in the early stages, being worse when the patient is lying down; it is particularly severe on waking in the morning, and often passes off during the day. The pain is increased by excitement, laughing, coughing, or sneezing, and as the condition advances the headache tends to become continuous. But there are other types of headache seen in cases of cerebral tumour; there may be a localized pain due to pressure of the tumour on the skull, and in this case there may be tenderness on pressure over the site of the pain. In pituitary tumours there is frequently bitemporal headache, and in posterior fossa tumours pain is sometimes referred down the back of the neck, but, on the whole, headache has little localizing value. Headache commencing in adult life which is severe and progressive should arouse suspicion of cerebral tumour, and it may be the patient's only complaint for weeks or months.

Papilloedema.—The next most common manifestation is papilloedema, which is seen in three-quarters of the cases. Papilloedema, which is a true oedema of the disk due to venous obstruction, shows itself as redness, blurring, and eventually swelling and haemorrhages; in the early stages there is little or no impairment of vision, but later the visual acuity diminishes, the visual fields contract, and blindness results unless the pressure is relieved. Papilloedema may start in one eye before the other, but this is of no localizing value. A patient may present himself on account of failing vision, but this is unusual, and by the time vision is impaired there are nearly always other signs and symptoms. Papilloedema is seen in conditions other than cerebral tumour; any cause of increased intracranial pressure will produce it—for example, meningitis or cerebral abscess—and I have seen a high grade of papilloedema develop within two hours of a severe head injury; it occurs, of course, in uraemia and in septicaemia, but the most difficult cases are those associated with arteriosclerosis of the cerebral vessels; in the past two years I have seen six cases with papilloedema associated with gross changes in the retinal vessels and raised blood pressure, but in each there was

a cerebral tumour as well as cerebral arteriosclerosis. One concludes, therefore, that if a patient has marked papilloedema and has no renal disease he is probably suffering from a cerebral tumour whether he be an arteriopath or not.

Vomiting.—The third most common symptom of increased pressure is vomiting, which occurs in some 60 per cent. of cases. Like headache and papilloedema, it may be the only symptom at first, and in this connexion I should like to say that the triad of headache, vomiting, and papilloedema is not seen in complete form in more than half the cases of cerebral tumour. Although vomiting of cerebral origin is said to be projectile and unassociated with nausea this is not true in many adult cases; there may be severe nausea and retching. The vomiting is usually worse in the morning at the time when the headache is most severe. Vomiting occurring in an adult without dyspepsia should always arouse suspicion of cerebral tumour, and if it be associated with headache the diagnosis is almost certain.

Vertigo is a less common symptom of increased pressure; it is usually little more than a feeling of unsteadiness and, though it may be severe in cases of cerebellar tumour, it has little localizing value. There are no changes in the pulse rate, respiration rate, blood pressure, or temperature which are in any way characteristic of increased intracranial pressure, but in the terminal stages the pulse is usually slowed.

Focal Signs of Cerebral Tumour

The second group of manifestations of cerebral tumour consists of the focal signs. In the greater proportion of cases a tumour presents pressure symptoms first and focal symptoms later; sometimes the focal symptoms appear at a very late stage, and sometimes never at all. But in some cases the patient presents himself on account of some disorder which is clearly due to a focal lesion of the brain, such, for example, as progressive hemiplegia, progressive speech defects, defects in the visual fields, or unilateral sensory changes. The exact interpretation of these signs demands a full knowledge of the anatomy and physiology of the brain, and forms too large and complex a subject to discuss here; further, when focal signs are associated with pressure symptoms, certain false localizing signs may appear, and an accurate diagnosis becomes increasingly difficult. But what I wish to emphasize is that when a patient shows evidence of an increasing localized lesion of the brain he is probably suffering from a cerebral tumour, despite the absence of headache, vomiting, and papilloedema. I have recently seen a woman who complained of pain down the left side of the body for many months; there were no symptoms of increased pressure, but she was suffering from a tumour involving the right optic thalamus.

The tumours which present themselves by virtue of their anatomical position more often than any others are, perhaps, the pituitary tumours, so that a word about their manifestations is not out of place. These tumours may produce symptoms either on account of diminished pituitary secretion, less commonly because of over-secretion, or from pressure on surrounding structures; an adenoma of the pituitary gland, unlike tumours arising from the pituitary stalk, rarely produce general pressure symptoms, at least not until the late stages. The changes associated with hypopituitarism are obesity, increasing smoothness of the skin, falling out of the hair, somnolence, fall of blood pressure and of metabolic rate, amenorrhoea, and impotence; any one of these may be the first symptom for which the patient presents himself. In addition, there may be great thirst and polyuria, the condition known as diabetes insipidus, and this again may exist for years as an isolated manifestation. Hyper-

pituitarism exhibits itself as gigantism in the young or as acromegaly in the adult. The type of pituitary dysfunction depends on the histological characters of the tumour, and this does not concern us here, but hypopituitarism is sometimes seen in cases of cerebral tumour remote from the pituitary gland. When there is a marked degree of internal hydrocephalus the third ventricle may be enormously distended; it bulges forwards and downwards, erodes the sella turcica and then compresses the pituitary gland. I have recently seen a case in which a girl complained of headache, failing vision, amenorrhoea, and increasing obesity; she had very large pupils, which were fixed to light, and a high degree of papilloedema; x rays showed that the sella had been completely disintegrated. At post-mortem examination the distended third ventricle presented at the base of the brain as a large cyst, which had eroded the walls of the sella. The tumour was a small glioma lying in the corpora quadrigemina.

Then there are the manifestations of pituitary tumour which are produced by local pressure, and the most important of these results from pressure on the optic chiasma; such pressure produces changes in the visual fields, the most usual being bitemporal hemianopia; less commonly homonymous hemianopia may occur; if untreated this condition progresses to complete blindness with optic atrophy. Then the enlarging tumour distends the sella turcica; this can be seen by x rays, when the sella is ballooned out, though it preserves its shape. As the tumour expands it may cause expansion of the root of the nose; there is often a complaint of mucous discharge from the nose or of epistaxis, and rarely of cerebro-spinal rhinorrhoea. These, then, are the manifestations of local pressure, and I would particularly emphasize the changes in the visual fields. There is one other common symptom of pituitary tumour, and that is headache; this is not the headache of increased intracranial pressure, and it is usually bitemporal and often very severe.

Epilepsy and Mental Changes

The third way in which a cerebral tumour may present itself is epilepsy. Epileptic fits are common in the late stages, when there is marked increase of pressure. There may be fits of the Jacksonian type when the tumour involves the cortex, such fits being of great localizing value. But perhaps the most important condition is epilepsy which antedates all other symptoms of a tumour for months or years. There is nothing about these fits which serves to differentiate them in any way from what we call "idiopathic" epilepsy, and the underlying tumour may lie in any part of the cerebrum. There have been cases in which epilepsy preceded other symptoms for as much as eighteen years,³ and Walshe⁴ considers that when epilepsy occurs for the first time in adult life cerebral tumour is the most likely cause of it. I have recently seen an adult epileptic in whom x rays revealed a large calcified mass in the substance of the right frontal lobe, almost certainly a tumour of some kind.

And lastly, there may be mental symptoms. A large proportion of cases of cerebral tumour exhibit mental symptoms at some time or other, although the proportion of cases in a mental hospital suffering from a cerebral tumour is small. The commonest cause of mental symptoms is the increased intracranial pressure, but there are cases in which mental symptoms depend on the anatomical position of the tumour, and they may antedate the symptoms of increased pressure. Tumours of the pituitary stalk are often associated with marked apathy and drowsiness, and tumours in the left hemisphere (in right-handed people), producing speech defects, often

show mental changes at an early stage. But the tumours most commonly producing mental changes are those of the frontal lobes and the corpus callosum. The pattern of the mental changes appears to have no localizing value, and the psychotic picture may be of various types. In the late stages, when pressure is much increased, the patient is usually drowsy and apathetic, and this often indicates the beginning of the end. But there may be lack of concentration, failure of attention, indifference, and loss of memory for recent events; sometimes there is incontinence of urine, with regard to which the patient is usually quite indifferent ("mental incontinence"), and this is often seen in cases of frontal tumour; in other cases there may be facetiousness and euphoria, and others may show depression.

Differential Diagnosis

We have to bear in mind that any condition producing a rise of intracranial pressure, or any localized lesion of the brain, may in certain circumstances simulate cerebral tumour. One of the first conditions to consider is renal disease, in which there may be headache, vomiting, and papilloedema, sometimes associated with transient hemiplegia or monoplegia; the diagnosis here depends on examination of the urine, the blood pressure (which is always raised in such a case), and the blood urea. Cerebral abscess does not often give rise to difficulty, as there is usually a history of recent ear disease; an important point to remember is that papilloedema is often absent in cases of cerebral abscess. Hydrocephalus following meningitis should not give rise to difficulty, but sometimes hydrocephalus complicates middle-ear disease; this condition, which is called otitic hydrocephalus,² is associated with high-grade papilloedema, and is of doubtful origin. Cerebral aneurysm rarely simulates tumour, for the reason that aneurysms are usually small, and only give rise to symptoms when they rupture. Neurosyphilis may simulate tumour in several ways: the early mental symptoms of a tumour sometimes resemble those of G.P.I., and in both epilepsy may occur. As I have already said gumma is a rare condition, but there was an instance in Leeds recently where a gumma presented as a case of cerebellar tumour. Careful examination of the pupils, combined with serological tests of the blood and cerebro-spinal fluid, should prevent an error in diagnosis. Lastly, cerebral arteriosclerosis unassociated with renal changes produces an infinite variety of clinical pictures which may resemble cerebral tumour, and it is probably the frequency of vascular disease that makes the diagnosis of cerebral tumour much more difficult in middle-aged and older people.

Conclusion

In conclusion, then, cerebral tumour is a common disease which occurs at all ages and produces a variety of signs and symptoms, which may be equivocal in the early stages. But if cerebral tumour be always kept in mind careful examination of the nervous system, together with examination of the cerebro-spinal fluid, will suggest the diagnosis in the great majority of cases; it is very important to make a diagnosis at an early stage, as many types of intracranial tumour are now suitable for surgical treatment, but surgical treatment can never hope to be of much value when there has been great and permanent damage to the brain.

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