THE EPIDERMOID TUMOURS OF THE PITUITARY BODY.

A CLINICAL AND PATHOLOGICAL STUDY.

BY

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INTRODUCTION.

Considerable interest has been evinced in the past in tumours situated in the hypophysis cerebri and its immediate neighbourhood. The occurrence of these tumours is of sufficient rarity to have induced an interest in them if only on that account alone. In the case of the epidermoid tumours this interest has been centred largely on the pathological side of the problem which held much that was obscure in embryology, histology and classification. Such writings as were directed towards the clinical side of the subject concerned themselves almost wholly with questions of symptomatology and diagnosis. The treatment of these cases was regarded as wellnigh hopeless, and either no surgical interference was undertaken, or else if an intracranial exploration were ventured upon the surgeon was content either to aspirate the contents of any cyst which might be encountered, or to accomplish a very partial removal. This inevitably led to a period of improvement of short duration, if indeed the case did not terminate fatally in the immediate post-operative period. The results achieved by surgical operative measures in the past have indeed been exceedingly melancholy.
More recently, however, and especially during the past decade, the outlook has considerably altered. Advances in neurosurgical methods, the introduction and elaboration of electrical appliances, and a better understanding of the principles of intracranial manipulations have to a large extent widened the scope of the surgeon practising this branch of his art. The outlook for the patient is so absolutely hopeless without operation, and the improvement to be gained from the partial removals of tumours so relatively slight and of such short duration that one has come to look upon complete extirpation of the growth as the only reasonable surgical aim. A review of the subject is demanded at the present time as it has now become one of live clinical interest, both in the literal and metaphorical meaning of the phrase.

The whole subject is still full of interest from many points of view. From a clinical standpoint, fuller and more careful investigation of symptomatology can lead to earlier diagnosis of the condition, with its increased chance of successful surgical interference. Physiological problems concerning the functions of the pituitary gland and the region of the hypothalamus are still requiring elucidation, and the co-ordination of the symptoms produced
produced directly or indirectly by these tumours, and the findings of clinical and biochemical investigations of these cases is an integrate part of this problem. In the sphere of clinical investigation the subject of perimetry is especially needful of further study and its incorporation into the methods of investigation carried out by the neurologist himself - instead of being in the province of the ophthalmologist alone - is a development very much to be desired. This of course applies not only to tumours such as those under consideration, but to any lesion affecting any portion of the fibre tracts concerned in the visual function.

There is still uncertainty regarding the etiology of these tumours and the views held on their origin have not been wholly satisfying. Especially in the writings concerning the histological structure of these tumours and the nomenclature adopted for their designation is there much that is uncertain or incorrect, and these failings have tended to be perpetuated by each succeeding author. The tumours were first given the name of hypophyseal duct tumours (Hypophysengangs geschwulsten) by Erdheim. There is, however, little to support such a name, for the origin of the tumours from the hypophyseal duct is at best a
a doubtful one. They have also been termed craniopharyngiomas. This term is equally bad, merely pointing to the supposed embryological source of the growth, without defining its actual site and nature. So, too, the term tumour of the craniopharyngeal duct (Frazier and Alpers) is grossly inaccurate in the absence of any such structure at any stage of the human prenatal development. The term adamantinoma introduced by Onanoff is one which has become quite fixed in the terminology. It was based on a mere structural resemblance of these tumours to the developing enamel organ - a resemblance which is a very superficial one - and has not since then been shown by any reasonable evidence to be more than a term coined through analogy. I shall hope to show that the name I here suggest - Pituitary Epidermoid Tumours - is a reasonable and simple one, designating sufficiently the site, origin, and essential nature of these growths without unnecessary reference to uncertain theories of their morphologic or embryologic relationships.

There were available for investigation fourteen cases of tumours of this type with histological material from eleven of them. It was thought, in view of their very interesting pathology /
pathology and the confusion arising out of so varied a terminology as that used in the literature, and particularly the vastly improved results attained by surgical methods which these case records bring to light, that it would be instructive to make a thorough survey of this material, especially at the present time when neuro-surgery is becoming more and more recognised as a live and progressive branch of the parent surgical art. It was because of all these facts then that the present study was undertaken and is now presented.

I should like here to express my thanks to those who have helped me in many ways in preparing this study: to Colonel Harvey of the Royal College of Physicians' Laboratory for his interest in the work and his great kindness in the discussion of various aspects of the pathology of these tumours; to Mr T. Hamilton of the same Laboratory, for his ready aid in many matters, but especially for the trouble and care he has taken in the preparation of the photomicrographs illustrating the histology of the tumours; to Professor D. P. Wilkie, Director of the Department of Surgery of the University of Edinburgh, in which department all the photographic work (with the exception /
exception of photomicrography) was carried out, and to Miss McLarty of the Department of Surgery, who has given so very much of her time and artistic talent to the production of the illustrations of various aspects of the work.

Especially are my thanks due to Mr Norman M. Dott. He it was who first gave me an interest in this branch of surgery, and the opportunity to become acquainted with its various aspects. I have to thank him now for the permission to make use of all his valuable material - the subject of the study, for his great interest at every point, for the immense amount of practical aid and guidance which he given to me, and most important of all - his constant encouragement.
(A.) FATAL CASES.


Admission on 10th July 1928, with complaint of failing vision.

Eight years ago, at the age of seventeen, the patient, who was then a well developed, healthy girl, had begun to exhibit infrequency and decrease of menstruation, and two years later amenorrhea became complete and remained so until the date of admission. Five and a half years ago she had begun to suffer from recurrent headache, referred chiefly to the left frontal region. This continued to recur until the date of admission, and was associated with vomiting during the previous six months. Four years ago sudden onset of blindness in both eyes had occurred. Within a few hours the right eye had recovered its normal vision, but the left eye did not recover and remained blind from that time.

Examination.
Examination. The patient was a rather slight, delicate-looking young woman. Pale complexion. Blood pressure 100/62. The following positive findings were revealed. There was a slight degree of bilateral exophthalmos. X-ray (see figure 1) showed a complete destruction of the dorsum sellae, and a well marked erosion of the left anterior clinoid process. The sellar floor was not expanded or depressed into the sphenoidal sinus. The left eye had no perception of light. Vision in the right eye was 6/9 minus, (see figure 2). The field of the right eye showed temporal hemianopia quite complete in the lower quadrant, and partial in the upper quadrant. There was bilateral primary optic atrophy. The skin was notably thin and fine and rather dry, and the growth of hair on the trunk and limbs was very slight.

Treatment. There was obviously a tumour in the neighbourhood of the sella turcica, causing erosion of bone in this situation involving visual fibres of the chiasm and left optic nerve, and interfering with pituitary internal secretion. The patient was a relatively poor surgical subject, and Mr Dott decided to carry out a transphenoidal operation in the first instance in the hope that an adenoma might be disclosed and dealt with by this route.

Operation, (I). /
Operation, (I). 26th September 1928. Intrapharyngeal ether anaesthesia. The usual transphenoidal approach was made, and the floor of the sella was adequately exposed through the sphenoidal sinus. As the first flake of bone was detached from the sellar floor there was a gush of typical olive-green fluid with glistening cholesterin crystals in it. Quite obviously we had to do with a craniopharyngeal cyst whose wall had been closely adherent to the bone of the sellar floor and had been torn in attempting to remove the bone. These findings contra-indicated any further operative procedure from the nose on account of the risk of intracranial infection. A drain was inserted into the site of the tear in the cyst wall, and brought out beneath the lip. The operation was well tolerated. The drain was removed on the fifth day. On the second day following operation there was rapid improvement in vision. The field of the right eye expanded almost to normal, and she became able to appreciate hand movements in the temporal field of the left eye.

Within a month, as was to be expected from the fact that the cyst had merely been opened, former symptoms began to reappear, - headache, and visual failure, and these steadily became worse. It became obvious that if any permanent relief were to be afforded, a more radical operative procedure, permitting complete removal of the cyst, would /
would have to be undertaken.

Operation, (II). Accordingly, on 29th November 1928, left transfrontal operation was undertaken by Mr Dott. This operation was very poorly borne. Anaesthesia was by rectal ether, and before the operation was commenced the blood pressure had rapidly fallen from 100 to 80. Low left frontal scalp and bone flaps were cut and elevated, and the ventricle was tapped in order to permit elevation of the frontal lobe. Although there had been practically no bleeding the systolic blood pressure had now fallen to 60, and it was judged that it would be quite impossible to proceed with radical operation. A lumbar puncture needle was therefore entered through the frontal lobe and directed to the neighbourhood of the cyst, which was thus tapped and emptied. The bone flap was replaced and the operation was abandoned. The patient made a satisfactory recovery from this operation, and again experienced complete relief from headache and improvement of vision following tapping of the cyst.

Within six weeks headache had begun again, and the vision again began to fall off. Any idea of radical removal of the cyst was now abandoned, and it was decided to mitigate the symptoms as far as possible by tapping the cyst as required with a lumbar puncture needle entered through one of the operation burr holes in the left frontal region.
From January 1929 until January 1930 the cyst was tapped in this way at intervals varying from three to six weeks. During this period the patient was living at home quite comfortably and leading quite an active life. She was in the habit of reporting at hospital when she noticed her vision getting a little dim, and the cyst was then tapped for her, forty to sixty ccs. of greenish-yellow fluid being removed on each occasion. On one occasion, in October 1929, after about forty ccs. of cyst fluid had been withdrawn, air in addition to fluid was obtained from the cyst through the needle. This prompted an X-ray examination, (see figures 3 and 4), which showed the cyst cavity outlined by air. Evidently the old tear into the sphenoidal sinus had re-opened at this time and permitted the entry of air into the cyst. This gave rise to no complications, and air was not obtained at subsequent tappings. A remarkable feature was that actually while the cyst was in process of being tapped the patient would notice her vision becoming brighter, indicating an immediate improvement in conductivity of the optic nerve as pressure upon it was released. The patient was thus kept comfortable and satisfactory vision preserved until, on 17th January 1930, the cyst was being tapped as usual. During the latter part of the /
the operation the patient complained of feeling queer and dizzy, and on this account she was kept in hospital and put to bed. A few hours later she suddenly became comatose, and died in this state about twelve hours after the tapping.

Post-mortem examination was obtained. The brain was fixed in situ by formaline injection of the carotids, and the brain was removed intact in its dural covering and together with the base of the skull. The bone was decalcified and a specimen subsequently cut in sagittal section, (see figure 5). Death was due to injury by the puncture needle of a branch of the anterior cerebral artery with haemorrhage into the third ventricle and hypothalamic region.

Comment. Considering the enormous size of this cystic and solid craniopharyngioma, it is astonishing to how little clinical disturbance it gave rise. The original transphenoidal procedure was of course inappropriate for this particular lesion. The later attempt at a trans-

ontal operation had to be abandoned on account of the patient's poor tolerance. She was, however, kept comfortable and well over a period of a year by the repeated process of tapping the cyst. During this time her only symptoms were amenorrhea, and some degree of permanent damage to vision in the left eye. It is astonishing how the brain had tolerated the gross distortion of its interpeduncular region. In spite
ite of these distortions this patient never exhibited polyuria, pathological somnolence, mental disturbance of any sort, nor any sign of brain stem compression.
FIGURE 1.
FIGURE 4.
Specimen of brain and base of skull with tumour in situ cut in sagittal section. Note the craniopharyngioma, cystic in its lower part, lid in its upper part. It occupies, and is adherent to, the walls of the expanded sella turcica. The pituitary body has been completely rarified by pressure of the cyst. The upper solid portion of the tumour projects deeply upwards and backwards into the interpeduncular region of the brain, distorting and compressing it. There is a recent haemorrhage around the upper pole of the cyst and into the ventricles of the brain. Note the clot in the fourth ventricle and the diffusion of blood in the subarachnoid spaces generally.
II. (No. 252.) Solid suprasellar craniopharyngioma in female aged thirty-two years. Transfrontal operation. Subtotal extirpation. Death 11 months later from probable further tumour growth.

Admission on 27th June 1930, complaining of headache and visual failure. Two and a half years ago menstruation, which had been quite regular up to that time, ceased suddenly and had remained absent to date with the exception of two normal menstrual periods, which occurred about one year ago. One year ago the patient began to suffer from headache referred behind the eyes and over the brow which recurred daily and was especially severe on rising in the morning. One year ago vision began to fail in both eyes simultaneously so that by nine months ago the patient was unable to read. The right eye continued to deteriorate and soon became almost blind while three months ago the left eye improved a little spontaneously so that the patient became able to read large print again.

Examination. The patient was a bright and active young woman. She was of rather slight build but not in any degree abnormal in this respect. The complexion was good. The skin was /
was rather fine and delicate though not really remarkable nor abnormal. Her growth of hair on the limbs and trunk was quite natural. She had the appearance of good health though she suffered considerably from headache and of course was greatly handicapped by her poor vision. The positive findings in this case were: - Vision of the right eye, hand movements; vision of the left eye 6/9 (see figure 1). The field of the right eye was curious, a large bright object being perceived in both upper quadrants and not in the lower quadrants - an altitudinal hemianopia. The field of the left eye showed a clean-cut hemianopia with some depression of the lower nasal quadrant. The right disc showed early primary optic atrophy. The appearance of the left disc was normal. X-ray examination of the skull showed a perfectly normal sella turcica with no trace of erosion of clinoid processes and no superimposed shadow of calcification (see figure 2).

Treatment. Quite obviously the case was one of a tumour compressing the right optic nerve and chiasm in an irregular manner. The normal X-ray appearances and the recurrence of menstruation one year ago suggested a suprasellar rather than an /
an intrasellar growth. Operation was undertaken on a clinical diagnosis of suprasellar craniopharyngioma.

Operation (see figure 3). 2nd July 1930. Right transfrontal exposure. Subtotal removal of solid suprasellar craniopharyngioma. Anaesthesia was by rectal ether and paraldehyde. The usual low right frontal osteoplastic flap was made and a good exposure of the chiasmal region obtained on elevating the right frontal lobe. The right optic nerve was of fairly good colour and consistence and it was tilted upwards and outwards on the surface of the tumour. The anterior pole of the tumour was more laterally placed than usual and did not present between the two optic nerves as usual but between the right optic nerve and the right internal carotid artery. It was at once obvious that the only possible means of access for removal of the tumour was by division of the right optic nerve. The nerve was deliberately sacrificed and cut near the optic foramen. This gave an excellent exposure. The tumour was found to be solid and of a homogeneous but soft and friable consistence. It was removed fragmentally. Its surface stripped easily from the surrounding structures and with the smooth and normal appearing roof of the sella turcica the stalk of the pituitary body was brought into view winding round /
round the left side of the tumour and it was preserved. As tumour removal was pursued into the depths it was found that a large part of the tumour extended backwards and downwards in front of the pons in the posterior cranial fossa. In this region also the tumour was easily mobilised and it seemed as if a complete removal were going to be possible. Unfortunately during manipulations of the posterior pole of the tumour a branch of the basilar artery adherent to its surface was torn. A very sharp arterial haemorrhage ensued. This was satisfactorily stopped by the application to the bleeding point of a piece of fresh muscle. This accident unfortunately prevented removal of the extreme posterior fragments of the tumour. The operation had been very well borne up to the time of the accidental haemorrhage. There was a considerable fall in blood pressure at this time. Convalescence was rather precarious during the first few days with marked variations in pulse and respiration rates and in the temperature. There was an immediate and severe post-operative polyuria, which was satisfactorily controlled by the use of pituitrin. A few hours after the operation a complete oculo-motor nerve paralysis was noted with ptosis, ophthalmoplegia and dilated pupil. Twenty-four hours after the operation a partial right-sided hemiparesis developed. During the next fortnight the /
the hemiparesis, which was probably due to a vascular lesion of
the left cerebral peduncle, had recovered. The polyuria had
become less troublesome though it was still present. During the
third week of convalescence the polyuria further diminished and
subsided. The paralysis of the left oculo-motor nerve however
remained and the visual field of the remaining left eye showed
considerable expansion (see figure 4). Acuity remained poor
probably due to lack of accommodation from the oculo-motor
paralysis.

During the next few weeks the oculo-motor paralysis recovered.
The patient became perfectly well, free of headache with good
vision in the remaining left eye, and took an active part in
household management, social affairs, etc. She remained thus in
satisfactory health during the next nine months.

Towards the end of May 1931 her memory rather suddenly became
deficient. She had an epileptic seizure of some sort. She
began to suffer from severe headache, intermittent vomiting and
the pulse rate fell to between 40 and 50. Further convulsive
seizures occurred. There was again intense thirst and extreme
polyuria. The temporal decompression which had been left at the
operation/
operation did not show any undue prominence. The patient died in coma following a convulsive seizure on 10th June 1931.

Comment. This case was unusual in several respects. The tumour was a solid homogeneous epithelial growth without cystic or gross degenerative changes. It is interesting to note how the fact that it was suprasellar in origin is reflected in the clinical picture. Bodily development was normal. Pituitary function as evidenced by menstruation was not disturbed until 2½ years before the patient came to treatment and even then the hypopituitarism was incomplete for menstruation recurred a year before she came to treatment. Excellent access was obtained to an otherwise inaccessible tumour by the division of one optic nerve. The tumour was unusual in extending backwards rather than upwards and this rendered its posterior pole very difficult of access. Moreover, it was solid and had no firm outer capsule which could be used to draw the tumour forward out of the depths. By reason of these difficulties the accidental operative haemorrhage occurred, which unfortunately precluded complete tumour removal. As a sequel to this accident and the necessary measures for stopping the bleeding the patient showed evidence of operative trauma of the /
the left cerebral peduncle and left oculo-motor nerve but these lesions recovered satisfactorily. The operative result was quite satisfactory with recovery of vision and relief from headache over a period of 9 months. The final recurrence of symptoms suggests that rapid cyst formation must eventually have occurred in this tumour for she eventually died with obvious signs of disturbance of the base of the brain and brainstem.
(Roughly) Large sheet white paper for object.
More perception in nasal field.
Some vision in both upper quadrants. No vision in lower quadrants.

JESSIE WATSON.

V. 1/9

25 : 6 : 30

V. H.M. very slightly + very near

FIGURE 1.
FIGURE 4.

Jessie Watson, 22: 7: 30

3 weeks after operation
III. (No. 293.) Cystic intrasellar craniopharyngioma in male aged 22 years. Transfrontal operation. Complete removal of cyst impossible. Death seventeen days later from disturbance of the base of the brain with hyperthermia, decerebrate rigidity, etc. Post-mortem examination.

Admission in October 1928 with complaint of visual failure, recurrent headache, failure of physical development and somnolence. This boy was quite normal up to the age of five years. At that time, five years before examination), he had an illness lasting for about three weeks, characterised by headache, vomiting and a marked degree of drowsiness. From this time he ceased to grow, and remained with a physical stature and development corresponding to five years old. A few months after this illness his eyesight began to fail, and in a short time the right eye became totally blind. He suffered from recurrent attacks of headache associated with drowsiness, and about a year ago he became quite comatose in one of these attacks and remained so for some ten days, during which nasal feeding was carried out. Vision continued to fail steadily in the remaining left eye.

Examination. This boy aged ten years had a physical development corresponding to about the age of five years. He was notably undersized.
Le was thin, pale and delicate-looking. Intellectually he was bright and active. The head was rather large, and there was some spreading of the cranial sutures, (see figure 1). The right eye was totally blind. The left eye had a visual acuity corresponding to about 6/60, (see figure 2), and showed temporal hemianopia and a considerable central scotoma. Both optic discs showed advanced primary optic atrophy. There was some tendency to blueness and coldness of the extremities. Systolic blood pressure was only 60. X-ray (see figure 1) showed displacement backwards and erosion of the dorsum sellae; some scattered suprasellar calcification between and above the anterior clinoid processes, and some further flakes behind and above the stump of the dorsum sellae.

Treatment. This boy obviously had a tumour occupying and projecting above the sella turcica, and the age of the patient, together with the character of the calcification in the tumour, made a diagnosis of craniopharyngioma almost certain. Although obviously a very poor surgical risk it was felt that this child ought to have the chance of surgical removal of the tumour.

Operation. Accordingly, on 7th November 1930, Mr Dott undertook a right transfrontal operation. Anaesthesia was by rectal ether and paraldehyde.
formaldehyde, and although the systolic pressure at the outset was only 10, the operation was well borne. The usual right frontal scalp and osteoplastic flaps were cut and elevated. The right ventricle was opened and a good exposure of the chiasmal region obtained. The interior wall of the enormous cyst was at once encountered. It was widely incised, and a large part of the semi-solid, granular, yellowish contents removed by means of spoon and sucker. On attempting to draw the wall of the cyst away from the brain it was found to be closely adherent, and it soon became obvious that a fatal contusion of the base of the brain must result if these attempts were persisted in. Operation was, therefore, abandoned, the cyst having been merely opened, and its contents partially removed.

Immediate recovery from the operation was highly satisfactory. On the following day the patient was bright and alert. He was conscious of considerable improvement in clearness of vision in the remaining left eye. He was much concerned to know whether a toy chicken which he had broken on the day before the operation had been satisfactorily repaired. These satisfactory conditions continued during the next two days. The pulse and respiration rates, which had been considerably elevated, fell to normal, as did the temperature. On the third day following operation there was a moderate elevation of temperature and the patient was somewhat restless and excited. On the fourth day, (see figure 3), the
Temperature rose abruptly to 105.4, the pulse became imperceptible, and breathing rate increased to 60 per minute. The temperature was artificially regulated by means of cold packs. The pulse rate became improperly satisfactory, but respirations remained rapid. The child was deeply comatose. These conditions persisted to the time of death, on the 16th November. During this period the child exhibited an extraordinary state of decerebrate rigidity, exactly similar to that experimentally produced in animals by section through the cerebral peduncles. Feeding during this period was easily maintained by a nasal tube, but in spite of this there was very rapid and marked emaciation. Death occurred in coma with gradual circulatory failure.

Post-mortem examination was obtained. The brain was fixed in situ formaline injection of the carotids, and it was removed with the dura mater, vault and base intact. Figures 4 and 5 show the specimen cut in sagittal section. The cause of death was quite evidently due to circulatory disturbances of the base of the brain incidental to the lift of tumour caused by the partial emptying of the cyst at operation. A line of cerebral softening can be seen in figure 4 extending across the brain stem a little above the level of the pons. There is no doubt that this anatomical lesion accounted for the appearance of decerebrate rigidity.

Comment. In this case there is a long history suggestive of recurrent
recurrent attacks of intracranial tension which were probably due to intermittent obstruction of the foramina of Munro by the enlarging cyst, which obstruction re-adjusted itself after the intraventricular tension had risen sufficiently. Co-incident with the first onset of these general pressure symptoms, at which time the intracranial portion of the cyst must already have been large, there is evidence of abolition of pituitary function by compression of the gland, in that he ceased to grow. It is extraordinary that this enormous tumour projecting upwards and forwards into the cranial base should have occasioned so little neurological disturbance, and this can only be explained by the fact that it grew so slowly that the adjacent brain was able to accommodate itself to the distortion. This accommodation was probably near breaking down at the time he came for treatment, as evidenced by his low blood pressure and vasomotor instability. At operation it was very soon realised that extirpation of the cyst was out of the question on account of its adherence to the base of the brain, and it was hoped that some measure of temporary relief might be afforded by the partial evacuation of the cyst contents. Even this very mild operative
operative manipulation was, however, sufficient to precipitate an acute vascular disturbance of the distorted and compressed cerebral base, and, while immediate recovery from the operation was good, these disturbances proved fatal on the seventeenth day. The basal cerebral disturbances comprised the usual hyperthermia, hyperpnea, and increased metabolic rate of a basal cerebral lesion. An additional remarkable feature, however, was the occurrence of typical "decerebrate" rigidity, and the post-mortem examination revealed the cause of this in a cerebral softening of the brain stem just above the pons which really amounts to a pathological transection of the brain stem.
Specimen of brain with tumour in situ. Note the large craniopharyngioma with semi-solid pontaceous content partially moved. There is a little post-operative haemorrhage into the cyst, not involving the surrounding brain. Note the extensive hydrocephalus of the lateral ventricle in figure 4, and the cause of this by the tumour obstructing the foramen of Munro in the third ventricle of figure 5. In figure 4 the darker area of cerebral softening involving the floor of the third ventricle and the brain stem just above the level of the pons.
IV. (No. 538.) Cystic intrasellar craniopharyngioma in male aged thirty-four years. Transfrontal operation. Radical extirpation of cyst. Fatal result eighteen hours after operation.

Admission on 25th July 1932, complaining of failing vision. The patient had never required to shave. Three years ago the patient noted quite definitely a relatively sudden and complete loss of sexual desire and potency. He remained otherwise quite well until three months ago he became aware of visual failure. This had affected both eyes but the left eye more than the right.

Examination. The patient was a slightly under-sized individual and he looked distinctly younger than his years. His general demeanour and intelligence were quite normal. He was moderately plump but not excessively so. The skin was remarkably fine and soft and there was a complete absence of growth of hair on the face, body and limbs. There was bilateral primary optic atrophy, more marked on the left side. Vision in the right eye was 6/36 and in the left 6/60. Bitemporal hemianopia (see figure 1) The X-rays (see figure 2) show a marked expansion of the sella turcica with thinning and backward displacement of the dorsum sellae /
sella. No suprasellar calcification. The patient quite obviously had a tumour in and above the sella turcica. It was doubtful whether this would prove to be an adenoma or a cranipharyngioma. The fact that he had never had to shave, dating his earliest symptom back at least 15 years suggested the latter.

**Operation. Mr Dott. 29th July 1932. (See figure 3).**

Local anaesthesia. Right frontal osteoplastic flap. The right frontal lobe was elevated and a good exposure of the chiasmal region obtained. The optic nerves were extremely flattened and stretched over the surface of a tumour bulging upwards from the sella turcica. The tumour was cystic and on incising its wall a large quantity of thick, greenish fluid and yellowish debris was removed with spoon and sucker. The collapsed cyst wall was then carefully dissected from the optic nerves and carotid artery on each side to which it was moderately adherent. On attempting to draw the wall of the cyst away from the base of the brain it was found to be considerably adherent to it. The operator was well aware of the risk of contusion of the base of the brain but considering the hopeless prognosis if the cyst were incompletely removed this risk was taken. At the expense of considerable contusion/
contusion of the floor of the third ventricle the cyst was completely mobilised from the surface of the brain. Though fairly adherent to the cavity of the sella turcica the cyst wall was eventually stripped out quite cleanly from it and a total removal thus effected. Bleeding was quite easily controlled. The cavity from which the tumour had been removed was drained with a fine tube and the wound closed.

During the latter part of the operation the patient had become dull and unresponsive and remained thus for six hours. He then recovered consciousness to some extent but shortly again lapsed into coma. The physical condition remained fairly satisfactory for about eight hours after the operation. The pulse then became feeble and irregular and the temperature rose abruptly to 104. Fluid was draining quite freely from the operation cavity. He remained semi-comatose and the temperature remained high in spite of repeated cold packs. Respiration was unaffected. The circulation gradually became more feeble and finally failed. He died in coma eighteen hours after operation.

Post-mortem examination was obtained. There was no sign of post-operative bleeding. There was considerable contusion and flattening /
flattening in the neighbourhood of the floor of the third ventricle.

Comment. In this case there was clear evidence of a tumour of the pituitary neighbourhood with rapidly progressive visual failure. At operation a large cystic craniopharyngioma was found to be densely adherent to the base of the brain. In view of the bad prognosis with incomplete removal a total extirpation was effected but the cerebral base was unduly contused in carrying this out with a rapid post-operative fatality in consequence of vascular disturbance and contusion of this vital region of the brain.
V. (No. 116). Cystic suprasellar craniopharyngioma in female aged forty-four years. Transfrontal operation. Total extirpation. Excellent recovery maintained to date, four and a half years after operation.

Admission on 6th September 1928, complaining of headache and failure of vision. Ten years ago she began to suffer from recurrent attacks of headache accompanied by vomiting, which continued to date of admission with increasing severity. Three years ago she abruptly became stouter and easily fatigued by physical exertion. Six months ago she began to experience recurrent sharp neuralgic pain in the distribution of the left supraorbital nerve. Three months ago she began to experience difficulty in reading. The onset of visual failure was sudden. When first noticed vision in the left eye was already nearly gone and a month later she began to be aware of a temporal restriction of the visual field on the right side. During the past week vision in the right eye had deteriorated very rapidly so that she could only count fingers at close range. The patient has two children, aged fifteen and ten years old. Menstruation was normal.
normal and regular until three years ago. It then became less frequent and less copious and during the past three months there has been a complete amenorrhea. An accurate visual history is available in this case (see figures 1 and 2). The first observation four months ago shows an incomplete right temporal hemianopia with an acuity of 6/12 in the right eye and no perception of light in the left. Two months later, the left eye remained blind and vision in the right had deteriorated to 6/60 and the hemianopia had become complete. A month later, acuity of the right eye had improved again to 6/36 while the hemianopia had changed in character, now showing some recovery in the upper temporal quadrant in contrast to the first observation. This shows a marked fluctuation in the degree and exact incidence of compression of the optic fibres, occasioned no doubt by the enlargement of the tumour and the accommodation of the optic nerves and chiasm to the distortion.

Examination. The patient was a well developed woman of average build. She was not unusually obese. X-ray showed a slight thinning of the clinoid processes but no gross distortion of the sella turcica. There was a flake of abnormal calcification apparently /
apparently lying on a depressed diaphragma sellae and showing as a concave shadow across the roof of the sella (see figure 3). Bilateral primary optic atrophy, more advanced on the left side. There was bare perception of light in the upper nasal quadrant of the right eye. The right eye had acuity only to count fingers at one foot and there was a temporal hemianopia with relative preservation of the upper quadrant. There was some slight impairment of memory and some degree of emotional instability.

**Treatment.** Quite obviously there was evidence of a tumour in the neighbourhood of the pituitary. The normal outline of the sella suggested that the tumour was suprasellar in location and the flake of calcification suggested the probability of a craniopharyngioma. Operation was undertaken on this diagnosis.

**Operation** (see figure 4). 12th September 1928 a left transfrontal operation was carried out by Mr Dott. Rectal ether anaesthesia. The usual low left frontal osteoplastic flap was elevated. There was difficulty in raising the left frontal lobe on account of intracranial tension and the anterior horn of the left ventricle was tapped. The left frontal lobe was then easily retracted and a good exposure of the chiasmal region was obtained.
The left optic nerve was stretched on the surface of a cystic tumour which presented between the two nerves and beneath the chiasm. The left nerve was of good colour and consistence. The cyst was tapped and about 8 cc. of greenish fluid containing cholesterin crystals was aspirated. This further improved access but it soon became evident that if the large cystic tumour were to be dealt with in any radical manner the interval between the two optic nerves would provide insufficient room in which to work. Accordingly it was felt that it would be justifiable to sacrifice the left optic nerve in the hope of obtaining a complete removal of the tumour and of preserving good vision in the right eye. The left optic nerve was sectioned close to its foramen. The chiasm could now be tilted over to the right and a very free exposure of the tumour was obtained. The relaxed capsule of the tumour could now be stripped under careful visual control from the surrounding structures. It came away easily from the right optic nerve and from the carotid artery on each side. When this had been accomplished it was found that a second and larger cystic cavity was present above and behind that first opened. The second cyst was incised and about 25 cc. of the same greenish fluid escaped. It was now possible to pull out the entire capsule from its recess in the base of the brain. The base of the tumour was not at all adherent /
adherent to the sella turcica and elevated quite cleanly from its roof as it was finally removed, exposing an intact diaphragma sellae and the clinoid processes. Thus a complete removal of the tumour was effected at the expense of sacrificing the almost blind left optic nerve and without inflicting trauma on the surrounding structures.

Post-operative progress was very satisfactory. There was an immediate post-operative polyuria which was satisfactorily controlled by the use of pituitrin and which had largely subsided within three weeks. There was no further headache. Vision in the remaining right eye rapidly improved and four weeks after operation acuity had reached 6/12 while there was some expansion of the temporal field into the lower quadrant (see figure 5), and eleven months after operation, (see figure 6), the acuity of vision in the remaining right eye had improved to 6/5 and the visual field had expanded so that there was only a slight remaining defect in the upper temporal quadrant. The patient has been heard from at intervals since. Her good vision in the right eye is well maintained. She has no further headache. Menstruation returned and she continues to lead an active life.

Comment.
Comment. This case is interesting from the point of view of chronology of symptoms. Headache and vomiting long preceded any other symptoms. The sudden increase in adiposity three years before the patient presented was the next symptom, presumably due to a final disturbance of the hypothalamic region. Relatively late in the course of the illness menstruation began to decrease and complete amenorrhea had only been present for three months. Interference with pituitary function then appears to have been of late onset in this case. It is probable that vision in the left eye had been affected for considerably longer than three months and that the patient only became aware of the defect when the right eye began to be involved.

The chronology of the symptoms is consistent with a suprasellar growth, behaving essentially as a basal intracranial tumour and only involving the pituitary gland at a late stage. It is of further interest to note that the complete removal of the tumour permitted re-establishment of pituitary function and menstruation. This case exhibited the very common post-operative polyuria due to operative disturbance of the neighbourhood of the tuber cinereum. From the surgical point of view the case is highly satisfactory, constituting total removal of a benign intracranial tumour with recovery of vision from hand movements to 6/5. Vision of the left /
left eye had to be sacrificed. Apart from this the patient is perfectly normal.
FIGURE 4.
FIGURE 5.
MONTHS AFTER OPERATION.

FIGURE 6.

MRS. A. HARRISON

16: 8: 29

NERVE SACRIFICED

BLIND
VI. (No. 145). Cystic intrasellar craniopharyngioma in female aged seventeen years. Transfrontal operation. Total extirpation of tumour. Excellent recovery, maintained to date — now four years since operation.

Admission on 9th January 1929 with complaint of failing vision, great thirst, headache, and deficient growth. Since the age of five years she had ceased to grow, and remained in stature, general physical development, and appearance, exactly like a natural child of five years old. At the age of ten years, seven years ago, she began to suffer from headache, generalised in character, especially apt to be present on waking in the morning, the headache was frequently accompanied by vomiting, and recurred at intervals of a few weeks. Five years prior to admission she began to suffer from double vision, having an internal squint of the right eye. This was variable and recurrent. At this time also she began to lose weight. On examination at this time, at the age of twelve years, she was found to be an alert and intelligent child, with marked physical under-development. There was no gross alteration of the visual fields, but there was
a pronounced bilateral papilloedema. There were no other definite findings at this time. The question of decompression operation was considered, but, pending arrangements for this, the papilloedema began to subside, and finally disappeared entirely, so that operation was not carried out. During the subsequent five years her height increased from 3 feet 8 inches to 4 feet, and she gained half a stone in weight. The headache became much less troublesome, but she had three attacks lasting for several days on each occasion, characterised by severe headache, drowsiness and vomiting. There was no further diplopia nor squint until six months before examination, when she again began to see double, and this recurred up to the date of examination. Six months prior to admission also she began to drink an excessive quantity of water, and to pass excessive quantities of urine at frequent intervals. Three months prior to admission vision began to fail, and she became aware of a temporal restriction in the vision.

Examination. This patient aged seventeen years had the appearance of a child of five or six years, (see figures 1 and 2), being four feet in height, and four stone, one pound in weight. She was slightly built, although not at all emaciated.
emaciated. Visual acuity in the left eye was 6/9, and in the right eye 6/60, (see figure 3). The visual fields showed a clean-cut bitemporal hemianopia with some impairment of the lower nasal quadrant on the right side, and with a central scotoma in the right eye. There was bilateral primary optic atrophy with no trace of former papilloedema, and there was also partial paresis of the right abducens nerve. X-ray showed a deep and notably expanded sella turcica with a small flake of obnormal calcification situated between the anterior clinoid processes, (see figure 4).

These findings clearly indicated tumour in the neighbourhood of the pituitary body, with progressive visual loss. The duration of symptoms, the age of the patient, and the presence of the small calcified area just above the sella turcica suggested a craniopharyngioma. Operation was undertaken.

**Operation.** Accordingly on 24th March 1929, a right trans-frontal approach was carried out by Mr Dott, (see figure 5). Rectal ether anaesthesia. The usual low right frontal osteoplastic flap was elevated. The right ventricle was tapped, and the right frontal lobe retracted. The tumour, yellow in colour, was found presenting between the optic nerves, with the chiasm /
chiasm stretched over its upper anterior surface. The surrounding arachnoid was extremely thickened. The tumour capsule was incised between the optic nerves. The capsule was fairly thick. In the interior was a mass of semi-solid, granular, yellowish material, which was easily scooped out with a spoon. This was continued until only the tumour capsule remained. This latter was freed without any difficulty from the optic nerves, carotid artery and base of the brain, and the upper portion, which protruded into the cranial cavity, was easily removed, being torn away at its margin of attachment to the sella turcica. The intrasellar portion of the tumour was separately removed. It was rather adherent to the perios teum lining the sella, but eventually the greater part of the cyst wall was stripped out. There was a little doubt as to completeness of removal on the anterior wall for the sella turcica was very deep and narrow, and it was difficult to obtain a complete view of all its walls. Accordingly the cavity was treated by the application of small pledges of cotton wool moistened with Zenker's solution in order that any remaining fragments of the cyst wall might be destroyed chemically. It was the operator's impression that tumour removal was probably complete, and it was thought practically certain /
certain that any possible remaining fragment must have been destroyed by the Zenker's solution.

Convalescence was very satisfactory. There was a temporary increase in the polyuria, which subsequently subsided. The left abducens nerve rapidly recovered, and there was no further headache. There was no appreciable change in vision for several months, (see figure 6).

One year nine months later she had grown 1/8 inch. There was no change in her weight. Visual acuity in the left eye had improved to 6/9 plus, and in the right eye had risen from 6/80 to 6/18. The central scotoma in the right eye had disappeared, there was a partial recovery of its temporal field, and both the visual fields had widened out, (see figure 7). There has been no further polyuria, and in every way she remains in excellent health. These good conditions have been maintained to the date of writing, and the patient has, during the past two years, been engaged as saleswoman in a tobacconist's shop.

Comment. This case presents several interesting features. The growth must certainly have been primarily intrasellar, since the
the first sign of its presence was the cessation of growth from compression of the pituitary gland at the age of five or six years old, about ten years before operation. The next phase was unusual for a case of pituitary tumour, viz., the development of symptoms of general increased intracranial pressure, including papilloedema, at the age of twelve years. At operation an unusual degree of arachnoid thickening was noted, and it seems likely that increased intracranial pressure was due to fluid obstruction and hydrocephalus from this cause. It abated spontaneously, and five years later the patient presented the typical signs of a pituitary tumour, including spontaneous diabetes insipidus. Operation was successful in completely relieving all symptoms, with the exception of the failure in growth. It appears likely that the longstanding compression of the pituitary body has completely damaged or abolished that organ, and restoration of its function is now improbable. Visual recovery was slow, but is now reasonably satisfactory, and the patient is leading an active and useful life.
This photograph of patient taken four weeks after operation. This patient, aged seventeen years, has a stature and build of a child of six years old.
FIGURE 2. X-ray of the hand taken at the age of seventeen years and showing a development corresponding to that of six or seven years of age.
1 MONTH AFTER OPERATION.

IVY GREEN.

25: 4:29

Figure 6
VII. (No. 247.) Cystic intrasellar craniopharyngioma in female aged nineteen years. Transfrontal operation. Total extirpation of cyst intact. Convalescence interrupted by wound infection. Final recovery satisfactory and well maintained to date of writing. Now three years since operation.

Admission on 30th May 1930 with complaint of failing vision, headache and diplopia. Fifteen months prior to admission, menstruation, which had formerly been quite normal and regular, became infrequent and scanty, and ceased altogether seven months before admission. Six months before admission she began to suffer from headache which recurred daily, and was referred chiefly behind the eyes. At this time also she began to exhibit periods of intense somnolence which would last for a few days at a time, and which recurred at intervals of several weeks. Six months before examination also vision began to fail. The right eye was first affected, and deteriorated rapidly. Soon afterwards the left eye was also affected, but it deteriorated more gradually. Three months prior /
prior to examination she began to experience recurrent diplopia which was more marked on looking to the left, and which still persisted up to the time of admission.

**Examination.** The patient was a very well developed young woman of average stature and build. Vision in the right eye was 6/36, and in the left 6/12. There was a clean cut bitemporal hemianopia, with a central scotoma in the right field extending into the lower nasal quadrant, (see figure 1). The right optic disc showed slight pallor, the left was normal. There was a slight degree of paresis of the abducent nerve. X-ray (see figure 2) showed a deeply excavated and widened sella turcica, with marked thinning of the dorsum sella and clinoid processes. There was no abnormal calcification.

**Treatment.** The case was quite obviously one of tumour in the sella turcica, projecting upwards from it. The diagnosis was quite uncertain as between adenoma and craniopharyngioma. Operative treatment was undertaken.

**Operation.** Accordingly on 11th June 1930, Mr Dott carried out a right transfrontal exposure. Rectal ether paraldehyde anaesthesia. The usual low right osteoplastic flap /
flap was elevated, and the right frontal lobe retracted. A soft reddish tumour presented between the slightly stretched and elongated optic nerves. The tumour was aspirated and about 3 ccs. of dark, chocolate-coloured fluid obtained. The relaxed wall of the cyst was very easily loosened from the optic nerves, carotid arteries, and from the base of the brain, but it was slightly adherent to the dura of the widely distended diaphragma sellae. These adhesions however, were relatively easily detached, and it was then possible to strip the cyst cleanly from the sella turcica, (see figure 3). The cyst was removed intact, (see figure 4 showing its external surface, and figure 5 showing its internal surface). It was recognised at the time, and subsequently verified histologically, that the remains of the pituitary body in this case were adherent to the cyst and spread out on its surface, and it was really this flattened out pituitary body which separated so easily from the dura of the sella.

Immediate post-operative recovery was entirely satisfactory except for some oedema about the wound region. On the sixth day after operation the temperature became elevated, and there was quite an obvious wound infection. Drains were inserted, but /
but progress was still very unsatisfactory. Two weeks later the wound was completely re-opened, and the bone flap removed. Following this procedure the infection gradually subsided, and the patient eventually made a very satisfactory recovery. Two months later, (see figure 6), the visual acuity, which was fairly satisfactory, remained unchanged, but the visual field showed considerable expansion. Two years later vision in the left eye had improved to 6/9, and there was a considerable further expansion of the visual field. She is able to lead quite an active life, and is normal except for the relatively defective vision of the right eye, amenorrhea, and the deformity occasioned by the removal of the bone flap. This latter is quite easily disguised by the hair.

Comment. This was a case of primarily intrasellar craniopharyngioma, which had enlarged upwards only sufficiently to involve the optic chiasm and nerves. It was completely removed, and, although convalescence was marred by operative infection, eventual recovery was satisfactory. As might be expected from the origin and position of the tumour abolition of pituitary function, as evidenced by amenorrhea, was the first symptom, and was followed considerably later by headache and involvement of the visual fibres.
FIGURE 4.

FIGURE 5.
Red 70/2000 better recognised in lower inner quadrant than in upper inner and lower outer quadrant.

Very faint vision for large white object in temporal field towards centre above horizontal.

FIGURE 6.
VIII. (No. 256.) Cystic intrasellar craniopharyngioma in male aged fifteen years. Transfrontal operation. Total extirpation of cyst. Satisfactory recovery maintained - now two years nine months since operation.

Admission on 8th July 1930 with complaint of failure to grow and headache. This patient, aged fifteen years, had ceased to grow since the age of ten years, so that his younger brothers and sisters had outstripped him in this respect. Three years prior to admission he began to suffer from headaches, recurring about once a week, and worst on waking in the morning. They were referred chiefly to the left frontal region. There had been occasional vomiting in association with these headaches. The headaches continued thus to recur for about six months, but during the two and a half years prior to examination there had been little or no headache. Also about three years prior to examination he experienced an unnatural degree of thirst, and drank excessive quantities of water, and at the same time he passed urine very frequently and in excessive amounts. This lasted for about three months, and did not then recur. Two and a
Two and a half years prior to examination it was appreciated that there was some impairment of vision in the left eye, and shortly afterwards in the right eye also. The visual field defect was very slowly progressive in the left eye. It was thought that the right eye had rather improved during the six months immediately prior to admission. Two and a half years prior to admission there was a tendency to external strabismus of the left eye noted by his relatives, but there was no subjective complaint of diplopia associated with this.

**Examination.** This boy of fifteen years had the stature and general appearance of a boy of ten years old. (See figures 1 and 2.) He was rather slightly built. The skin was notably fine, smooth and delicate. Vision in the right eye 6/9 plus, and in the left 8/18 minus. There was a bitemporal hemianopia, complete in the left eye, but with a relative sparing of the lower temporal quadrant in the right eye, (see figure 3). X-ray (see figure 4) showed a widely expanded sella turcica, the dorsum sellae being thinned and displaced backwards, and a flake of abnormal calcification was noted 15 mms. above, and slightly behind, the posterior clinoid processes, in the midline. There was no particular suggestion either of adiposity /
adiposity or of emaciation. The degree of genital infantilism corresponded with that of his general physical retardation, that is, he was generally, and also sexually, similar to a boy of ten years old. There was a concomitant, divergent strabismus, which was thought to be connected with loss of central vision in the left eye, rather than with any paresis of ocular muscles.

**Treatment.** This was obviously a tumour of the pituitary region. The age of the patient and the flake of abnormal calcification strongly suggested a craniopharyngioma. The distension of the sella turcica and the fact that cessation of growth was the first symptoms, suggested that the tumour had originated within the sella, while the visual disturbance and the history of polyuria suggested that it had enlarged considerably upwards to involve the visual fibres and the base of the brain. Operation was undertaken.

**Operation.** Accordingly, on 11th July 1930, Mr Dott carried out a right transfrontal procedure. Rectal ether, paraldehyde anaesthesia. The usual low right frontal osteoplastic bone flap was made and elevated, (see figures 5 and 6). The right frontal lobe of the brain was retracted, and a good
good view of the chiasmal region obtained. The optic nerves were stretched and raised on the wall of greenish cystic tumour which presented between the two nerves and the chiasm. The latter was very markedly thinned and stretched on the surface of the tumour. The cyst was tapped and 7 ccs. of greenish-brown fluid containing cholesterin crystals was aspirated from it. The collapsed cyst wall was very easily stripped from the carotid arteries on each side. It was more adherent to the optic chiasm, and the latter was somewhat contused in the process of dissection from the cyst wall. The upper and posterior part of the cyst stripped away very easily and smoothly from the base of the brain. The cyst could now be drawn forwards to meet the chiasm, and it remained attached only to the sella turcica. It was closely adherent to the posterior clinoid processes, and sharp dissection, and a certain amount of force were required to detach it from these. The wall of the cyst came away very easily from the sellar pocket and was finally removed in a single piece, although considerably lacerated, (see figure 7).

Recovery was entirely satisfactory. There was a sharp post-operative polyuria during the first twelve hours, which was controlled /
controlled by the administration of pituitrin, and when this was stopped two days later the polyuria did not recur. On the seventh day after operation an extensive rash appeared, slightly raised and papular, and affecting the face, the whole trunk, and the flexor surfaces of the extremities. It was associated with some degree of drowsiness and general muscular pains and stiffness. It subsided after three days. The occurrence of this rash could not be traced to any drug or other treatment, and it was thought that it was probably associated with absorption of some of the cyst fluid, which may have escaped during the operation.

Visual fields charted four weeks after operation show the fairly satisfactory visual acuity almost unaltered, that is, with good practical reading vision in the right eye. The field of the left eye is unchanged, that is, there is still a complete temporal hemianopia. The field of the right eye shows a considerable loss of the temporal field as compared with the pre-operative examination. This was known to be due to contusion of the chiasm in separating it from the cyst wall. (See figure 8).

Comment. In this case the tumour certainly originated in the sella, as shown by the expansion of its cavity, and the early abolition of pituitary function, as indicated by the cessation of growth /
growth five years before the patient came to treatment. This case also exhibited a spontaneous polyuria for a short period three years before he came to treatment, but there was no polyuria at the time of admission. Operative treatment was successful in completely removing the benign tumour with preservation of excellent reading vision, and giving a normal life expectancy. It is probable that the pituitary body has been completely destroyed by the pressure of the cyst in this case, for so far the patient has not grown. In other respects, however, he remains entirely well - now two years, nine months since operation.
FIGURES 1 and 2. Photographs of the patient twelve days after operation, showing juvenile appearance and well healed operation scar.
Figure 3.

JAMES WYLIE

6:7:30

R.

L.
FIGURES 5 and 6. X-rays taken after operation showing outline of bone flap.
FIGURE 8.

JAMES WYLLIE

8:8:30

4 WEEKS AFTER OPERATION.

V.6/8

V.6/6+
IX. (No. 374). Cystic intrasellar craniopharyngioma in male aged twenty-five years. Transfrontal operation. Total extirpation of cyst. Satisfactory recovery well maintained, now one year nine months since operation.

Admission on 11th June 1931, complaining of headache and visual failure. Four months prior to admission the patient began to suffer from headache referred behind the eyes and most troublesome on rising in the morning and recurring daily. At the onset of these headaches he felt weak and somewhat unsteady on his feet for a few days but these latter symptoms subsided and only the headache continued to recur to date of admission. Seven weeks prior to admission vision of the left eye became dim and he then discovered for the first time that the right eye was almost blind. He had no idea how long this defect of the right eye had been present. Deterioration of vision in the left eye had been steadily progressive and two weeks prior to admission he had become unable to read. The patient did not admit to any depression of sexual activity.

Examination. /
Examination. The patient looked somewhat juvenile for his age and had the appearance of a youth of sixteen or seventeen rather than a man of twenty-five (see figure 1). He was rather plump though by no means grossly obese. The skin was fine and soft. There was a complete absence of hair on the body, limbs and on the face. Vision in the left eye was 6/12 minus and in the right he could just count fingers at one metre. The visual fields showed bitemporal hemianopia, complete in the better left eye but with relative preservation of the upper temporal quadrant in the scotomatous right eye (see figure 2). There was a slight depression of the right corneal reflex and a slight depression of sensibility in the skin area of the ophthalmic division of the right trigeminal nerve. There was no polyuria nor pathological somnolence. The X-ray (see figure 3) showed considerable expansion of the sella turcica with thinning and backward displacement of the dorsum sellae and a small flake of calcification in the midline about one cm. above and slightly behind the posterior clinoid processes.

Treatment. This was obviously a case of tumour in the pituitary region. The age of the patient and the fact that he had /
had never had to shave, indicating a pituitary lesion of considerable standing, together with the flake of calcification in the tumour suggested a craniopharyngioma. The history of hypopituitarism, dating back at least to adolescence, and the expanded sella turcica indicated that the growth had originated within the sella while the implication of the visual fibres, the headache and giddiness indicated a more recent intracranial expansion.

Operation (see figure 4). 24th June 1931. Mr Dott carried out a right transfrontal procedure. Rectal ether anaesthesia. A low right frontal bone flap was cut and elevated and the frontal lobe retracted, exposing the chiasmal region. The optic nerves were raised and moderately stretched on the surface of a cystic tumour which presented between them. The chiasm was notably thinned and stretched out on the surface of the tumour. The cyst had a faintly bluish tinge and its wall was fairly thick though quite soft. It was punctured with a knife and about 15 cc. of a greenish fluid, containing cholesterin crystals was aspirated. The collapsed wall of the cyst could now be drawn forwards /
forwards between the optic nerves and from beneath the chiasm.

The cyst stripped away with ease from the surrounding structures. The posterior and upper part came away quite cleanly from the base of the brain. The cyst was now pulled into the field of operation. It remained attached only to the margins of the sella turcica. It was rather densely adherent to the posterior clinoid processes and to the edge of the dorsum sellae. It was freed from this by sharp dissection. The remainder of the cyst then stripped away readily from the cavity of the sella and from the lower parts of the carotid arteries and cavernous sinus on each side. A patch of whitish tissue on the outer surface of the anterior part of the cyst where it was removed from the sella was taken to be the flattened remnants of the pituitary body adherent to the cyst wall and this was subsequently verified histologically. Figures 5 and 6 are lateral views of the removed cyst. Figure 7 is a photograph of its basal surface. Figure 8 is a view of its nodular interior.

The patient made an excellent recovery from operation. There was an immediate post-operative polyuria, which was satisfactorily controlled by the administration of pituitrin and which had considerably subsided within two weeks so that pituitrin was /
was discontinued. A moderate degree of thirst and polyuria persisted for three months and then disappeared. Six weeks after operation the visual fields showed considerable expansion. The acuity of the left eye was quite satisfactory, remaining unchanged, while the low acuity of the right eye due to central scotoma persisted, (see figure 9). These conditions have remained unchanged. The patient has returned to his work in a grocery store. He has no disability whatever beyond defective vision of the right eye and is able to lead quite an active life in every way.

Comment. This case again illustrates the onset of hypopituitarism as indicated by lack of development of secondary sexual characters as the first symptom and corresponding with this the X-ray shows a notable expansion of the sella turcica indicating tumour originating within the sella and causing hypopituitarism by compression of the pituitary gland as its first symptom. At the time of operation he was suffering from headaches and visual loss from compression of the optic fibres by the cyst was in rapid progress. Complete removal of a benign tumour has been effected giving a normal life prognosis with preservation of practically useful vision in one eye and no other disabilities /
disabilities. The patient believes that his sexual functions are normal though this is to be doubted in view of the lack of development of secondary sexual characters.
FIGURE 1. Photograph of patient 4 weeks after operation showing relatively juvenile appearance and well healed operation scar.
FIGURE 3.
Figure 5. Left lateral view of cyst removed at operation. The somewhat cone-shaped projection into the end of which a pin has been inserted is the part of the cyst which lay within the sella turcica and on this the flattened remains of the pituitary gland can be seen.

Figure 6. The anterior view of the cyst showing similar characters.
Figure 7. A view of the cyst from its basal aspect showing the prominent portion which occupied the sella turcica and the wide flattened remains of the pituitary gland stretched on its surface.

Figure 8. A view of the interior of the cyst from above showing typical warty nodular distribution of tumour tissue on its walls.
John Kenn

Y. 6/12 +

6 weeks after operation. Fingens at 2½ m.

FIGURE 9.
X. (No. 444). Cystic suprasellar cranipharyngioma in male aged thirty-three. Right transfrontal operation. Complete extirpation of cyst. Satisfactory recovery maintained to date, now fifteen months since operation.

Admission on 3rd November 1931. This patient, a doctor, had been quite normal to the age of twenty-five. He had carried through his medical course quite successfully and regarded himself as a normal individual in every way.

However, as early as the age of fourteen he began to suffer from headache, which troubled him off and on until early in 1923, at the age of twenty-five, when he had a severer attack of headache which lasted for several days and was associated with vomiting and with diplopia. These symptoms cleared up but about a year later he had a similar attack. Again, a year later, in January 1925, he had another attack of headache and vomiting again accompanied by diplopia. At this time the eyes were examined by Dr. Sinclair, who found a well defined left homonymous central scotoma (see figure 1). There was also papilloedema. X-ray examination at this time revealed a calcified shadow above the sella /
sella turcica in the midline. An accurate diagnosis was not then made but in view of the papilloedema and headache a decompressive operation was carried out elsewhere.

On 3rd March 1925 a right temporal decompression was made. Intracranial pressure was found to be very high and there was considerable cortical injury during the operation. Convalescence was protracted. Following the operation there was a considerable degree of left hemiparesis and the left hemianopia became complete. He gradually recovered so that he was able to walk about though with some degree of spastic limp on the left side. The arm recovered so that he could move it fairly well at the shoulder and elbow but the hand has never recovered. Apart from these disabilities the patient remained fairly well during the next two years though on account of his hemiparesis he was unable to take up any active work.

Four years prior to admission he began to be troubled by an insatiable thirst. He drank very large quantities and passed water very frequently and in excessive amounts. Three years prior to admission he became emotionally unstable, a fact which he was quite aware of himself. Eighteen months prior to admission vision of the right eye rather suddenly became blurred so /
so that he could not see to read with it. Vision in the left eye remained fairly good to date of admission though of course it was hemianopic.

**Examination.** This man of thirty-three was of rather small stature and very slightly built, but his father was also of this type. He was pale and delicate-looking. The secondary sexual characteristics were quite well developed. There was nothing unusual in the character or distribution of the hair and the sexual organs were quite normal. There was present a very prominent and tense right temporal decompression and a considerable degree of left hemiparesis. The right eye was capable only of perceiving hand movements and there was an extensive central scotoma. The left eye had 6/24 vision (see figure 2). There was a well defined clear-cut left homonymous hemianopia. Both discs showed advanced primary optic atrophy with slight blurring of their outlines from the previous papilloedema, which had quite subsided. There was a marked degree of impairment of memory and concentration and a conspicuous emotional instability. The X-rays (see figures 3 and 4) show a shallow sella turcica. The posterior clinoid processes and dorsum sellae are eroded so that only a small stump of the dorsum /
Apart from this the sellar outline is normal. In the midline about 3 cms. above and a little behind the dorsum sellae there is a dense shadow of abnormal calcific deposit.

**Treatment.** A diagnosis of a large tumour above the pituitary region was obvious and the characteristic shadow in the X-ray made the presumptive diagnosis, craniopharyngioma, while the normal sellar appearance and normal sexual development suggested that the tumour was suprasellar in origin. Operative treatment was advised.

**Operation (see figure 5).** 11th December 1931. Mr Dott carried out a right transfrontal procedure. Rectal ether anaesthesia. The usual low right frontal bone flap was cut and elevated. The right frontal lobe of the brain was retracted and the chiasmal region exposed. It was found that the optic nerves were very short. They were obviously pushed forwards and upwards on the surface of an underlying tumour but the tumour could barely be seen in the narrow interval between the nerves and chiasm. The right optic nerve was known to be of little value and although its colour and consistence appeared wonderfully good it was felt necessary to sacrifice it in order to obtain sufficient exposure of the tumour. Accordingly the right optic nerve /
nerve was cut close to its foramen. The chiasm could now be
folded over to the left and a wide exposure of the tumour was thus
obtained. The cystic tumour was tapped and about 40 cc. of
clear golden fluid containing cholesterin crystals was aspirated.
The slack cyst was now gently pulled upon and it stripped away
with remarkable ease from the left optic nerve and from the carotid
artery on each side. The arachnoid membrane was everywhere intact
over the tumour so that the capsule could be pulled out from
beneath the chiasm and from the base of the brain without inflicting
any trauma whatever. Eventually it was completely removed in
two large pieces. The cyst was not adherent to the sella turcica
and when it had been removed the diaphragma sellae with its
central aperture was seen quite intact. The large cavity left
by removing the cyst was drained.

Immediately following operation the patient's temperature
fell to that of the room though otherwise he appeared quite
well. 1 cc. of pituitrin was administered intramuscularly and
within a quarter-of-an-hour the temperature had risen to normal.
Polyuria diminished after the operation but recurred at the end
of a week. Drainage was continued during the first week and
after the drain was removed the condition became much less
satisfactory /
satisfactory. The patient became confused and restless with rapid pulse and moderate elevation of temperature. Lumbar puncture was carried out and a large quantity of yellow blood-stained fluid removed. The condition remained unsatisfactory during the next week and lumbar puncture had to be repeated daily. At the end of a week the lumbar fluid was becoming clear, the mental confusion cleared up and the pulse rate fell to normal. From this point convalescence was very satisfactory. Five weeks after operation vision in the left eye had improved from 6/24 to 6/12, the patient being able to read the smallest print. There persisted a clean-cut left homonymous hemianopia (see figure 6). During the next few months the patient's general condition greatly improved. A mild degree of polyuria persisted. The mental state became quite normal. He became able to go about quite actively. Improvement in this case continues to date. He is of course considerably disabled by his hemiplegia but he contemplates taking up medical literary work for which he would be quite well fitted.

Comment. The history in this case is essentially that of an intracranial rather than a pituitary tumour. Headache, diplopia and vomiting are the earliest symptoms. The optic nerves /
nerves were very short and apparently as the cyst enlarged the chief incidence of its pressure or stretching came upon the right optic tract just behind the chiasm producing at first the left homonymous central scotomata and later the complete left homonymous hemianopia. Papilloedema ensued as the cyst enlarged and was relieved by the decompression operation though this had the unfortunate effect of causing a permanent degree of hemiparesis. It of course permitted the cyst to attain an enormous size as it continued to grow during the next few years. Finally a direct attack was made on the cyst and this benign tumour was completely extirpated with excellent preservation of vision in one eye. It is unfortunate that the result is marred in this case by the hemiparesis due to the ill-advised earlier operation for decompression. The patient nevertheless has a normal life expectancy and is able to get about quite actively and should be capable of quite a useful and active life. It is interesting to note that the cyst being suprasellar in origin, the pituitary gland itself has escaped injury so that the patient is quite normal in general development and in sexual functions.
FIGURE 2.

BEFORE OPERATION

JOSEPH MARTIN.

V. 3\over 24

3 : 11 : 31

V. HM.
FIGURE 3.
XI. (No. 489.) Multicystic intrasellar craniopharyngioma co-incident with chromophobe adenoma in male aged thirty-two years. Transfrontal operation. Radical extirpation of tumour. Excellent visual and general recovery well maintained - now one year since operation.

Admission 18th March 1932 with complaint of recurrent visual loss and headache. Five years prior to admission the patient noticed that he was having difficulty in reading, and that his temporal fields of vision were restricted so that he could only see what was straight in front of him. Both eyes were approximately equally affected. There was a good deal of variation in the state of vision from day to day. The visual defect persisted for about three months, and then cleared up spontaneously so that vision again became approximately normal. During the next four years, at approximately yearly intervals, he had a recurrence of slight dimness and temporary restriction of vision, lasting on each occasion for several months, and clearing up in the intervening intervals. Co-incidentally with these periods of visual depression he suffered from morning headache.
headache, referred chiefly behind the eyes. During the five years prior to admission there was some slight degree of lack of energy. The recurrent attacks of visual loss were competently investigated by an ophthalmologist, and recognised as a bitemporal hemianopia, but the behaviour of the lesion led quite naturally to the supposition that it was due to a chiasmal retrobulbar neuritis. There was no depression of sexual activity or potency until about four months prior to admission, when there was a definite and complete loss of sexual activity. Two months prior to admission vision again became impaired, and a bitemporal hemianopia developed as on former occasions, the left eye being rather more affected. Examination at this time, three weeks prior to operation, showed visual acuity 6/12 in each eye, (see figure 1). The left field showed a depression of its temporal half, more marked in the upper quadrant, and a complete temporal hemianopia for a small red object. The right eye showed similar conditions, although less advanced. During the three weeks prior to operation there was a very rapid visual deterioration so that the acuity of each eye fell to mere perception of hand movements in the nasal field of each eye.
Complete temporal hemianopia had developed in each eye with a considerable central scotoma. Vision had deteriorated so markedly that the patient could not see his way about.

**Examination.** The patient was a young man of quite average stature and build. There was nothing unusual about the character or distribution of hair nor the texture of the skin, and the development of sexual organs was quite normal. Vision was reduced to perception of hand movements in each nasal field. There was a complete bitemporal hemianopia, which owing to the presence of central scotomata, could not be accurately charted. Discs presented a healthy and normal appearance. X-ray (see figure 2) showed a widely expanded, globular-shaped sella turcica with thin dorsum sellae displaced backwards.

**Treatment.** Quite obviously the patient had a pituitary tumour originating within the sella turcica, and expanding as shown in the X-ray. There had been intermittent pressure on the optic chiasm at intervals during the previous five years, and now the tumour had enlarged upwards rapidly so as to cause an acute compression of the optic nerves and chiasm. In view of the normal sexual history up until the last few months, and the intermittent /
intermittent character of the symptoms until the last few months, along with the very rapid recent development, a cystic lesion was suspected, for it was thought that variation in the content of a cyst might explain these fluctuations and symptoms. Operation was undertaken.

**Operation.** Accordingly, on 2rd April 1932, Mr Dott carried out a right transfrontal procedure under local anaesthesia. The usual low right frontal osteoplastic flap was cut and elevated, and the right frontal lobe of the brain was retracted. As the chiasmal region was exposed a large rounded tumour was found presenting between the two optic nerves laterally and the chiasm above, and these structures were stretched tightly over its surface. The tumour was of a bluish red colour, of smooth outline and tense consistence. Puncture of the tumour with aspiration failed to withdraw any fluid. The tumour capsule was incised. It was found that the capsule was lined by soft, fleshy-looking tumour tissue, while the interior of the tumour was occupied by a number of cystic spaces containing thick, dark, blood-stained fluid. The soft tumour tissue, including the cysts, was easily cleared out from within the capsule by the use of a blunt spoon and suction apparatus. The operator's impression /
impression at this time was that he was dealing with a pituitary adenoma which had undergone cystic degeneration. Subsequent histological examination showed, however, that the cysts were epidermoid cysts embedded in chromophobe adenomatous tissue. After clearing out its contents the capsule of the upward projecting intracranial portion of the tumour was easily withdrawn from beneath the chiasm. It was very thin and friable, and tore away quite easily from the margins of the sella turcica. Subsequently the intrasellar portion of the capsule was also mobilised and stripped cleanly from the sellar cavity. The precaution was taken of treating the cavity of the sella with pledgets of wool moistened in Zenker's solution in case any minute fragment should have been left. (See figure 3).

Post-operative recovery and convalescence were satisfactory. Within twenty hours of the operation a marked improvement of vision was appreciated. The right eye had already largely recovered. The temporal field of the left eye had expanded into the lower temporal quadrant. Three weeks after operation vision had recovered to 6/18 in each eye, (see figure 4). The visual field of the right eye had expanded to normal limits, while /
while that of the left showed only a relative defect in the upper temporal quadrant. The hemianopia could still be defined by the use of a very small red object for each eye. Three months later vision had improved to 6/12 in each eye, and there remained only a slight upper temporal restriction in the field of the left. In view of the fact that adenoma was present in this case the prophylactic course of deep X-radiation was given. The only remaining disability was the persistence of the depression of sexual function.

Comment. This case is of particular interest in that it presents a double lesion, viz., a cystic intrasellar craniopharyngioma and a pituitary chromophobe adenoma. It appears probable that the earlier symptoms of recurrent chiasmal compression were due to the craniopharyngioma, and the various fluctuations were due to alterations in the cyst contents, quite probably caused by small haemorrhages into the cyst. Later, more rapid visual deterioration and abolition of pituitary function as evidenced by sexual depression were probably due to the development of the adenoma. Clinically the case is a dramatically successful one, in restoration of vision from a condition of practical blindness to practically perfect sight in /
in each eye. A benign tumour has been completely removed, and the patient's life expectancy should be quite normal.
FIGURE 1.

No quadrant's sign in nasal field.

Mr. TABB

V 5/2

2000 red.

18 - 3 - 32

Red.

L.

V 3/2

330 white.

300 white.

290 white.

280 white.

270 white.

260 white.

250 white.

240 white.

230 white.

220 white.

210 white.

200 white.

190 white.

180 white.

170 white.

160 white.

150 white.

140 white.

130 white.

120 white.

110 white.

100 white.

90 white.

80 white.

70 white.

60 white.

50 white.

40 white.

30 white.

20 white.

10 white.

0 white.

330 red.

300 red.

290 red.

280 red.

270 red.

260 red.

250 red.

240 red.

230 red.

220 red.

210 red.

200 red.

190 red.

180 red.

170 red.

160 red.

150 red.

140 red.

130 red.

120 red.

110 red.

100 red.

90 red.

80 red.

70 red.

60 red.

50 red.

40 red.

30 red.

20 red.

10 red.

0 red.
FIGURE 3.
FIGURE 4.
XII.

(No. 593.) Cystic intrasellar craniopharyngioma in female aged ten years. Transfrontal operation. Radical extirpation of tumour. Satisfactory recovery, but with severe visual impairment.

Admission 20th December 1932, with complaint of failure to grow, periodic drowsiness, headache and visual loss. For some two or three years prior to admission the patient had ceased to grow. Certainly she had not grown at all during the year immediately previous to admission. Two months prior to admission she started to exhibit periodic drowsiness which would last for several days at a time. One month prior to admission she began to complain of headaches referred to the frontal region. They were at times very severe, causing her to cry out, and on these occasions they were associated with vomiting. Three weeks prior to admission she complained of difficulty with vision, and this was found to be already so bad that she had difficulty in seeing her way about the house. It was assumed that vision must have been defective for several years, but no definite observation was made until three weeks before admission.
Examination. The patient was ten years old, and looked about four or five years younger, (see figure 1). She was definitely small for her age. She was very slightly built and rather emaciated. As a rule she was quite alert, although at times drowsy. There was some enlargement of the head suggesting hydrocephalus. The left eye was completely blind. Vision in the right eye was about 2/60, and showed a clean-cut temporal hemianopia which could not be charted accurately on account of the low visual acuity. The discs showed advanced primary optic atrophy on each side. X-ray (see figure 2) showed a deeply excavated and expanded sella turcica, with thinned dorsum sellae and erosion of posterior clinoid processes. About 3 cms. above the posterior clinoid processes there was a faint narrow flake of abnormal calcification which occupied approximately the midline. No polyuria nor undue thirst. The systolic blood pressure was only about 60.

The age of the patient, the expansion of the sella turcica, the retardation of growth, the character of the visual changes, and the presence of a calcified flake above the sella turcica, indicated a diagnosis of craniopharyngioma, originating in the sella /
sella turcica. Operation was undertaken.

Operation. Accordingly, on 21st December 1932, Mr Dott carried out a left transfrontal procedure, (see figures 3 and 4, and also illustrations in section on operative treatment).

Ether anaesthesia. A low left frontal osteoplastic bone flap was cut and elevated. The dura was freely opened, and turned downwards over the supra-orbital margin, and the left frontal lobe was retracted. Access was improved by tapping the anterior horn of the left ventricle, which was moderately distended. On exposing the chiasmal region the optic nerves were found to be stretched up almost vertically on the anterior surface of a large cystic tumour. The chiasm was greatly stretched and thinned out. The cyst was tapped, and about 30 ccs. of yellowish-green fluid containing cholesterin crystals was aspirated. As the cyst was thus collapsed access was still further improved. The left optic nerve was not particularly attenuated, but was definitely grayish in colour, and as the left eye was doomed to be blind, it was decided to cut the optic nerve in order to obtain sufficient access for tumour removal. Accordingly the nerve was cut. The chiasm could then be folded over to the right, and a very wide view /
view of the cyst was obtained. The cyst wall could now be gradually and gently drawn up beneath the chiasm and from its deep recess in the base of the brain. It stripped away quite cleanly. The right optic nerve was easily cleared, and was completely relaxed as the cyst was removed from beneath it. Finally the entire upward projecting part of the cyst was drawn into the wound free from the right optic nerve and the carotid artery on each side, and it remained attached only to the margins and cavity of the sella turcica. By rocking it gently from side to side, and at the same time pulling upon it, the cyst was detached. It came away quite satisfactorily from the posterior clinoid processes, and also from the anterior wall of the sella turcica, but as the central part which was adherent to the floor of the sella turcica was pulled upon, profuse venous bleeding occurred. This was easily checked by packing the cavity of the sella turcica. It became evident that this central part of the wall of the cyst within the sella turcica was firmly attached to the dura which was being torn away along with the cyst, and it was feared that if this endeavour were persisted in, a dangerous tear into the cavernous sinus on one or other side might be caused. The large portion of the cyst wall /
wall, therefore, which was free, was cut away from the small remaining patch which was left adherent to the floor of the sella turcica. This remaining patch of cyst wall was then treated by the coagulating diathermy current. It was attached only in the middle of the sellar floor. It was quite clear of the carotid arteries on each side so that it could be coagulated. It was thus treated until it was shrivelled into a small charred fragment. Thus the greater part of the cyst was completely removed, and the small fragment in the sella was utterly destroyed by electric coagulation. The enormous cavity remaining after this large tumour had been removed was drained.

During the first week convalescence was very smooth, but two days after the drain had been removed the temperature rose abruptly to 102.6, and the patient became restless and drowsy. Lumbar puncture was carried out, and yellow, slightly turbid fluid was drained. This was sterile on culture, and probably represented an aseptic meningitis resulting from the distribution of debris from the tumour cavity into the cerebrospinal fluid. During the next three weeks there was occasional recurrent elevation of temperature, and the patient remained somewhat /
somewhat drowsy and irritable. Intracranial tension was increased so that the bone flap became somewhat prominent. Lumbar puncture was repeated at intervals of two or three days, and always had the effect of improving the general condition and relaxing intracranial tension, so that the bone flap receded into place. Thereafter convalescence was quite smooth. The patient remains very well to date of writing — bright, active and intelligent. Vision, however, shows little improvement. Acuity has slightly improved to about 6/48. She can read large print, recognise pictures, faces, etc., and can see her way about quite well. Temporal hemianopia persists absolute.

Comment. This case was unfortunate in coming to operation at a stage when visual impairment was already severe, and had probably been so for months or years. No attention seems to have been paid to this until the child herself complained regarding it. It has, however, been possible to improve slightly upon and preserve such vision as existed. A benign tumour has been completely removed. The life prognosis should be quite normal, and there appears no reason why this child should not lead an active and useful life, although handicapped by relatively poor vision. It is probable that the pituitary body /
body has been entirely destroyed, and that she will not develop physically beyond her present state. It is extraordinary that with a craniopharyngioma so large as this there should have been no spontaneous polyuria, and that the disturbance incidental to removing the cyst should not have induced a post-operative polyuria. The history that cessation of growth preceded by several years any other symptom, together with the expanded appearance of the sella turcica in the X-ray, suggests that the tumour was primarily an intrasellar development, and first affected the pituitary gland by compressing it, and later enlarged upwards, producing visual impairment and general pressure symptoms.
FIGURE 1.
FIGURE 4. Photograph of patient taken one month after operation, showing well healed operation scar.
CASES NOT TREATED BY OPERATION.

XIII. (No. 39). Enormous cystic suprasellar craniopharyngioma in male aged forty-three years. Operative treatment advised.

Admission on 27th January 1927. Since early childhood this patient was quite remarkable for his gross adiposity. At the age of twelve he was of average height but weighed 12 st. 6 lbs. He continued to increase in adiposity to date of admission and then weighed 18 st. 4 lbs. In stature he developed quite normally and attained a height of 5 feet 11 inches by the age of twenty. There were no other symptoms other than this remarkable adiposity until twelve years prior to admission, when at the age of thirty-one he developed diplopia. This continued for about four months then disappeared spontaneously. Nothing was known of its exact nature. It recurred seven years prior to admission but not since then possibly by reason of visual loss in the right eye. Nine years prior to admission he began to suffer from recurrent attacks of headache coming on at intervals of several months and lasting for several days at a time. The pain was referred to the frontal region and was severe but was not accompanied by vomiting /
vomiting except on one occasion. Three years prior to admission he began to suffer from prolonged attacks of drowsiness which persisted to date of admission. Two-and-a-half years before admission he began to exhibit a mild degree of right hemiplegia. Eighteen months before admission he discovered accidentally that the right eye was almost blind. He did not know how long the defect in the eye may have existed before this. There had been no change in the condition of the eye to the date of admission. He had not been aware of any defect in the left eye. Fifteen months prior to admission he began to experience difficulty in controlling urine and exhibited precipitant urination. Four months before admission he began to have difficulty in speaking. His speech became somewhat slurred. During the last three months he had several attacks of faintness or giddiness. Within the last three months there had been an abrupt cessation of sexual activity. The patient was married at the age of forty and sexual functions were quite normal until three months before the date of admission.

**Examination.** The patient was 5 feet 11 inches in height and well built. He was grossly obese (see figures 1 and 2).
The quality and distribution of hair on the trunk and limbs and face was quite natural and sexual organs were normally developed. There was a mild degree of right hemiparesis though the patient could get about quite actively. There was a marked degree of emotional instability. He was slovenly and untidy in his habits and showed occasional instances of disorientation and indecent behaviour. Vision in the right eye had perception of hand movements in the nasal field and the left eye had acuity of 6/9. The visual fields showed a temporal hemianopia in the right eye with central scotoma. The left eye showed a complete defect in the lower temporal quadrant and a relative depression of the upper quadrant. (Figure 3). The optic discs showed a mild degree of papilloedema which on the left side was superimposed on an advanced primary atrophy. The X-ray (figure 4) shows a sella turcica possibly slightly deepened but whose outline is within normal limits. The anterior clinoid processes are eroded but the dorsum sellae and posterior clinoid processes are quite well preserved. Projecting upwards and backwards from the sella turcica there is seen an irregularly calcified outline of an enormous cyst extending upwards almost half-way to the vertex and dipping backwards well into the posterior fossa.

There /
There was no reasonable doubt in this case of the diagnosis, viz. an enormous calcified suprasellar cranipharyngioma. The lesion had been only very gradually progressive since childhood. It was felt that this large calcified cyst would certainly be adherent to the base of the brain and that in any event the disturbance of removing or even emptying so large a basal tumour would probably be fatal. Operative treatment was therefore disadvised. Four years later there was little change in the patient's condition and apparently the papilloedema had subsided. The right hemiplegia in this case was probably due to compression of the left crus cerebri against the tentorium as judged from the disposition of the tumour shown in the X-ray.

Comment. This case was of great interest from the point of view of pathological physiology of the pituitary neighbourhood. It would appear that this cranipharyngioma had been very slowly developing since early childhood. It must certainly have been suprasellar in origin as suggested by X-ray appearances and the fact that growth in stature was normal, sexual development was normal and sexual functions remained unimpaired until the age of forty-three. The earliest symptom observed was that of adiposity /
adiposity, no doubt from interference with the hypothalamic region of the brain. Later diplopia and headache provided evidence of increased intracranial tension. Visual impairment was certainly late though its exact date of onset is not known. In spite of the enormous size of this craniopharyngeal cyst and the existence of adiposity associated with it, it has never produced undue thirst or polyuria.


Figure 3.

A.D. Smith
27: 1: 27

White (24 mm seen in upper inner quadrant, Red near horizontal meridian)

White (not done on perimeter) for large object.

Skeklz
°MA

Done on perimeter for large object.
FIGURE 4.

REMARKABLE. This boy of nine looked distinctly less than six years of age, corresponding to about six or seven. He was rather small, but well and moderately nourished. The head was large and quite convexly hydrocephalic. The left eye was completely

...
XIV. (No. 332). Intrasellar craniopharyngioma in male aged nine years. Advanced visual impairment, hydrocephalus and hemiplegia. Operation advised.

Admission on 14th February 1931. The patient ceased to grow about two years before admission but remained otherwise perfectly well until one year before admission. He then began to suffer from attacks of severe headache referred to the frontal region. The headache continued for about a month, ceased but recurred during the last six weeks before admission. Six weeks prior to admission he developed a moderate degree of right hemiplegia, which rapidly increased so that he became unable to walk or stand. Five weeks prior to admission it was discovered that the left eye was practically blind and vision in the right eye impaired. During the last four weeks he had been very drowsy and had been confined to bed.

Examination. This boy of nine looked distinctly less than his years, corresponding to about six or seven. He was rather slightly built and moderately emaciated. The head was large and quite obviously hydrocephalic. The left eye was completely blind /
blind, vision in the right eye hand movements only. There was a complete temporal hemianopia in the right eye and the remaining nasal field showed general depression and contraction. Vision was too poor for accurate charting. There was advanced primary optic atrophy on each side with superimposed papilloedema. There was a severe degree of right hemiplegia with increased tendon jerks and ankle jerks on both sides. In the X-ray, (see figure 1) the sella turcica is considerably expanded. The dorsum sellae and posterior clinoid processes are eroded and there are flakes of abnormal calcification extending from the sellar cavity upwards between the anterior clinoid processes and for about 2 cms. above them. The skull shows general pressure atrophy and widening of sutures.

The diagnosis in this case is reasonably certain from the character of the visual impairment and the X-ray appearances, viz. an intrasellar craniopharyngioma with extensive upward protrusion into the base of the brain. The patient was in very poor condition. Vision was already hopelessly impaired. The tumour was so large as to have caused hydrocephalus either from obliteration of the third ventricle or an aqueduct or both.
It was felt that any attempt at radical operative removal of the cyst could only terminate fatally and that anything short of this would be futile considering the patient's age and state. Operative treatment was therefore disadvised.
FIGURE 1.

There is a small recess pocket. This can vary in depth and is generally called Rathke's pouch. At this stage, there is a slight constriction of the pouch at the oropharyngeal extension. About this time, this can be observed as a distinct bulge ridges over the buccal mucosa of the oropharynx.

FIGURE 1.
DEVELOPMENTAL CONSIDERATIONS.

The development of the hypophysis is of particular interest in connection with any discussion regarding the etiology of the class of tumours under consideration.

It is a well established fact that the hypophysis cerebri is of dual origin and results from the fusion of an upgrowth from the pharynx with a downgrowth from the diencephalic floor. In a very early stage of development the buccal ectoderm and neural tissue of the floor of the diencephalon are in very intimate contact. Rathke's pouch in a 4-5 mm. embryo is first seen as a shallow diverticulum in the roof of the oropharynx just in front of the situation of the pharyngeal membrane showing in transverse section distinct lateral angles. There is at this stage no remains of the pharyngeal membrane. This diverticulum continues to grow, and in a 10 mm. embryo there is a well marked pocket. This was first described by Rathke in 1838, and is generally called Rathke's pouch. At this stage there is a slight constriction of the pouch at its pharyngeal extremity. About this time also can be observed definite lateral ridges near the buccal extremity of the hypophyseal
hypophyseal pouch.

Further reduction progressively occurs in the buccal opening of the pouch, while distally the lumen of the pouch remains patent. By about the 20 mm. stage the stalk has become solid, and the distal portion of the pouch, now emigrated some distance from the buccal epithelium, a closed sac. The pre-cartilaginous condensation later to form the sphenoid bone is developing, and has cut off the sac from the stalk by the 22.5 mm. stage. In the 36.5 mm. embryo there are portions of the stalk still attached to the sac within the substance of the sphenoid and at the buccal end of the stalk. In the 100 mm. embryo the pharyngeal hypophysis has developed an appearance of glandular trabeculae, and is in contact with the nasopharyngeal epithelium just below the sphenoid cartilage.

The first indication of the neural portion is in the 8 mm. embryo stage, (Atwell), as an evagination of the floor of the diencephalon. There is at first a central thickening of the floor with a lateral slit-like fissure on either side. As the median evagination increases these fissures become less and less prominent. This is the method of development in all the vertebrates except in the elasmobranch fishes, which have an infundibular /
infundibular canal into which opens on either side the "saccus vasculosus" which arises early by the outgrowth of the wall of the cerebral vesicle (Herring). The lateral fissures of vertebrates may be related to the "saccus vasculosus" of elasmobranchs. The tissue forming the infundibulum is continuous with the ependymal layer of the neural wall. At first there is a cavity from end to end of the neural evagination but later this becomes wholly or largely obliterated. By the fourth month it comes into contact with the upward growing buccal portion, and comes to lie on the distal margin of Rathke's pouch, passing on to the caudal wall of that cavity.

The two lateral ridges near the buccal extremity increase in size caudally, and as a result of cupping by the enlarging neural lobe, they come to lie close to the brain floor, near the infundibulum. By the 45 mm. stage they have become continuous across the midline, forming a thin epithelial layer projecting nasally. It is in contact with the tuber cinereum and is spread out under it. It is now called the "Pars Tuberalis" (Tilney).

Growth of the neural lobe results in a flattening of the apex /
apex of Rathke's pouch. It lies in a notch on the caudal margin of the pouch. The epithelial part in contact with the neural part is the earliest beginning of the Pars Intermedia.

The pars intermedia comes from the dorso-caudal lip of Rathke's pouch, and its limit is indicated where the neural lobe comes into contact with Rathke's pocket. The extent of contact is gradually increased by growth of the neural lobe. The free surface faces the residual lumen of the pouch.

There is a prominent protuberance forward in the midline of the pouch near the stalk attachment in about the 17 mm. stage which is called the "Anterior Chamber." It contains a cavity only at a very early stage. This is borne on a ridge which divides the cavity of the hypophyseal cup into two parts - the "fossae" which contain connective tissue invaded by trabeculae of the growing hypophysis.

The remainder of the epithelial hypophysis - mainly the anterior wall of Rathke's pouch, becomes the anterior lobe proper. The cells forming this region proliferate very rapidly, and it is possible by the fifteenth week of foetal life to distinguish cords of cells which very soon afterwards have a definite
definite acinar arrangement.

On account of the rotation which occurs in the developing gland, the region of insertion of what was the hypophyseal stalk is carried upward to the anterior infundibular and upper pars anterior surface. (Duffy.)

It has been a question in the literature whether the entoderm of the foregut takes any part in the formation of the pituitary by an infolding occurring in the roof of the foregut, and known as Seesel's pouch. While it is probable that this does play a part in certain lower vertebrate forms, it would appear to be the general consensus of present opinion that there is no entodermal element in the human hypophysis.

As the histological structure of the tumours under discussion has been correlated by some observers with the development of the enamel organ it will be well shortly to examine the early development of this structure.

The first occurrence is a continuous linear thickening of the buccal epithelium along the line of the gum. This occurs at an early stage of foetal development. This thickening grows down into the corium of the mucous membrane to from the "common
dental lamina." From this at regular intervals grow downwards ten flask-shaped collections of cells - the "special dental rudiments." Into these rudiments from below grow the dental papillae from the mesoderm of the corium. The connection with the surface ectoderm is soon lost, and the whole structure becomes enclosed in a vascular connective tissue membrane - the "dental sac."

The polyhedral cells of the dental rudiment undergo a transformation into four layers of modified cells. The innermost is a layer of columnar cells - the "ameloblasts." The outermost layer is a single one of cubical or polyhedral epithelium, (external epithelium). Most of the other cells become transformed into branching corpuscles forming a network. Between the ameloblasts and the reticulum of branching cells of the enamel pulp is a stratum of polyhedral cells, (stratum intermedium).

The manner in which the enamel is formed is still a matter of dispute. It is held by some (Jones, Waldeyer) that the ameloblasts are actually converted into enamel. Others again (Tomes, Schafer) believe in a secretion from the ameloblasts which /
which produces enamel. Schwann believes that the enamel rods are formed by growth of the ends of the ameloblasts next to the formed enamel.

EPITHELIAL "RESTS" IN THE VICINITY OF THE HYPOPHYSIS AND INFUNDIBULUM.

The presence of rests of epithelium in the hypophysis cerebri has long been appreciated. They were seen by Zeuker in 1857, but their significance apparently not realised. Such rests were first described in the normal hypophysis by Luschka in 1860. In 1903 Erdheim made a minute examination of thirteen adult normal hypophyses, and in ten found evidence of such rests, mainly along the anterior surface of the infundibulum or beneath the capsule on the upper surface of the anterior lobe. Erdheim was the first to suggest their being remnants of the hypophyseal duct.

Carmichael in 1931 reported the results of an examination of fifty-five cases. In eighteen of these (32.7%) masses of cells resembling squamous epithelium were found. They might be within or without the capsule of the hypophysis, and occurred...
most frequently on the anterior aspect of the infundibulum and upper pars distalis. The masses predominated in or near the midline. He comments on the difficulty of identifying squamous epithelium. The epithelium lining the embryonic hypophyseal duct is of cubical type. This might become squamous in rests, as in the mouth.

Susman in 1932 gave his findings in a series of serial sections of two hundred and thirty hypophyses. Of these, seventy-one contained epithelial rests of an embryonic character, (30.4%). Of the seventy-one, thirty-two glands contained squamous epithelial rests whose cells possessed intercellular bridges; twenty-nine had primitive rests - a low type of epithelium; three contained glandular rests - medium-sized, closely packed spheroidal cells.

The common site here again was under the capsule of the pars anterior and along the anterior margin of the infundibulum. Both Carmichael and Susman comment on the fact that few rests are found in subjects under twenty years of age - in Carmichael's series - none; in Susman's - 17%. Rests were also found in the parenchyma of the gland - in the pars anterior, pars intermedia and pars posterior.
It is seen, therefore, that rests of a squamous epithelial nature are relatively commonly found in the hypophysis cerebri. The possibility of their being the site of origin of tumours in this region having an epithelial structure was suggested first by Erdheim (1904), and since then this has been a generally agreed-upon hypothesis.
FIGURE 1. Sagittal section through the hypophysis region of a 9.5 mm. human embryo. Nasal end left.
1. Brain wall.
2. Rathke's pouch.
3. Stomatodeum.

FIGURE 2. Sagittal section through the hypophysis region of a 10.5 mm. human embryo. Nasal end left.
1. Brain wall.
2. Rathke's pouch.
3. Stomatodeum.
FIGURE 3. Midsagittal section through the hypophysis region of a 17 mm. human embryo. Nasal end left.

1. Pars Neuralis.
2. Pars Intermedia.
3. Residual lumen of Rathke's pouch.
4. Hypophyseal stalk.
5. Stomatodeum.

FIGURE 4. Sagittal section through the hypophysis region of a 55 mm. human embryo. Nasal end left.

1. Pars Tuberalis.
2. Pars Neuralis.
3. Pars Intermedia.
4. Residual lumen of Rathke's pouch.
5. Pars anterior.
FIGURE 5. Diagrammatic sagittal section of hypophysis, showing meningeal relations of pars tuberalis.

2. Arachnoid space.
3. Pars tuberalis.
4. Diaphragma sellae.
5. Pars neuralis.
6. Pars intermedia.
7. Pars anterior.
8. Sphenoid bone.
PATHOLOGICAL ANATOMY.

Gross Appearances. These tumours are in general globular or ovoid in shape. Their outer wall is smooth over the larger part which is in contact with the arachnoid membrane covering the brain, optic nerves, etc. These tumours, which have originated within the sella turcica and expanded it, exhibit a protuberance which occupies that cavity, and there may be a slight constriction between these parts at the site of the expanded diaphragma sellae, (see diagrams of operative findings attached to individual case records). The intrasellar portion of the tumour has a matt surface, for it is more or less adherent here. Tumours may be divided according to their location into the primarily intrasellar group just described, which comprises ten of the fourteen cases, and into a primarily suprasellar group of which there were four examples. This distinction has an important bearing on clinical symptomatology and operative management. There may be secondary protuberances which have been forced into available crevices beneath the optic nerves, or in the base of the brain. In general, however, the outline tends to be smooth and plain. The tumours may also be divided into cystic and solid groups. Frequently /
Frequently the same tumour may exhibit both characteristics, (Case I), but in this series of fourteen cases twelve were mainly cystic and two were solid.

The cystic tumours usually consist of a single large cavity, but they may be multicystic, (Case V). The wall of the cyst may be quite thin, and the inner surface smooth and glistening. It may be of considerable thickness, and have small cysts in its substance. The inner wall of the cyst may be studded with knobs and papillary projections, (Cases III and II), and it may have a shaggy appearance caused by the deposition of inspissated cyst contents upon it. The contents of the cyst vary from a thin, clear, golden-coloured fluid to a thick, opaque, green, brown or reddish, granular material. There is always abundance of shining cholesterolin crystals in the fluid. The character of the contents is modified on the one hand by the presence and relative quantity of the yellowish kerato-hyaline disquamation from the epithelium lining the cyst wall. This, if abundant, may render the contents semi-solid or actually solid. On the other hand haemorrhage into the cyst wall and cavity is of frequent occurrence, and signs of old extravasations are evident in many specimens of this series. The more recent haemorrhages
give the cyst fluid a dark reddish or brown colour, while after a long interval, a greenish hue is imparted. The occurrence of haemorrhages into the cyst probably has an important bearing on the variable and often abrupt symptoms in these cases. Calcification on a gross macroscopic scale is of frequent occurrence, and may be very widely distributed over the wall of a cyst, (Case XIII), or may take the form of a localised flake or nodule in some part of the wall as exhibited in a majority of the cases. The external appearances of a cystic tumour are naturally modified by the thickness of its wall and the colour of its contents.

The solid tumours may consist of a mass of epidermoid cells with more or less supporting stroma, (Case II). Such a tumour is more irregular in outline than a cystic growth, and is flesh-coloured. In another instance, (Case VI), the solid character of the tumour depended on the degree of inspissation of its kerato-hyaline interior. This tumour had a thin, glistening, pearly-looking capsule, and its yellow interior of kerato-hyaline was quite firmly solid.

Anatomical Relationships. If the epidermoid tumour has taken origin within the cavity of the sella turcica, i.e.,
below the diaphragma sellae, it first dilates that cavity, compresses its other contents, and finally, distending the diaphragma upwards, it expands into the intracranial space. Such a tumour then, is closely and intimately applied to the cavity of the sella. The pituitary gland is flattened and spread out on the wall of the cyst, and the fact that it is intimately adherent to it and comes away with the cyst rather than remain adherent to the sellar walls, suggests that most of these tumours originate in the substance of that gland, (Cases VII and IX). If the cyst is of long standing, and its pressure has been considerable, the pituitary gland may be entirely destroyed. In these circumstances the cyst wall becomes intimately adherent to the periosteal lining of the sella, (Case XII), but in less advanced stages it strips out readily. The cyst is always more or less adherent to the dural margins of the sella turcica, for here the expanded diaphragma sellae has become more or less blended with the fibrous cyst wall. Sharp dissection or considerable force is necessary to liberate this line of attachment. The sella turcica is expanded by a tumour originating in it and its surrounding clinoid process may be more or less eroded by pressure.
pressure.

The originally suprasellar tumour lies upon the intact diaphragma sellae, and does not affect the sella turcica nor its contained pituitary gland, but the sellar cavity, although it may be flattened, is not expanded. The tumour usually strips away quite cleanly from the indented roof of the sella turcica.

The large intracranial extension of a cystic tumour which has originated in the sella and the cyst which has arisen primarily from the epithelium around the pituitary stalk above the diaphragma sellae are quite similar, and the following description applies to both. The cyst occupies a distended interpeduncular space. It may rise somewhat vertically into the base of the brain, (Cases VI and XI), or it may slope more backwards against the pons, (Cases V, X and XII), and even project downwards and backwards considerably into the posterior fossa, (Cases II and X).

Its anterior surface is in contact with the optic nerves and chiasm. This relationship is of great importance, both in determining the nature and degree of visual affection and the /
the accessibility of the cyst at operation. Much depends on the anatomical type of nerves and chiasm - whether the nerves are long and the chiasm far back (post-fixed chiasm) or short, and the chiasm bound low and forwards by them, (pre-fixed chiasm). In the former event the cyst bulges well forwards between the nerves which pass laterally over its anterior pole and are splayed apart and are less subject to stretching and distortion than the chiasm, which is more subject to stretching by the cyst which has got forwards well beneath it. With a pre-fixed chiasm the anterior protrusion of the cyst cannot get into the narrow gap in front of the chiasm and tends to crowd and kink the short nerves forwards against the margins of their foramina so that the chief incidence of compression falls on them at this point, and again on the optic tracts which, tethered to the pre-fixed chiasm, are stretched by the cyst rising upwards behind it. Some degree of asymmetry is frequent. A secondary pocket of the cyst may insinuate itself under one optic nerve and thus compress and distort it much more severely than its fellow. On rare occasions the tumour may even be so asymmetrical as to present outside one of the optic nerves, between it and the carotid artery, (Case II).
On either side of the basal aspect of the anterior pole the carotid arteries, which may be elongated by gradual stretching, pass upwards and backwards to the base of the Sylvian fissure. Further back the cyst wall is in relation to the oculomotor nerves.

Posteriorly the cyst may reach and compress the anterior surfaces of the cerebral peduncles and pons, and may crowd the brain stem back against the sharp dural edge of the incisura tentorii.

Above, the upward-projecting dome of the cyst indents the base of the brain, and by infolding and expanding the floor of the third ventricle displaces that cavity, and indents the cerebral tissues bounding its lateral walls. A cyst thus enlarging upwards first meets the tuber cinereum, and later thins out the entire floor of the ventricle to an attenuated membrane, while later its pressure affects the higher and more laterally placed basal cerebral nuclei.

Finally the cyst may rise high enough to compress the foramina of Monro, or it may extend so far backwards as to compress the upper end of the aqueduct of Sylvius. In either event
event the cerebro-spinal fluid is obstructed, and secondary hydrocephalus ensues. These tumours growing relatively slowly probably never cause a serious increase of intracranial pressure by their own volume _per se_ - but only when they give rise to secondary hydrocephalus.

In a majority of cases in this series the intracranial portion of the tumours stripped easily from the optic nerves and base of the brain, leaving a smooth clean surface behind them. Long-sustained and severe pressure destroys the leptomeninges, and it is on the presence or absence of this structure that adherence or non-adherence depends. In some cases there were localised adhesions at points of maximal pressure - e.g., the chiasm in Case VIII. In only two of the twelve operated cases had adhesions to the surroundings of the cyst become extensive, (Cases III and IV). In these the arachnoid space between brain and tumour surface had become obliterated, and removal of the cyst involved superficial tearing and abrasion of the brain surface. In the other ten a relatively free arachnoid space separated the surfaces of brain and tumour.
PATHOLOGICAL HISTOLOGY.

The microscopical appearances of epidermoid tumours occurring in relation to the hypophysis is marked by a great variation in structure and cellular architecture and in the relative proportions of stroma and epithelial elements.

Essentially the tumours consist of epithelial cords which interlace and anastomose in complex fashion in a stroma of fibrous tissue. Metaplastic and degenerative changes of many kinds occur in the epithelium and the stroma too undergoes various transformations.

The epithelial portion of the tumour is formed of columns of epithelium branching and interlacing in all directions. They are, in the main, solid structures but cyst formation is a relatively common finding. There is as a rule a well marked basal layer of cubical or low columnar cells with oval or elongated deeply staining nuclei. They tend to be arranged parallel with one another and with their long axes at right angles to the surface of the epithelial masses. Typically there is but a single row of such cells. This arrangement has been called "palisade" formation. These cells have been considered by some, especially by Critchley and Ironside.
Ironside, to be similar in form and arrangement to the ameloblasts of the primitive enamel organ.

The central area of the epithelial cords is made up of cells of a round or polygonal type with round nuclei staining less deeply with basic dyes than those of the peripheral cell layer. In a very few cases in this series (Case V) there are areas having a disposition of cells after the type of the developing enamel organ. Deep to the palisade layer is a layer of cells having oval nuclei which do not stain very intensely and whose long axes are in general at right angles to the outer columnar cells. In the centre of the mass the cells show a tendency to be stellate in outline. This latter appearance is not however at all well marked.

More commonly the central area shows no particular cell arrangement though there may be a tendency to "streaming" or whorl formation. In some cases there is no suggestion of an arrangement as that described above, the cell mass being made up of cells of a basal type arranged in small islets or alveoli. In other instances the central mass of cells is very definitely of squamous type. The cyst wall may be lined by a layer of stratified
stratified squamous epithelium. In one case (Case XII) small islets of epithelial cells are present in the wall of the cyst. The cells have the appearance of glandular epithelium; they may possibly represent a primitive salivary gland formation.

In many of these tumours well formed cell-nests are present. These are formed of whorls of cells which are flattened peripherally, thus giving the masses a concentrically laminated appearance. (Case III). Keratinisation of the nests is of frequent occurrence, the outlines and nuclei of the cells having disappeared.

Eleidin granules have not been encountered in the sections examined. Erdheim and, later, Jackson both denied the presence of eleidin granules in tumours of this type but they were observed in abundance in a case reported by Duffy and Bailey found them in three cases recorded by him in 1921.

Cysts are very commonly observed in the epithelial masses in these tumours. They are of very varying type, not only in different tumours but also in different areas of the same tumour.

(1). There may be irregular spaces without a definite epithelial lining but lined by the irregular margins of the inner cells of the mass. They contain a clear fluid or may show a fine granular /
granular content and may contain scattered rather degenerated cells. They are doubtless the result of hydropic change and subsequent disintegration of the inner cells of the epithelial mass, (Case V).

(2). Small round cysts containing a homogeneous colloid substance. They are lined by a single layer of flattened cells which usually lie end to end round the cyst. In some cases these cysts tend to be larger and are then lined by a cuboidal cell layer, the cells being arranged side by side. (Case X).

(3). Regular circular cavities in the centre of the epithelial masses. They are empty and are lined by a single row of low columnar epithelium accurately arranged in palisade fashion. Their origin is not very easy to surmise. It has been suggested by Critchley and Ironside that they are the result of inclusions of ameloblasts into the cell mass, the columnar cells corresponding to the external epithelium of the enamel organ.

Various degenerative changes occur in these tumours. In the region of necrosis foreign body giant cells are nearly always found. Calcification is very common in the necrotic areas. As a result of the accumulation of dissolved out calcium salts the neighbouring fibroblasts become osteoblastic and thus areas of heterotopic bone are formed. This is perhaps analogous to the occurrence in calcified /
Calcified epitheliomata of the skin, of bone replacement as described by Nicholson. This bone formation is not common. It was present in one case of Erdheim's, in one of those reported by Duffy and in one case of seven reported by Critchley and Ironside. It is present in two of the cases in the present series (Cases III and XII). The bone is in lobed masses lying in fibrous tissue stroma.

The stroma is composed of a young fibrous tissue surrounding the epithelial masses. It varies considerably in its texture and in its relative proportion to the epithelial elements. The fibrous tissue is varyingly cellular, the cells being either spindle-shaped as in fibroblasts or with flattened poorly defined nuclei in more mature tissue.

In many of the tumours there is a very marked small round cell infiltration which is sometimes quite definitely perivascular, sometimes generally widespread. Lymphocytes and plasma cells are particularly common. A few polymorphonuclear leucocytes and some red blood corpuscles are generally present. (Case VIII).

Myxomatous degeneration of the stroma occurs and in some cases the fibrous tissue takes on a hyaline character. Cyst formation /
formation may also occur in the stroma but never to so marked a degree as in the epithelial element.

Parenchymal cells of the pars glandularis of the pituitary are present in a number of the sections but this is a result of the proximity of the pituitary to the tumour. There is no evidence in any of the cases to lead one to suppose that a malignant invasive character is present in the tumour cells. The tumour formation may of course take place in the substance of the pituitary gland parenchyma.

Cholesterin crystals are of very frequent occurrence in these tumours; during the course of preparation of paraffin sections they are dissolved out leaving long narrow acicular spaces in the tissue where they once were. These spaces are very frequently surrounded by a foreign body giant cell reaction.

The epithelial element may be very scanty indeed. This is seen in Cases IV and VIII. In the former it is represented only by a few small spaces lined by a single layer of cuboidal epithelium and by a few small islets of cells with palely staining rounded nuclei. The latter has a cyst wall of well formed fibrous tissue /
tissue lined by a layer of stratified squamous epithelium about three cells deep and showing desquamation on its free surface. There is also a portion of anterior lobe of pituitary parenchyma present in the substance of which are embedded two well formed, muchplicated bands of epithelium. There is a definite basal layer, the underlying cells having a squamous character.

Case XI on section show a large celled chromophobe adenoma of the pituitary gland. It contains numerous cysts, both large and small. The larger ones are lined by a single layer of flattened cubical epithelium and contain a homogeneous colloid material. The smaller cysts are rather irregular in form and are lined by cuboidal epithelium. The larger cysts are in certain areas lined by stratified squamous epithelium showing a basal layer in parts two or three cells deep and cells which stain a pale pink with eosin and are being cast off as squamous. There is no evidence of any epithelium of ciliated type.

There have long been described what have been termed "rests" of squamous epithelium in the hypophysis cerebri and in its neighbourhood. Luschka was the first to draw attention to them and later Erdheim suggested that they might have their origin in remnants of the hypophyseal duct. This view has been very generally /
generally accepted. It was suggested first by Onanoff (1892) that the palisade layer of cells in the tumours which we are discussing were related to the ameloblasts of the primitive enamel organ and he gave these tumours the name of adamantinoma. Critchley and Ironside state that in examining the epithelial vestiges occurring round the distal extremity of the infundibulum in normal people they encountered here and there little clusters of columnar cells indistinguishable from ameloblasts which they consider the clue to the origin of the pituitary adamantinomata.

One feels that there is room for criticism of the views put forward by these various authors and others. It must be granted that remnants of the hypophyseal duct do occur. They are found however (1) in the floor of the sella turcica outside the capsule of the hypophysis, (2) in the substance of the sphenoid bone, (3) under the mucous membrane of the roof of the nasopharynx. Tumours may and do occur in these parts but are not related to those tumours now under discussion. It does not seem to me to be easy to explain the presence of those "rests" within the actual parenchyma of the epithelial portion of the pituitary on a basis of their being remnants of the hypophyseal duct. The cells of the buccal ectoderm at the time when the pharyngeal diverticulum
is being evaginated are presumably capable of forming any of the tissues arising from the stomatodeum - mucous membrane, squamous epithelium, teeth, etc. Those cells taking part in the formation of Rathke's pouch are intended to differentiate into the cells of the epithelial portion of the hypophysis. Some of these cells for some reason not understood might proceed on a course of aberrant metamorphosis and produce squamous epithelium in place of pituitary cells. This does appear to me to be a more reasonable hypothesis. The so-called "rests" then become areas of cell dysplasia. This might occur anywhere where pituitary gland epithelium is present and so might occur in the pars anterior, pars intermedia or pars tuberalis - situations both below and above the diaphragma sellae. Proportionately one might expect more tumours to occur primarily in the sella turcica below the diaphragma and in our series this was the situation of the original growth in the great majority of cases.

Glandular rests have been described by Susman as occurring in the hypophysis cerebri. There are two possibilities to consider in trying to arrive at their origin. The pituitary gland is in an early developmental stage a gland of external secretion and the cells forming it are, at that stage, of a glandular type. It /
It may be, then, that these glandular rests are indeed rests of this glandular epithelium whose development has become arrested while it is still of a primitive type. On the other hand, these rests may be brought into line with the squamous epithelial "rests" by again supposing an aberrant metaplasia to have occurred towards a salivary gland type of epithelium - it may be in a primitive condition.

Many classifications of these tumours have been suggested. 
(a) Duffy: 1) Rathke pouch cysts; 2) Benign squamous epithelial cysts; 3) Benign or locally malignant adamantinomatous cysts or solid tumours of hypophysis or infundibulum; 4) Malignant spindle cell carcinomas. 
(b) Cornil: 1) Rathke pouch tumours; 2) Pharyngo-hypophyseal epitheliomas; 3) Teratomas. 
(c) Frazier and Alpers: 1) Adamantinomas; 2) Rathke pouch tumours; 3) Carcinomas; 4) Teratomas. 

There are no instances in this series of cases of tumours which could be derived from remnants of the pouch of Rathke, nor were there any teratomas or tumours which show any signs of malignancy. It seems very probable that cysts should arise from portions of the residual lumen of Rathke's pouch and they should certainly be kept apart /
apart from other epithelial tumours in this region in any classification thereof.

One would urge for the discontinuance of the term "adamantinoma". There is apparently a complete absence of calcified dental tissues in these tumours. Where teeth have been described the tumour has been of the teratoma group. It is on a resemblance to the primitive dental formative tissue - a resemblance which is often a very imperfect one - that this nomenclature has been adopted. There does not appear to be any convincing evidence that the cells of the palisade layer are in any way related morphologically to the ameloblasts. Rather are these tumours squamous epithelial tumours pure and simple. It has been suggested in a recent communication by Sprawson that the term "basal-cell carcinoma" should be used. In studying the histology of the tumours in the present series one is convinced that they are all essentially of similar nature though varying considerably in their actual cellular architecture. They should all be classed together and I suggest that the term "epidermoid" tumours of the hypophysis cerebri is best fitted as a designation for them. By this term one means a tumour which may show any or all of the formations present in the epidermis from the squames on the free surface down to the basal /
basal layer below. Therefore into this group of tumours one could place those tumours which have a definitely stratified squamous epithelium; those of squamoid type with well marked basal cell layer and showing in their structures all the changes occurring in the Malpighian layer—cell nest formation, etc., and Keratinisation and calcification would be easily understood in these situations; or again those tumours showing a basal epithelial structure above—without nests or Keratinisation. Thus in one simple term could be included all the various tumour types encountered in the present series. The term does not imply malignancy and such terms as "carcinoma" and "epithelioma" should be avoided because of this implication.

One is not in a position to suggest a complete classification of all tumours arising in the hypophysis or from its anlage but one would like to bring forward this simpler, reasonable and to my mind satisfactory view of the nature and formation of the so-called squamous "rests" of the hypophysis cerebri and to urge that the term "adamantinoma" be not used in connection with these tumours, the term being morphologically unsound and misleading in its implications.
Fig. 1. (Case II). L.P. photomicrograph showing epithelial cords with well marked basal cell layer, the inner cells of the cords having a squamoid appearance. Round cysts without content, lined by single layer of cuboidal cells. Stroma of acellular loose fibrous tissue. x 140.

Fig. 2. (Case II). H.P. field of same tumour as Fig. 1 showing especially the marked basal cell layer with palisade formation. x 450.
Fig. 3. (Case XII). L.P. photomicrograph of wall of cyst showing lining of stratified squamous epithelium, the surface layer scaling off. In the underlying fibrous tissue are small islands of epithelium and around them a marked small round cell infiltration. x 120.

Fig. 4. (Case XII). H.P. view of Fig. 3 showing stratified squamous epithelium and the islands of epithelium in the wall of cyst. These have a primitive glandular appearance and may be related to salivary gland tissue. x 400.
Fig. 5. (Case X). Photomicrograph showing irregular cystic spaces and papillary outgrowths lined by epithelium of varying cell depth. A definite basal layer is present in the larger part of the section. The epithelium in certain areas is of definitely squamous type. x 110.

Fig. 6. (Case XII). Photomicrograph showing cystic space and papillary projection lined by uniform rounded cells of basal type. There are a few Keratinised epithelial pearls in some of which calcification has occurred. Fibrous tissue stroma with small round cell infiltration. x 135.
Fig. 7. (Case VIII). Photomicrograph shows parenchymal cells of anterior lobe of pituitary gland embedded in which is a plicated cord of epithelium of definitely squamous type. There is a well marked basal layer of darkly staining cells. This may be interpreted as a localised area of aberrant cell metaplasia.

x 140.

Fig. 8. (Case XI). Photomicrograph showing an irregular space in the midst of parenchymal pituitary tissue. The space is lined by a varyingly thick epithelium of squamous type and having a definite basal layer.

x 80.
Fig. 9. (Case IV). Photomicrograph showing in bottom left part pituitary parenchyma with cells in trabecular with sinusoidal blood space. Above to right fibrous tissue with few cells. Between them and in fibrous zone are fairly large cysts lined by a single layer of cuboidal epithelium. x 140.

Fig. 10. (Case VII). Photomicrograph to show two large cysts in pituitary parenchyma lined by a layer of cuboidal cells and containing homogeneous though laminated eosinophilic substance of colloid-like nature. x 100.
Fig. 11. (Case III). Photomicrograph to show in particular an area of bone formation. In the right of the field are seen some Keratinised epithelial pearls with areas of calcification.

x 85.

Fig. 12. (Case IX). Photomicrograph showing marked formation of Keratinised material. In the right hand upper corner are seen the acicular spaces out of which cholesterin crystals have been dissolved.

x 80.
Fig. 13. (Case X). Photomicrograph showing the extreme degree of Keratinisation and pearl formation present in this case with early calcification. There is a large irregular cyst probably of degenerative type. 

x 110.

Fig. 14. (Case V). Photomicrograph showing epithelium in cords and sheets showing basal cell character. There is marked cyst formation in the epithelium. Cell nests are seen in the section and pearls of Keratinised material are also present.

x 90.
Fig. 15. (Case X). Photomicrograph of an area of small round cell infiltration showing the very definite perivascular arrangement which is present. 

X 140.

Fig. 16. (Case VIII). Photomicrograph of area of small round cell infiltration. Lymphocytes and plasma cells are very frequent.

x 400.
SYMPTOMATOLOGY.

INCIDENCE. The epidermoid pituitary tumours are by no means rare. They are of less frequent occurrence than pituitary adenomata, the proportion in available statistics being about one to four. They are of more frequent incidence than other tumours of this neighbourhood, e.g. suprasellar endothelioma, teratoma or chordoma. The facts that they often affect young children and are insidious in their development probably cause many cases to remain unrecognised.

The age incidence in this series at the time of admission was - first decade, three cases, second decade three cases, third decade, two cases, fourth decade, four cases, fifth decade, two cases. However, since these tumours are often of extremely slow development the age at time of admission gives little idea of the age at onset of the earliest symptoms. The symptoms can often be traced back many years, an extreme instance being Case XIII, whose earliest symptom - adiposity - was manifest in childhood and who presented himself for treatment at the age of forty-three. An analysis of the case histories shows that the first recognisable symptom /
symptom was manifested at an average age of fifteen, with six in the first decade, five in the second decade and only three cases over twenty at the appearance of the earliest symptom. It is then essentially a disease of childhood and adolescence. It is a disease of very slow development so that the average duration of symptoms from their earliest onset to the time of seeking treatment was almost exactly ten years in this series of cases. It is perhaps somewhat speculative to enquire of these facts as to the probable time when the tumour actually took its inception but considering their slow growth it is certain that the tumour actually exists for a considerable time before it is large enough to produce any recognisable symptoms. The facts suggest that the tumours often take origin in very early childhood or possibly prenatally, a suggestion which strongly supports the belief in their origin from faulty metaplasia of certain cells of the pituitary epithelial anlage.

The sex incidence is not remarkable — six females and eight males comprising this series.

**CLINICAL SYMPTOMS AND SIGNS.** As already indicated in dealing with their pathological anatomy the intradural portion of
an originally intrasellar tumour and the tumours originating above
the sella are quite similar and hence they give rise to similar
symptoms. The distinguishing features of the more frequent
intrasellar tumour is the early effect upon the sella turcica and
its contained pituitary gland. In these cases (Cases I, III, IV,
VI, VII, VIII, IX, XII and XIV), hypopituitarism was clearly and
by far the earliest symptom. The failure of pituitary secretion
was manifested in children by cessation of growth and general
physical development at a definite time; in adolescents by
failure of sexual and secondary sexual development; in adults
by cessation of sexual activity (menstruation or libido sexualis).
A peculiarly fine, soft, relatively hairless skin was characteristic
at all ages. Case XI was an exception to this rule, but the
picture is complicated in his case by the coincidental presence of
a pituitary adenoma which was certainly of intrasellar origin,
though whether the epidermoid cysts in his case were originally
supra- or intrasellar can hardly be assessed. In contrast to
these originally intrasellar tumours are the suprasellar tumours
(Cases II, V, X and XIII). In them other symptoms had long
preceded those of hypopituitarism, which had only become apparent
for a period of months before admission in three of them and was
absent in the fourth.
In addition to the early occurrence of hypopituitarism the tumour originating in the sella has a distinctive effect on the sella turcica. The sella turcica is invariably expanded and its volume increased. The X-ray may show a large globular distension, (Case IV) or a deep narrow sella (Cases VI and XII), or intermediate forms between these. The suprasellar tumour does not expand the sella which may appear perfectly normal (Case II) or its upstanding clinoid processes may be flattened from above, while its cavity is unaffected (Cases V and X). A striking and highly significant feature in pituitary epidermoid tumours is the frequent appearance of abnormal opacities in the X-ray due to calcification in the growths. Calcification was thus recognisable in nine of the fourteen cases. It may appear merely as a faint flake in some part of the cyst wall (Cases V, VI, VIII, IX, XII and XIV) or as a dense irregular shadow of some considerable size (Case X) or the greater part of the cyst wall may be outlined in this way (Case XIII).

The visual disturbance is predominantly a bitemporal defect, for the chiasm crossing the midline over the anterior pole of the cyst and tethered by its optic nerves is the part of the visual paths/
paths most subject to pressure and stretching. The more the cyst can protrude forwards beneath a chiasm provided by Nature with long nerves the more it will damage it and it alone, producing a clean cut bitemporal hemianopia with relatively good preservation of macular vision (Cases VII and VIII). According as the cyst pushes forwards and laterally beneath the optic nerves, and especially by strangulating them against the sharp edges of their foramina the nerves themselves are damaged with predominant injury to macular vision (Case IV). This optic nerve strangulation is frequently asymmetrical, giving a lesion varying from a central scotoma to total blindness on the affected side (Cases IX, VI, V and I). Less commonly one of the optic tracts behind the chiasm may be chiefly affected by a posteriorly projecting tumour, as in Case X, giving an homonymous hemianopic defect. In this case a later central scotoma in the right eye from anterior extension of the cyst on that side was produced.

It may here be noted that, in these cystic tumours, in contrast to other solid tumours of this region, sudden appearance or alteration of symptoms is common. This is especially true of visual symptoms. It is probably due to sudden alterations in the /
the cyst volume caused by small haemorrhages and their subsequent absorption.

Cranial nerve involvement other than that of the optic pair is relatively uncommon. In spite of the relation of the oculomotor nerve to the tumour, there is no instance of disturbance of its conductivity except in one case from operative trauma. Paresis of the abducens nerve occurs occasionally, but only in association with increased intracranial pressure. This was observed in Case VI and a history of temporary internal squint with diplopia associated with crises of headache was recorded in several others (VII and XIII). The fluctuating character of those abducens palsies and their association with other general pressure signs puts them on a parallel with this symptom as observed in any sort of increased intracranial pressure. Its cause is a downward dislocation of the brainstem and is not significant of any particular type or site of intracranial tumour.

In one instance, (Case IX), there was slight depression of conductivity in the first division of the left trigeminal nerve. Probably it was caused by direct pressure of the cyst on the inner edge of the Gasserian Ganglion or on the nerve near this point.

Polyuria /
Polyuria and excessive thirst were spontaneous symptoms of tumour pressure causing disturbance of the tuber cinereum in four instances (Cases V, VI, VIII and X). Most of the operated cases had a post-operative disturbance of water-balance from operative interference with the tuber region, lasting for days, weeks or even months in a few cases. It was always easily controlled by pituitrin administration. This symptom is curious in its irregular appearance and apparent lack of dependence on the size and upward projection of the tumour. It is not at present clear why one tumour will cause it and another apparently very similar tumour will fail to do so.

Adiposity was present in only one of the fourteen cases (Case XIII). This case is of special interest in demonstrating that the adiposity was caused by a basal cerebral rather than a pituitary lesion. The tumour was originally suprasellar as judged from the X-ray and his growth and primary and secondary sexual developments were normal indicating an intact hypophysis. Yet from early childhood, and as a first symptom of his disease, he exhibited typical gross adiposity. Most of the cases were of thin, slight build even to a slight degree of emaciation in some cases.
Pathological somnolence was a striking feature in Cases III, VII, XII and XIII and is interpreted as a direct effect of tumour compression of the anterior basal nuclei.

Mental disturbance was evident to a conspicuous degree in two cases, (Cases X and XIII), and was regarded as evidence of frontal lobe compression by the very large tumours in these cases.

Signs of pressure on the projection tracts of the brainstem was present in two cases (Cases XIII and XIV), evidenced as spastic hemiparesis and hemianesthesia. This occurrence is interpreted as due to pressure of the cyst on the peduncles and pons forcing the brainstem backwards or laterally against the sharp dural edge of the incisura tentorii. In Case III, as a consequence of operative disturbance of the distorted brainstem, a vascular lesion virtually transected it just above the pons and gave rise to the typical state of "decerebrate rigidity". In this case also temperature regulation was disturbed causing persistent hyperthermia. In Case X immediately after operation a disturbance of temperature regulation caused the opposite effect - poikilothermia - and the low temperature rose immediately in response to the administration of pituitrin.
The occurrence of objective signs of a general rise of intracranial pressure was infrequent. Headache was common, but very irregular in its site, type, time of occurrence in the course of the disease, and might subside spontaneously and remain absent for years. In four cases actual papilloedema was observed (Cases VI, X, XIII and XIV). In Case VI it had subsided spontaneously and remained absent for five years. In Case X it had been relieved by an earlier decompressive operation. In Case XIII it subsided and remained absent two years after its observation. Only in Case XIV was it seriously and steadily progressive and associated with signs of hydrocephalic distension of the skull. It may well be that the infrequency of papilloedema even in the presence of severe headache may be due to blocking of the optic foramina by direct tumour pressure, and that only with a large posteriorly-lying cyst is it likely to be present.

**DIAGNOSIS.** The diagnosis of a tumour of the pituitary region presents no special difficulty and is clinched more especially by the evidence of progressive chiasmal involvement. The differential diagnosis of a primarily intrasellar tumour depends on the history of hypopituitarism as the initial symptom and the X-ray appearance of the sella. Here we have to distinguish the
epidermoid pituitary tumour from the chromophobe adenoma. An epidermoid growth would be favoured in a person below twenty years of age and the presence of calcification in the tumour is almost pathognomonic. In a person over twenty and without calcification a differential diagnosis would be uncertain. In the case of a suprasellar tumour, the late onset of hypopituitarism and X-ray appearance of the sella distinguish it from an intrasellar growth. The suprasellar epidermoid tumours are distinguished from other suprasellar lesions by their typical calcification when it is present. If calcification is absent, the age of the patient may be suggestive, but apart from this consideration the diagnosis cannot be carried beyond the presumption of a suprasellar swelling of uncertain character.
TREATMENT.

The epidermoid pituitary tumours under consideration are not amenable to medicinal or physiotherapeutic remedies. X-rays have little or no influence on the mature resistant cells of these growths and while radium is effective for the rather similar rodent ulcer and benign papilloma of the skin surface, its practical application to an extensive thin cyst wall, surrounded by vital structures, and relatively inaccessible in position appears quite impossible and has not been attempted.

Operative treatment alone requires consideration in dealing with the lesion. Up to quite recent times surgical results in the treatment of these tumours have been deplorable. Thus Cushing, writing in 1930, with an experience of over eighty cases characterizes them as "disheartening from the neurosurgical aspect" and again he refers to the "hazards of operations for craniopharyngiomas if more is attempted than mere evacuation of a cyst. Experience has shown that these cysts invariably refill after operation . . . . The temptation to remove as much of the cyst wall as possible is irresistible". Cushing has not yet published details of his series but it is evident from his references to the subject that his experiences lead him to consider /
consider these tumours as very rarely amenable to successful surgical removal. Moffat reports one case of Cushings's in which a total extirpation was followed by satisfactory recovery.

Critchley and Ironside reported eighteen cases from the National Hospital, Queen Square, London, in 1926. The eleven cases operated on all died within six months and in no case was a complete removal effected. Beckman and Kubie in 1929 reported twenty-one cases from the same institution admitted between 1918 and 1929. Twenty of these were operated on with early fatality in fifteen and early recurrence of symptoms after incomplete tumour removals in the remaining five.

Frazier and Alpers record fourteen cases in 1931 and of the twelve cases operated on a complete removal with satisfactory survival was effected in one case. Another has survived thirteen years after a partial removal and chemical treatment of the remaining cyst wall, another died of recurrent symptoms eight years after similar treatment. The remaining nine cases died from operation or from early recurrence of symptoms after incomplete removals.

Peet in 1927 recorded three cases treated by operation; in one with good recovery after a complete tumour removal, one with early /
early recurrence and death after an incomplete removal and one which died from the operation.

It would appear that until quite recently only some three or four cases of complete removal of one of these tumours with success have been reported from the most active and progressive neurosurgical clinics. Of cases operated on, the vast majority have either died in immediate consequence of the operation or have only obtained very temporary benefit following incomplete tumour removals.

In this series of fourteen cases which have come under my observation in Mr Dott's service in Edinburgh between 1927 and 1932 two cases were considered unsuitable for operative treatment. Two cases died as a direct consequence of the operation. Two cases survived incomplete operation for about one year each. In the remaining eight cases total removal of the tumour was successfully accomplished and all these patients remain alive and well.

The operation has been essentially similar in all these cases. The approach has been beneath the frontal lobe and from the side on/
on which vision is most affected, with the possible necessity of sacrificing one optic nerve in view. This was actually necessary on four occasions (Cases II, V, X and XII), in order to obtain adequate access to the tumour. In the earlier cases a coronal scalp incision from temple to temple was employed. The whole forehead scalp was reflected forwards (see Case VIII) and a low frontal bone flap hinging on the temporal muscle was fashioned on the selected side. More recently this has been modified by using a concealed fronto-temporal skin flap (see figure 1 and Case XII). The bone flap is formed with its lower edge as close to the supraorbital margin as the frontal air sinus permits (see figures 1, 2 and 3). In the earlier cases the dura was stripped from the orbital roof and opened deep along the sphenoidal ridge. This gives good protection to the brain during the operation but affords somewhat limited access for these large tumours. In the more recent cases the dura has been opened widely and folded down over the supraorbital margin and the brain more freely retracted (see figure 5). In doing this it may be advantageous to tap the anterior horn of the ventricle to obtain greater relaxation of the brain. The cyst is tapped as soon as it is exposed not only to identify the nature of /
of the tumour, but because this further reduction in volume enormously facilitates adequate exposure and inspection. The further procedure depends on the individual conditions. If the optic nerves are naturally long and still further elongated by stretching over the tumour sufficient access for removal of the cyst wall may be obtained in through the aperture bounded by the nerves on either side, the tuberculum sellae in front and the chiasm behind and above. When the optic nerves are short and the chiasm bound down by them it is essential to divide either one optic nerve or the chiasm. In this series the latter measure has not been adopted and in most cases division of an optic nerve will be much more serviceable in giving access. With a nerve divided the optic chiasm and adjacent cerebral base can be freely retracted and displaced towards the opposite side, and the removal of the cyst wall pursued under direct vision (see figures 6 and 7). The cyst is carefully detached from the optic nerves and chiasm, from the carotid artery on each side, from the floor of the third ventricle and from the anterior surface of the brainstem. Care must be exercised to identify and preserve the oculo-motor nerve which is often in contact with the lower posterior part of the cyst. In the case of a primarily suprasellar tumour the wall can
can now be cleanly stripped from the intact upper surface of the diaphragma sellae and thus removed. In the case of a primarily intrasellar growth traction is made on the freed upper portion. The intrasellar pocket of the growth is adherent to the margina of the sella and to the remains of the expanded diaphragma sellae (see figure 8). Here sharp dissection and a certain amount of force is necessary to liberate it, especially from the dorsum sellae. Having thus been freed from the sellar margins the cyst wall usually strips from the dural lining of the sella readily (see figure 9). On three occasions in this series it failed to do so and remaining fragments were destroyed by the application of Zenker's solution to them or better still by electro-coagulation as in Case XII. Drainage of the tumour bed is certainly a wise precaution as evidenced by the ill effect of removal of the drain in the convalescence of Cases X and XII.

The general pre-operative and post-operative management does not differ in other respects from that in other intracranial operations.
Diagram showing outline of "concealed" frontal flap incision - i.e., concealed beneath the hair. The outline of the bone flap is shown.
FIGURE 2. The skin flap has been reflected over the supra-orbital margin. The bone flap has been cut, and its base broken over to hinge on the temporal muscle. The dura has been secured to the pericranium along the supra-orbital margin.
FIGURE 3. Postero-anterior X-ray (case XII) to show outline of bone flap. Note the silver clips on meningeal vessels in the dura.
FIGURE 4. Left lateral X-ray (case XII) showing bone flap.
FIGURE 5. The operation field (case XII) showing the dura opened, and the frontal lobe retracted to explore the chiasmal region. The optic nerves and chiasm are stretched and flattened, but the nerves are short and impede adequate access to the underlying cyst.
FIGURE 6. (Case XII). The left optic nerve has been cut, and the brain displaced backwards and to the right, greatly improving access.

FIGURE 7. (Case XII). The cyst has been evacuated and is slack and collapsed. Its capsule is being drawn upon.
FIGURE 8. (Case XII). The capsule has been drawn out from behind the
sella turcica. Its base remains adherent to the margins of the sella
turcica. The left posterior clinoid process has been brought into
view and the left oculo-motor nerve is seen entering the dura above
the cavernous sinus.

FIGURE 9. (Case XII). The cyst wall having been freed from the sellar
genus has been stripped from its cavity and removed. The widely
empty sella turcica is seen.
In assessing the suitability for operation in these cases one has to consider that although the tumour is benign and of slow growth it is soon severely disabling from visual damage and must eventually terminate life by a long and distressing illness. In the rare case of a middle-aged patient in whom symptoms were but slowly progressive one might well shrink from the undoubted hazards of operation (see Case XIII). In the vast majority of cases, however, we have to deal with children or young adults, and in them treatment holding any reasonable chance of complete removal of the lesion with satisfactory conditions of after life would appear imperative. In this series of fourteen cases only two were denied the chance of operative exploration. The decision to carry out a serious and hazardous operation on a child in apparently good health will often be a difficult one, but must be faced on these lines.

Two other points in the treatment of these cases require mention. Polyuria is an occasional spontaneous symptom and a frequent post-operative complication. Care must be exercised in the first hours after operation that the bladder does not become over distended from this cause, and timely catheterisation should /
should be resorted to in such a case. Polyuria of this type is easily and completely controlled by the administration of pituitrin. In a few cases this may have to be continued for weeks or months. In none of the cases in this series has the condition persisted longer.

The pituitary gland is frequently destroyed by tumour compression, or if not so destroyed its flattened remains will be removed adherent to the wall of the cyst (see Cases VII and IX). The patients are therefore entirely deficient in pituitary secretion. This implies permanent dwarfism and infantilism in the young, and permanent abolition of sexual functions in adults. The time has not yet come when adequate substitution therapy for pituitary deficiency can be given, but recent advances in knowledge of the pituitary growth and sex hormones and their successful administration to experimental animals suggest that treatment on those lines may soon be available for the patients from whom epidermoid pituitary tumours have been removed.
SUMMARY AND CONCLUSIONS.

Fourteen cases of pituitary epidermoid tumours have been presented from both clinical and pathological aspects.

The Case Records include the clinical findings, operative procedure (where such was undertaken), progress and termination.

The Embryological development of the pituitary body is discussed and the presence of "rests" of squamous epithelium commented upon, with a consideration of their etiological relationship to the pituitary epidermoid tumours.

The Pathological histology of the tumours in the present series is presented. The microscopic appearances of the tumours are detailed. Illustrative photomicrographs are shown. The mode of development of the epithelial "rests" is considered. Their origin from remnants of the hypophyseal duct is not considered to account adequately for their presence in many situations where they occur, and an alternative hypothesis put forward to explain their origin is one which could be extended to include those "rests" having a glandular structure.
The nomenclature to be adopted in describing these tumours is reviewed. None of the terms at present in use can be considered wholly satisfactory. Many do little but describe the position of the tumours, others are misleading in their implications, or inaccurate, and based on a resemblance—often superficial—between some of these tumours and those occurring in the jaw and known as adamantinomas.

The term "pituitary epidermoid tumour" is suggested as best describing the histological findings in the present series, and also indicating the site of occurrence.

The Pathological Anatomy, including the gross appearances, is described, and the relations of the tumours to surrounding structures discussed in relation to certain points in symptomatology and operative procedure.

The Clinical Symptoms which occurred in the series are described and correlated with the site and type of growth present, and the diagnosis shortly considered.

Treatment is discussed. Operative measures only are of value at present. The generally hopeless attitude towards these
these cases is illustrated from the literature and the most melancholy results generally obtained commented upon. The operative procedure adopted in the removal of these tumours is described and illustrated. The question of the operability of certain cases, and the advisability of undertaking a definitely hazardous operation is considered.

The results in the present series of operated cases are given. Briefly they are: of twelve operated cases, two post-operative deaths; two deaths under one year following incomplete removals; eight complete removals with permanent cure.
1. "The Development of the Hypophysis Cerebri in Man, with special reference to the Pars Tuberalis."

2. "Note concerning Keratin and Keratoxyaline in Tumours of the Hypophyseal Duct."


4. "Squamous Epithelial Rests in the Hypophysis Cerebri."

5. "The Pituitary Adamantinomata."


8. "The Intracranial Tumours of Pre-adolescence."


9. "The Chiasmal Syndrome of Primary Optic Atrophy and Bitemporal Field Defects in Adults with a normal Sella Turcica."


10. "Neurohypophyseal Mechanisms from a Clinical Standpoint."


11. "Distortions of the Visual Field in Cases of Brain Tumour and Chiasmal Lesions."


12. "Hypophyseal Duct Tumours."


14. "Epithelial Cysts of the Pituitary."

15. "Meningeal Relations of Hypophysis Cerebri."


17. "Histological Appearances of the Mammalian Pituitary."

18. "Craniopharyngeal Duct Tumours."


22. "The Rontgenological Diagnosis of Craniopharyngeal Pouch Tumours."

23. "Epithelioma of Hypophyseal Duct."

24. "Pituitary Adamantinomas."

25. "Embryonic Epithelial Rests in the Pituitary."


27. "The Diencephalic Floor."

9. "The Development of the Hypophysis Cerebri in Man, with a Note on the Structure in the Human Adult."