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THE UNIVERSITY OF MINNESOTA
GRADUATE SCHOOL

Report
of
Committee on Examination

This is to certify that we the
undersigned, as a committee of the Graduate
School, have given Walter Ivan Lillie
final oral examination for the degree of
Master of Science in Ophthalmology.
We recommend that the degree of
Master of Science in Ophthalmology
be conferred upon the candidate.

W. S. Lundell
Chairman

H. R. Lyman

J. E. McKinley

A. T. Rasmussen

Date Dec 2-1922

Graduate School, University of Minnesota.

Date: November 11, 1922

This is to certify that Walter Ivan Lillie, a candidate for the degree of Master of Science in Ophthalmology, has passed the final written examination for the major in the Department of Ophthalmology.

W. L. Bundick

For the Major Department.

Graduate School, University of Minnesota.

Date: November 11, 1922.

This is to certify that Walter Ivan Lillie, a candidate for the degree of Master of Science in Ophthalmology, has completed the requirements for the minor in the Department of Neurology.

M. S. Sheldra

For the Minor Department.

REPORT
of
Committee on Thesis

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Walter Ivan Lillie for the degree of Master of Science in Ophthalmology. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Ophthalmology.

W. L. Purdick
Henry W. Holtzman
A. P. Lyons
A. S. Kasmussen

THESIS

OCULAR PHENOMENA PRODUCED BY INTRACRANIAL LESIONS
INVOLVING THE OPTIC TRACTS NEAR THE CHIASM.

Walter Ivan Lillie, M.D.

Submitted to the faculty of the Graduate School of the
University of Minnesota in partial fulfillment of the
requirements for the degree of Master of Science in
Ophthalmology.

October, 1922.

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The study of the following cases of intracranial lesions affecting the chiasm has been carried on to ascertain whether some ophthalmologic method of examination could be found to enable the ophthalmologist to determine more definitely the origin or position of the lesion affecting the chiasm.

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Anatomy of the Chiasm (Traquair). "In many, even up-to-date, text-books, whether of anatomy or of ophthalmology, the chiasm is said to lie upon the optic groove of the sphenoid, all further details being permitted to remain in obscurity. This description is not based on actual observation and is completely imaginary. Only the anterior half of the chiasma could lie on the narrow optic groove; the posterior part would lie over the olivary eminence and the anterior edge of the sella turcica. The angle between the two optic nerves would require to be practically equal to two right angles. The infundibulum would pass vertically downwards or even downwards and backwards to the pituitary body, leaving a wide angle between its anterior surface and the inferior surface of the chiasma. Such conditions very seldom occur.

"The anatomical relations of these parts have been studied by Lawrence, Fawcett, Zander, Hirsch, Wallis, and Cope, and most of the essential points may be regarded as established. The optic groove was found by Zander in only 34 per cent of skulls. Behind this lies the olivary eminence, which varies greatly in size and is very often poorly developed. The sphenoidal cells, when well developed, extend beneath the optic groove, olivary eminence, and sella turcica. The dorsum sellae, crowned by the posterior margin of the latter is more variable and corresponds to the posterior margin of the olivary eminence. The diaphragma sellae is a fold of dura mater which roofs in the sella. It is attached in front to the posterior margin of the olivary eminence, a band on each side passing to the lower edge of the optic foramen, and behind to, or immediately below, the crest of the dorsum sellae.

"In or often slightly behind, the centre of the diaphragma is an opening through the posterior part of which the infundibulum passes. This opening, or

foramen diaphragmatis, varies greatly in size and is nearly always much too large for the infundibulum. It is filled in by a thin transparent membrane, through which the hypophysis is visible, and which may form almost the whole roof of the sella, the diaphragma itself being reduced to a mere rim. In such cases there would be practically no obstruction to the easy upward growth of an hypophyseal tumor. Thus the area under consideration extends from the limbus sphenoidalis in front to the dorsum sellae behind and consists anteriorly of a thin bony wall of variable extent covering the sphenoidal cells and posteriorly of a membranous layer of varying thickness covering the pituitary body. Above these structures lie the optic nerves and chiasma. While the plane of the area described is approximately horizontal, or sloping a little downwards posteriorly, that of the optic nerves and chiasma inclines slightly upwards behind, so that the back of the chiasma lies at a somewhat higher level than the optic foramina, and the space between the chiasma and the subjacent structure increases from before backwards.

"The intracranial part of the optic nerve varies greatly in length from 1 mm. to as much as 21 mm., averaging 13 mm. (Zander). The position and relation of the chiasma obviously depend to an important degree upon this factor, as the shorter the nerves are the more relatively anterior will be the chiasma and vice versa. The angle between the optic nerves is usually more or less acute, quite unlike the very obtuse angle becomes wide and the chiasma therefore occupies a forward position. In such cases, which are not common, a well developed olivary eminence is beneath and possibly in contact with the anterior border of the chiasma. In eleven subjects Wallis observed one case in which more than one-half of the chiasma lay upon the optic sulcus and the olivary eminence. Judging by the findings of others, the proportion of such cases must be much less than one to eleven.

"If the chiasma with the apex of the third ventricle be left in situ, after removal of the rest of the brain and viewed from above, a wedge-shaped portion of the diaphragma sellae, extending backwards to the extent of a third or a

half, or even more of its anterioposterior diameter, will usually be seen in the angle between the optic nerves and frequently also a portion of the foramen diaphragmatis. Thus the chiasma lies well behind and above the usually described position. Its posterior edge projects behind the level of the dorsum sellae to an average of 1.58 mm. (Zander) and is very rarely found in front of this point. A large subarachnoid space lies beneath the chiasma, and the vertical distance between its lower surface and the diaphragma sellae is as much as 5 mm. to 10 mm., according to different observers.

"The writers mentioned pay scant attention to the position of the infundibulum. The structure, as is well known, resembles a much elongated funnel, being thin at its termination and considerably thicker where it leaves the third ventricle. At this point it lies behind the level of the dorsum sellae, over which it passes in a forward and downward direction. Immediately beyond its commencement it is in contact with the centre of the lower and posterior surface of the chiasma. As it arches over the dorsum sellae, its direction is almost parallel to the plane of the chiasma. In front of the dorsum sellae it is directed more downwards, leaving the chiasma at a very acute angle, and passes to the posterior edge of the foramen diaphragmatis keeping close to the dura covering the dorsum sellae.

"It is important to remember that it is the infundibulum and not the hypophysis which is in immediate contact with the chiasma. The pia mater stretches across between the optic nerves like an apron and is closely adherent to their lower surfaces. At the sides it is attached to the carotid arteries and behind to the anterior border of the chiasma and to the infundibulum which it closely surrounds. Delicate connections pass between the pia and the dura over the roof of the cavernous sinus and over the dorsum sellae. In front of the infundibulum and anterior border of the chiasma, over the diaphragma sellae and the sphenoid, there is a free space, apparently without connecting filaments.

"The relation of the chiasma to the circle of Willis is of some importance in that the anterior communicating artery lies across the two optic nerves. When

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the chiasma is forced upwards by a tumor the optic nerves are compressed between the vessels, usually the beginning of the anterior cerebrals, and the tumor. This point is referred to by Uhthoff and others, especially by Hirsch. Bartles states that if the constriction is slight and slowly developed, direct damage to the nerve need not result.

"Another pathological anatomical feature is the indentation of the optic nerve at the entrance to the optic foramen when the chiasma is pressed upwards. This condition is referred to by Walker and Cushing and by Uhthoff who, however, failed to find any true constriction of the nerve at this point."

The cases reported in this study have been divided on the basis of the origin of the lesion into six groups in order to show the striking similarity in the ocular phenomena, together with the changes in the sella turcica as shown by the roentgenogram. The six groups are:

- Group 1. Pituitary tumors without glandular disturbances.
- Group 2. Pituitary tumors with acromegaly.
- Group 3. Pituitary tumors with diabetes insipidus.
- Group 4. Intracranial tumors, not of pituitary origin, affecting the chiasm.
- Group 5. Naso-Pharyngeal tumors affecting the chiasm.
- Group 6. Infectious basal meningitis affecting the chiasm.

Pituitary Tumors.

So much has been written by individuals or in collective reports concerning the ocular phenomena resulting from tumors of the pituitary body that it is useless to try to give a detailed report of this literature. In over four hundred references from the literature I have found that hardly 5 per cent are certified cases but generally a suspected tumor is reported. The outstanding works on this subject can be obtained in two well known volumes: Cushing, "The Pituitary Body and its disorders," published in 1912, and Wilbrand und Saenger,

"Die neurologie des Auges", volume vi, published in 1915. The first book gives 256 references and the latter gives 742 references from the literature. These two volumes will suffice to acquaint any one with the amount of careful study already given to this subject. Since 1915 a few authors stand out far supreme to the mass of contributors on the subject and one only has to mention Josefson, Rönne, Bogatsch, Hirsch, Cushing, Traquair, de Schweinitz, Walker, and Peter, to see the amount of careful study that has been done concerning the perimetric defects produced by chiasmal lesions. Of the foreign authors Josefson, Rönne, Hirsch, and Traquair, have contributed much to our knowledge concerning the field changes in chiasmal lesions. One only has to consider the great contribution concerning perimetry by Rönne in the early field changes in glaucoma to realize how careful a worker he has been. Traquair also has contributed considerable work on the scotomatous type of field changes as has de Schweinitz in this country. Walker, under the careful guidance of Harvey Cushing, has contributed largely to studies of perimetry in this country. Although we view some phases of his technique with reservation one cannot but admit that he has placed careful perimetric observations in the foreground. The greatest compliment one can extend to Walker in regard to perimetric work has been expressed by Cushing. "The difference is as great as that before a child's sketch and an architect's drawing to scale."

In the series of forty-six cases of pituitary tumor reported in this study twenty-seven did not show any glandular disturbances, seventeen cases were definitely acromegalic, and diabetes insipidus was found in only two cases.

Report of cases

Group 1.

Group 2.

Group 3.

Visual fields of Groups 1 and 2.

Visual fields of Group 3.

Group 1

Chart I

Pituitary Tumors Without Glandular Disturbances

Case	Age Sex	Duration of chief complaint - years	Duration of visual symptoms - Years	Roentgenogram of sella turcica	Blood Wasserman	Vision		Pupils	Reflexes	Ocular Movements	Fundi	Perimetric fields	Diagnosis	Surgery	Remarks
						Right	Left								
A15560	F	Amenorrhoea for 12 years Convulsions	4	Enlarged with erosion of posterior clinoids	Negative	Nil	6/10	Right larger than left	Right consensual and accommodation Left direct and accommodation	Normal	Right secondary optic atrophy Left low grade optic neuritis	Right blind Left temporal hemianopsia	Chiasmal lesion	11/1/17 Pituitary tumor	Pathological report-malignant tumor mass extended into the frontal lobe and back along the brain stem.
A91684	F	Failing vision 13 years	2	Enlarged with erosion of posterior clinoids	Negative	6/12	Nil	Left larger than right	Normal	Weakness of left internal rectus	Pallor of both nerve heads	Temporal hemianopsia right eye	Pituitary tumor	Craniotomy 3/22/21 Pituitary tumor	Necropsy 3/24/21 Moderate extradural hemorrhage. Moderate nephritis Arteriosclerosis
A201188	F	Failing vision 50	2	Enlarged with roughening of posterior wall	Negative	6/12	C.f.	Equal	Normal	Normal	Pallor of nerve heads	Bitemporal hemianopsia	Pituitary tumor	8/22/17 Pituitary tumor	Fields improved considerably
A207279	M	Failing vision 43	2	Normal	Negative	C.f.	6/15	Equal	Normal	Normal	Simple optic atrophy both eyes	Bitemporal hemianopsia	Pituitary tumor	10/10/17 Pituitary tumor	
1/12/18						M.O.	1/60	Equal	Normal	Normal	Simple optic atrophy both eyes	Some improvement in left field			

Group 1 continued

A207279 4/30/18					C.f. 1/60	Equal	Right slow Left normal	Normal	Simple optic atrophy not so marked in left	Some improve- ment in left field			
12/31/18					1/60 2/60	Equal	Right slow Left normal	Normal	Simple optic atrophy not so marked in left	Some improve- ment in left field			
6/5/20					C.f. M.O.	Equal	Right slow Left normal	Normal	Simple optic atrophy not so marked in left	Bitemporal hemianopsia			
A234782	F Headache 38 Blind- ness	Flat sella	Nega- tive	5/60	C.f.	Equal	Slow	Normal	Normal	Bitemporal hemianopsia	Pituitary tumor	Pituitary cyst 8/10/18	Patient died in summer of 1919.
A236675 6/27/18	F Head- aches 4 years Failing vision	Enlarged 4 with thin- ning of base and posterior clinoids	Nega- tive	5/30	6/20	Equal	Normal	Normal	Normal	Bitemporal hemianopsia for colors	Pituitary tumor		
11/3/19				5/60	6/20	Equal	Normal	Normal	Pallor of both discs	Partial bi- temporal hemianopsia		12/6/19 Pituitary tumor	Pathological report - glioma
8/24/21				M.O.	6/18	Equal	Normal	Normal	Simple optic atrophy both eyes	Partial bi- temporal hemianopsia			
A248126	M Blind- ness	Enlarged 4 with de- struction of poster- ior cli- noids	Nega- tive	L.P.	M.O.	Equal	Normal	Normal	Slight pal- lor of nerve heads	Unable to obtain	Pituitary tumor	10/20/18	Necropsy 10/30/19 Epithelial growth from anterior lobe of pituitary
A250408 11/13/18	F Failing vision	Large cal- cified pi- neal gland Sella nor- mal	Nega- tive	6/30	6/5	Equal	Normal	Normal	Slight pal- lor nerve heads	Bitemporal hemianopsia	Pansinu- sitis	11/18/18 Exenter- ation of sinuses	Middle meatus and ethmoid labyrinth filled with pus
11/29/18				5/12	6/10	Equal	Normal	Normal	Slight pal- lor nerve heads	Marked im- provement in temporal fields			

Group 1 continued

A250408 2/10/19					6/10	6/10	Equal	Normal	Normal	Slight pal- lor nerve heads	Bitemporal hemianopsia	Pituitary tumor	2/22/19	Pathological report - Carci- noma of pitui- tary	
4/2/19					6/7	6/10	Equal	Normal	Normal	Slight pal- lor nerve heads	Slight con- centric contraction for form and colors				
A253633 43	M	Impaired vision	4	Destruction of sella	Nega- tive	6/30	6/60	Equal	Normal	Normal	Simple optic atrophy both eyes	Bitemporal hemianopsia	Pituitary tumor	1/21/19 Pituitary tumor	Pathological report - Round cell sarcoma
A254897 38	M	Head- aches Failing vision	1	Normal. Cal- cified pine- al gland	Nega- tive	1/60	1/60	Equal	Normal	Normal	Normal	Bitemporal hemianopsia	Pituitary tumor	1/18/19 Pituitary tumor	Pathological report - squa- mous cell growth Died 12/8/19
A257278 55	F	Failing vision	5	Apparent de- struction of posterior clinoids	Nega- tive	6/15	6/60	Equal	Normal	Normal	Slight pal- lor in both discs. More in left	Bitemporal hemianopsia	Pituitary tumor	7/19/19 Pituitary tumor	Pathological report - small round celled sarcoma. Died 7/20/19
A262796 51	M	Failing vision	4	Destruction of sella	Nega- tive	6/60	C.f.	Equal	Slow	Normal	Simple optic atrophy both eyes	?	Pituitary tumor	3/22/19 Pituitary tumor	Pathological report - looks more like a glioma
A265097 3/27/19	M	Loss of vision right eye	28	Enlarged 4	Nega- tive	1/60	5/60	Equal	Normal	Normal	Secondary optic atro- phy both eyes	Bitemporal hemianopsia	Pituitary tumor	4/5/19 Pituitary tumor	Pathological report - car- cinoma
4/29/19					1/60	6/60	Equal	Normal	Normal	Secondary optic atro- phy both eyes	Fields improved				
A268798 42	F	Failing vision left eye	1	Enlarged 3 with erosion of the base	Nega- tive	6/6	C.f.	Equal	Normal	Normal	Marked pal- lor of nerve heads - more in left	Bitemporal hemianopsia	Pituitary tumor	5/17/19 Pituitary tumor	Pathological report - small oval and round cell sarcoma

Group 1 continued

A270734	F	Poor vision	3	Normal	Negative	6/15	Nil	Equal	Normal	Normal	Marked pallor of discs more in left	Temporal hemianopsia right eye	Pituitary tumor	6/21/19 Pituitary tumor	Pathological report - epithelioma. Necropsy 6/25/19. Recent removal of tumor of hypophysis. Some edema.
A271683	F	Blurring of vision	7	Enlarged with destruction of posterior clinoids	Negative	M.O.	6/30	Right larger than left	Normal	Normal	Simple optic atrophy both eyes	Bitemporal hemianopsia	Pituitary tumor	5/27/19 Pituitary tumor	Pathological report - carcinoma
6/19/19	33														
3/7/19						6/30	6/15					Widening of both temporal fields			
A288874	M	Failing vision	34	Enlarged 2 with thinning of posterior clinoids	Negative	6/60	6/30	Irregular	Slow	Normal	Normal	Bitemporal hemianopsia with contraction of nasal colors	Pituitary tumor	9/30/19 Pituitary tumor	Pathological report - malignant cellular tumor
9/11/19															
1/13/20						Nil	6/15	Irregular	Slow	Normal	Pallor of both discs	Improvement in left field			
3/12/20						Nil	6/15	Irregular	Slow	Normal	Pallor of both discs	Improvement in left field			
A293423	F	Head-aches Failing vision	4	Enlarged 3 with erosion of posterior clinoids	Negative	3/60	6/15	Equal	Normal	Normal	Pallor of nerve heads	Bitemporal hemianopsia	Pituitary tumor	10/18/19 Pituitary tumor	Pathological report - sphenoidal tumor, consisting of small undifferentiated cells with an ovoidal nucleus
12/5/19															
						3/60	6/15	Equal	Normal	Normal	Pallor of nerve heads	Considerably improved			
A318569	M	Poor vision right eye	2	Enlarged with destruction of posterior clinoids	Negative	C.f.	6/30	Equal	Normal	Normal	Simple optic atrophy both eyes	Bitemporal hemianopsia	Pituitary tumor	6/19/20 Pituitary tumor	Pathological report - carcinoma
6/5/20	23														

Group 1 continued

A318569 7/22/20					2/30	2/20	Equal	Normal	Normal	Optic atrophy both eyes	Bitemporal hemianopsia	Pituitary tumor		
A318766 6/8/20	F 61	Failing vision	10	Destruction of sella	Negative	C.f.	Nil	Normal	Right normal Left stiff	Normal	Pallor of both discs	Temporal hemianopsia left	Pituitary tumor	8/15/20 Pathological report - carcinoma
7/8/20					C.f.	Nil	Normal	Right normal Left stiff	Normal	Pallor right disc. Simple optic atrophy left disc	Temporal hemianopsia left			
A319688 45	M	Tired feeling 7 years		Enlarged 4	Negative	6/60	6/60	Normal	Normal	Normal	Simple optic atrophy both eyes	Bitemporal hemianopsia with islands of temporal vision	Pituitary tumor	8/5/20 Pathological report - hemorrhagic degenerating adenoma. Necropsy 8/4/20. Generalized flattening of the cerebral convolutions. Bilateral pulmonary edema.
A322203 27	M	Failing vision	$\frac{1}{2}$	Enlarged with erosion of posterior clinoids	Negative	6/6	L.P.	Equal	Right normal Left Argyll Robertson	Slight divergence 10°	Right normal Left simple optic atrophy	Contraction of superior temporal field right eye. Left none obtainable	Pituitary tumor with extension to right capsule	8/3/20 No tissue removed
A340815 11/17/20	F 42	Head-aches Loss of vision	1/3	Normal	Negative	Nil	C.f.	Equal	Right stiff Left direct and accommodation	Normal	Pallor of both discs with blurred margins	Right blind Left upper quadrant hemianopsia	Questionable brain tumor	

Group 1 continued

A340815 1/7/21					Nil	5/60	Equal	Right stiff Left direct and ac- commo- dation	Normal	Optic atro- phy right Left choked disc one diopter					
4/22/21					Nil	5/60	Equal	Right stiff Left direct and ac- commo- dation	Normal	Optic atro- phy right Left choked disc one diopter			4/28/21 Right subtempo- ral decom- pression	Necropsy 5/4/21. hemangioma of the Pituitary. Dilated spaces filled with blood. Marked in- crease of baso- philic cells.	
A354926 38	F	Failing vision Head- aches	1 1/2	Roughening and thicken- ing of cli- noid proces- ses	Nega- tive	6/12	6/60	Equal	Right normal Left slow	Normal	Pallor of both discs more in left	Bitemporal hemianopsia	Pituitary tumor	4/26/21 Pituitary cyst	Pathological report - Adeno- ma. Necropsy 4/27/21. Post- operative hemorrhage
A370484 8/30/21	F	Failing vision	4	Enlarged 4 with erosion of posterior clinoids	Nega- tive	6/60	6/30	Irreg- ular	Normal	Right diver- gent stra- bismus	Pallor of discs with loss of sub- stance on temporal halves	Bitemporal hemianopsia	Pituitary tumor	9/10/21 Pituitary tumor	Pathological report - glioma
1/17/22						L.P.	C.f.	Irreg- ular	Right Argyll Robert- son Left normal	Right diver- gent stra- bismus	Simple optic atrophy both eyes	Bitemporal hemianopsia			
A380367 12/28/21	M	Failing vision	1 1/2	Destruction of sella	Nega- tive Nonne posi- tive Lym- pho- cytes 33	6/30	6/60	Left larger than right	Right slow Left normal	Normal	Right, pallor of nerve head, Left pallor with loss of sub- stance	Partial bitemporal hemianopsia	Pituitary tumor		

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Group 1 continued

A380367					6/12	C.F.	Left larger than right	Right slow Left normal	Normal	Right pallor of disc. Left pallor with loss of sub- stance	Complete bitemporal hemianopsia		3/14/22 Pituitary tumor	Pathological report - adeno- carcinoma. Rx radium	
3/7/22															
3/27/22					6/7	6/60	Left larger than right	Right slow Left normal	Normal	Right pallor of disc. Left pallor with loss of substance				Ex radium	
A390283	F	Head- aches	1/2	Enlarged 3	Nega- tive	2/12	C.f.	Left larger than right	Right normal Left stiff	Paral- ysis of left third	Some blur- ring of nasal margins both discs	Right nor- mal. Left partial loss of lower field	Pituitary tumor	5/6/22 Pituitary tumor	Pathological report - carcinoma

Chart II

Group 2
Pituitary Tumors with Acromegaly.

Case	Sex Age	Duration of chief complaint years	Duration of visual symptoms years	Roentgenogram of sella turcica	Blood Wasserman	Vision		Pupils	Reflexes	Ocular movements	Fundi	Perimetric fields	Diagnosis	Surgery	Remarks
						Right	Left								
A2147 9/24/07	F 40												Acute infection of breasts	10/1/07 Drainage of left breast	
5/8/08													Ovarian tumor	5/10/08 Ovarian tumor removed	
3/27/15		Acromegaly, hemorrhages 5 years	5 1/2	Enlarged 4		20/30	L.P.	Left larger than right	Right normal Left slow	Normal	Right normal; Left simple optic atrophy	Bitemporal hemianopsia			
3/27/17		Acromegaly	5	Enlarged 4	Negative	20/30	L.P.	Left larger than right	Right normal Left slow	Normal	Right normal; Left simple optic atrophy	Bitemporal hemianopsia	Acromegaly		
A98762	M 31	Acromegaly 3 years	1	Enlarged 4 with erosion of posterior clinoids		Nil	20/40	Normal	Right slow Left normal	Normal	Right simple optic atrophy; Left normal	Right blind; Left temporal hemianopsia			
A152061	F 39	Failing vision	3	Enlarged 4 with erosion of posterior clinoids	Negative	6/6	6/6	Equal	Normal	Normal	Normal	Normal	Toxic goiter Pituitary tumor	2/22/16 Thyroid-ectomy	Necropsy 4/18/16. Pituitary tumor. Multiple hemorrhagic fibrous degeneration

Group 2

A154591	M	Acromeg- aly 2 years	45	1	Enlarged 4	Nega- tive	20/70	Nil	Normal	Right Normal Left stiff	Simple optic atrophy both eyes	Right tem- poral con- tracted Left blind			
A173672 9/20/16	F	Acromeg- aly 6 years	51		Enlarged 4 with erosion of posterior clinoids	Nega- tive	6/60	6/15	Normal	Normal	Poor conver- gence	High myopia both eyes	Partial bitemporal hemianopsia		10/6/16 Tonsil- lectomy
10/13/21		Acromeg- aly		3	Enlarged 4 with erosion of posterior clinoids		6/60	6/15	Normal	Normal	Poor conver- gence	High myopia both eyes	Left homon- ymous hem- ianopsia		
A178603	M	Acromeg- aly, hem- orrhoids, 4 years	26	3	Enlarged 4	Nega- tive	20/50	20/50	Normal	Normal	Normal	Pallor of both discs	Bitemporal hemianopsia	Secondary anemia	
A245366	M	Acromeg- aly 1 year	36		Enlarged 4 complete destruction	Nega- tive	L.P.	M.O.	Normal	Right Argyll Robert- son, left normal	Hori- zontal nystag- mus, no conver- gence	Simple optic atrophy both eyes	Right blind Left upper nasal quad- rant intact	Tumor or cyst of pituitary	9/21/18 Removal of pitui- tary tumor
A253290	M	Acromeg- aly 6 years	28	6	Enlarged 3 calcified pineal gland	Nega- tive	6/10	C.f.	Normal	Normal	Normal	Simple optic atrophy both eyes	Bitemporal hemianopsia	Pituitary tumor	1/25/19 Pituitary tumor removed
A298149	M	Acromeg- aly 2 years	37	1	Enlarged 4 with erosion of posterior clinoids	Nega- tive	6/10	6/10	Irreg- ular	Argyll Robert- son	Normal	Pallor of both discs	Left homon- ymous hem- ianopsia	Pituitary tumor	
A311383	M	Acromeg- aly 4 years	49	4	Enlarged 4	Nega- tive	6/12	6/30	Normal	Slow	Normal	Right disc pale, Left disc blurred	Bitemporal hemianopsia	Pituitary tumor	Death 12/14/21. At home

Group 2

A328357	F	Acromeg- aly 5 years	Enlarged 4	Nega- tive	Nil	C.f.	Normal	Stiff	Divergent squint 30°	Simple optic atrophy both eyes	Right blind Left tem- poral hem- ianopsia	Adenomas of thy- roid	8/31/20 Removal of pitui- tary tumor	
9/13/20		5			Nil	6/30	Normal	Stiff	Divergent squint 30°	Simple optic atrophy both eyes	Right blind Left slight return of temporal field			
A334946	M	Acromeg- aly 28	Enlarged 4 with erosion of posterior clinoids	Nega- tive	L.P.	L.P.	Left larger than right	Slow	Divergent strabis- mus, proptosis	Simple optic atrophy both eyes	Unable to obtain field			
A347073	F	Acromeg- aly 7 years	Enlarged 3	Nega- tive	6/6	6/10	Normal	Normal	Normal	Normal	Bitemporal hemianopsia for colors	Pituitary tumor	2/8/21 Pituitary tumor removed	
3/4/21			Enlarged 3		6/6	6/6	Normal	Normal	Normal	Normal	Normal			
A361945	M	Acromeg- aly 17 years	Enlarged 4 with erosion of posterior clinoids	Nega- tive	6/7	6/30	Normal	Normal	Normal	Normal	Partial right ho- monymous hemianopsia	Pituitary tumor		
A363469	M	Acromeg- aly 13 years	Negative	Nega- tive	C.f.	6/7	Normal	Normal	Mild ex- ophthal- mos	Normal	Normal	Adenomas of thy- roid	7/20/21 Partial thyroid- ectomy	Death 7/22/21. Pituitary tumor. Hypertrophy of thyroid with adenomas. Sella enlarged 4.
A374192	M	Pain right side of face, Acro- megaly 4 years	Enlarged 4 with erosion of posterior clinoids	Nega- tive	6/10	6/6	Normal	Normal	Normal	Normal	Temporal contraction	Pituitary tumor	11/5/21 Removal of pitui- tary tumor	Death 11/5/21. Cancer of pitui- tary, extension into right gass- erian ganglion

Group 2

A390564	M	Shortness of breath acromegaly 12 years	2	Enlarged 4 with erosion of posterior clinoid	Nega- tive	6/15	6/20	Normal	Normal	Normal	Hyperten- sion sele- rcsis both eyes	Bitemporal color hem- ianopsia with slight contrac- tion of form fields	Hyperthy- roidism pituitary tumor	5/23/22 Partial thyroid- ectomy	Pathological re- port - Multiple hemorrhagic degen- erating fibrous hyaline colloid and fetal adenomata
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Fig. 1.

Fig. 11.

Fig. 111.

Types of Pituitary Tumors affecting the Chiasm.
 Fig. 1. (Case No. A245365) Malignant Tumor of the Pituitary gland.
 Fig. 11. (Case No. A248126) Epithelial Growth of the Anterior Lobe of the Pituitary.
 Fig. 111. (Case No. 273290) Sarcoma of the Pituitary gland.

Types of field changes produced by Pituitary Tumor.
Fig. VII to Fig. X.

Types of field changes produced by Pituitary Tumor.
Fig. XI to XVI.

Types of field changes produced by Pituitary Tumor.
Fig. XXIII to Fig. XXVIII.

The change in the character of the field as well as the visual acuity may be altered by conditions that materially change the pressure in the region of the chiasm. In case A250408 of the series there was temporary increase of vision after operation for suppurative sinusitis.

Case A250408.--Mrs. P., aged 41, came for examination, Nov. 8, 1918, complaining of progressive failing vision which had begun three weeks previously. The eye history up to that time had been negative. The failure of vision was not accompanied by pain or headache. The general history was negative except that the patient had passed through the menopause at the age of 36. Examination revealed the eyes to be normal in position, the lids, conjunctivae and corneas clear; the pupils, which were equal and round, reacted normally to direct and consensual light stimulation and in accommodation. Ophthalmoscopic examination revealed the media to be clear, the discs slightly oval, long axis vertical, margins well defined, and the nerve heads pale pink without swelling or shrinkage of the nerve substance. There was no change in the retinal circulation or other lesion of the fundus. Vision in the right eye was 6/30; in the left eye, 6/15. The fields showed bi-temporal hemianopsia. The field in the right eye was cut squarely through the macular region, and in the left eye the temporal field encroached within 5 degrees on the horizontal meridian. A roentgenogram of the head revealed a normal sella turcica, but a large calcified pineal body. There were many bad roots in the jaw. The tonsils were moderately enlarged and contained fluid pus; the nasal septum was deviated to the right, causing almost complete obstruction. There were polyps in both middle meatuses, and there was much pus in the left nostril.

Nov. 15, 1918, a submucous resection of the nasal septum was done (H.I. Lillie) and the nasal polyps were removed. The ethmoids were not extirpated. Nov. 18, the patient volunteered the information that she could see much more to the side than previously, and that her vision was much clearer. Examination on that day revealed visual acuity of the right eye to be 6/15, of the left eye 6/12 plus 2. The field of the right eye was increased to between 30 and 50 degrees in

the lower outer quadrant, and the field in the left eye was increased uniformly to 50 degrees. This increase in the fields was merely a relative increase, showing with a 22 mm. test at 290 mm. but not found when the 5 mm. test object was used. Nov. 23, the patient had a pan sinus exenteration (right side). "The middle meatus and ethmoid labyrinth were filled with pus and hyperplastic tissue. The ethmoid labyrinth gave the sensation of brittleness and was entirely exenterated. The sphenoid was entered and found to be affected. The antrum was irrigated and foul pus removed" (H.I. Lillie). Nov. 27, the patient stated that she could see to read. The fields taken on that day, however, showed no improvement; in fact, some of the relative field in both eyes had been lost between the last two operations. No further sinus operations were necessary. The vision had now improved to 6/12 in the right eye and 6/10 in the left. Dec. 18, the relative field with 22 mm. test object at 290 mm. was narrow, and the patient had almost complete bitemporal hemianopsia with 6/12 vision in the right eye and 6/7 vision in the left eye. Feb. 19, 1919, she had complete bitemporal hemianopsia, with the fields divided vertically just to the temporal side of the point of fixation.

A roentgenogram of the head showed the sella to be negative, but disclosed a large calcified pineal body. The nasal accessory sinuses had been exenterated, following which the visual acuity improved and the size of the visual fields increased temporarily. Because of the appearance of the nerve heads (absence of neuritis) and the visual fields, the patient was operated on Feb. 22, 1919, for pituitary tumor (Adson). "On exploring the optic commissure, the tumor was found bulging in front and pressing out laterally on each optic nerve. The upper portion of the tumor was very cystic, so that a depression was made on either side by the optic nerve. The tumor was not adherent either to the optic nerves or commissure. About 2 drams of watery fluid escaped when the capsule of the tumor was opened." Following this operation the fields returned practically to normal both for form and colors.

Types of field changes produced by Pituitary Tumor.
Fig. XVII to Fig. XXII.

Types of field changes produced by Pituitary Tumor.
Fig. XXIX to Fig. XXXII.

Types of field changes produced by Pituitary Tumor.
Fig. XXXIII to Fig. XXXVI.

Types of field changes produced by Pituitary Tumor.
Fig. XXXVII to Fig. XLI.

Types of field changes produced by Pituitary Tumor.
 Fig. XLII to Fig. XLIII as charted with the Lloyd
 Stereo Campimeter.

Types of field changes produced by Pituitary Tumor.
Fig. XLIV to Fig. XLVII.

Types of field changes produced by Pituitary Tumor as
 started with the Liebig Stereo Camplotter.
 Fig. XLVIII to Fig. LI.

Types of field changes produced by Pituitary Tumor.
 Fig. LII to Fig. LIV.

Chart III

Group 3
Pituitary Tumors with Diabetes Insipidus.

Case	Sex Age	Duration of chief complaint - years	Duration of visual symptoms - years	Roentgenogram of sella turcica	Blood Wasserman	Vision		Pupils	Reflexes	Ocular movements	Fundi	Perimetric fields	Diagnosis	Surgery	Remarks
						Right	Left								
A219123	F 9	Loss of vision left eye	1	None	None	6/6	L.P.	Equal	Right: direct light and in accommodation Left: consensual light and in accommodation	Normal	Right: hyperemia of nerve head. Left: choked disc two diopters	Right homonymous hemianopsia	Pituitary tumor	1/24/18 Pituitary tumor	
A381088	M 25	Blurred vision	1 1/2	Normal	Negative	6/60	6/60	Equal	Normal	Normal	Marked pallor of discs without loss of substance	Varied from homonymous to bitemporal hemianopsia for colors	Pituitary tumor, diabetes insipidus	Ventriculogram	Prescribed radium

Field changes in two cases of Pituitary Tumor with Diabetes

Insipidus.

Fig. 1, case (A-219213). Temporal hemianopsia for form in the right eye. Irregularly constricted field for form in the left eye with only a small portion of the upper temporal field intact. No color vision in either eye.

Fig. 11 to VI, various changes in the fields while under treatment.

Intracranial Tumors not of Pituitary Origin

The classification of this type of tumor is most difficult as there are so many different types of lesions and the locations are so varied, yet all of these cases have produced more or less typical chiasmal field changes. Many isolated cases have been reported of cerebral tumors producing these defects. Wilbrand and Saenger³⁸ list the following locations of tumors causing chiasmal field changes: Tumors of the Sella Turcica, Interpedunculated space, Pars Petrosa, Sphenoid Bone, Base, Temporal Lobe, Peduncle, Pons, Pia, and Pineal Body.

⁴Cushing in 1912 reported six heteroplastic or extra-pituitary tumors out of a series of twenty-nine cases. Two were teratomas, two infundibular cysts,^{26 14} and one superimposed endothelioma. Isolated cases of de Schweinitz, Farnal, and Kummell,²¹ also describe different central lesions secondarily affecting the chiasm.³⁷ Weisenberg in 1910 collected twenty-seven cases from the literature and reported three cases of his own of third ventricle tumors and established a symptom-complex for tumors of this origin. Unfortunately no perimetric fields were recorded in any of these cases. Wilbrand und Saenger think that fluctuating visual disturbances are more or less characteristic of tumors in this origin. Most any type of chiasmal field defect could be found from a tumor or hydrocephalus of the third ventricle, and pressure exerted by the distended ventricle has been quoted by Cushing and Walker⁹ in their report of binasal hemianopsia produced by certified²⁴ brain tumors which were chiefly situated in the posterior fossa. Peter does not agree with Cushing and Walker that the binasal defects of visual fields produced by the lesions as described are due to chiasmal pressure, as an altitudinal anopsia should also be present in such condition. He is of the opinion that the pathology is at the optic disc and not at the chiasm and is secondary to the continued²² choking of the disc. In 1921 the author reported six cases of intracranial lesions not of pituitary origin.

The cases reported in this paper have all been certified either by operation or necropsy and have affected the chiasm by direct extension and not by

remote secondary effects such as increased intracranial pressure. They have been of sufficient interest to report in detail in order to show how easily one can be lead into an erroneous diagnosis by the ophthalmologic findings. The similarity of this group and those of pituitary tumor is very striking. Group 4 case report.

Case A148006.--J.R., aged 13 years, was first examined Dec. 15, 1915, chiefly because of severe pains in the head with vomiting and unnatural gait. As a child the patient had always been backward mentally. Since birth the patient's gait has been peculiar. In July, 1915 he began to complain of pain in the back of his head which has become more severe and more frequent. The pain was generally accompanied by sudden projectile vomiting without any relation to his meals. Since July he has had a mild exophthalmos in each eye. During the attacks of pain his head would be drawn backward and he would gradually fall forward or to one side. Patient never had a generalized convulsion.

The general examination was essentially negative throughout. The nose, throat, and nasopharynx were negative; Wassermann reaction on the blood was negative. The roentgenogram of the head showed the sella turcica to be greatly enlarged with erosion of the posterior clinoid processes. The vision in each eye was barely light perception. The pupils were equal and the right did not react to any type of stimulation, the left reaction was typically Argyll Robertson. There was a slight divergence of the left eye. The fundi showed a secondary optic atrophy of both discs, otherwise negative. The perimetric fields could not be obtained because of marked diminution in vision.

The neurological diagnosis was cerebellar tumor. A puncture of the corpus callosum and the right lateral ventricle was done Dec. 21, by Doctor Beckman. The patient died three days later and at necropsy a large tumor of the optic commissure was found. There was also a bilateral internal hydrocephalus and congestion of all the parenchymatous organs.

Case A152904.--Mr. M.R., aged 20 years, was first examined Feb. 24, 1916 because of blindness in the left eye. He had complained of poor vision for two

years with diplopia and frequent headaches. Glasses improved the condition for nine months, when he had a very high fever with vomiting and headache, and within three or four hours total blindness in the left eye. The right eye had been normal until two months before examination, when vision had become "smoky" and he could not see to read or write. The headaches persisted over the eyebrows, but they were not so frequent. He had vomited only once or twice during the last three months. He had lost slightly in weight.

The general examination was negative. The roentgenogram of the sella turcica was negative, and the Wassermann reaction on the blood was negative. Vision in the right eye was 20/70, in the left eye nil. The right fundus was negative, but the left fundus showed a complete simple optic atrophy. Perimetric fields showed a temporal hemianopsia in the right eye. The neurologic examination was negative except for the ophthalmic findings. A diagnosis of questionable pituitary tumor was made.

March 23, 1916 a right subtemporal decompression was performed. (Dr. Beckman). Considerable cerebrospinal fluid escaped, but it was not under much pressure. The patient was dismissed after an uneventful convalescence.

Jan. 21, 1920 the patient returned to the Clinic because vision in the right eye had failed since his previous visit to the Clinic. He had had periods in which the vision was poor, but generally the vision had remained good until the last few months, when it had failed steadily. Examination revealed the vision in the right eye to be 3/60, in the left eye nil. The pupils were equal; the right pupil reacted promptly to direct light and in accommodation. The right nerve head was greenish white throughout without loss of substance; the arteries and veins were normal. In the left eye the media were clear; the nerve head showed a marked pallor without loss of substance. The patient developed a mild attack of influenza and was in bed one week. A slight cough persisted, and he felt weak, although his appetite improved steadily. The general examination after influenza was negative except for a mild bronchitis. The roentgenogram of the head showed the sella

turcica slightly enlarged with thinning of the posterior clinoids, trephine in the right temporal region. The neurologic examination was objectively negative except for eye findings. The metabolic rate was -7 per cent. A diagnosis of pituitary tumor was made. The patient returned home to recuperate from the influenza before operation.

The second operation was performed May 11, 1920. At this time the vision in the right eye was 1/60, in the left eye nil. The fundi were the same as previously reported. Dr. Adson operated, and reported findings as follows: "A mass was found situated between the optic peduncles and extending underneath the brain. This mass was dark red without definite capsule, and did not come down into the sella, but up between the peduncles, spreading them for a distance of 3 cm. Some tissue was removed for diagnosis, but the tumor could not be removed." A diagnosis was made of supratentorial basal tumor. The pathologist reported malignancy. The patient died May 13, 1920; necropsy was refused.

Ophthalmologically this case could not be differentiated from that of pituitary tumor. It is interesting to note that the sella showed no change so far as could be determined by the roentgenogram until nearly five years after the onset of the visual symptoms.

Case A298592.—Miss B. L., aged 33 years, was examined Dec. 2, 1919 because of loss of vision in both eyes. Radium treatment in April and in June for fibroid tumor of the uterus had controlled the hemorrhages she had had every month. July 1 she awakened with blurred vision in both eyes; this gradually grew worse until she was only able to read the headlines in the paper. She was able to continue her work, checking large figures, until October 18. In walking on the street she often bumped into persons coming upon her left side, but she was able to see them in front of her or on her right side. The left eye became worse more suddenly than the right. For the last five weeks she had been unable to detect light. During the last two weeks she had had three attacks of loss of consciousness. She knew of one attack, and this caused her more anxiety than the blindness; she was

not told of the other attacks. The attacks came on in the night, with deep breathing and frothing at the mouth. She was not rigid, but she could not be aroused for one-half hour; the next day she was very tired. For the last five weeks she had been conscious of a peculiar odor, as of coal-gas, for half a second or so, with a peculiar sensation in her nose and on the right side of her throat.

General examination revealed uterine fibroids. A roentgenogram of the sella turcica showed it to be normal. The roentgenogram of the chest revealed slight bronchial thickening. The Wassermann test on the blood was negative; the naso-pharynx was negative. The eyes were normal in size, shape and position. The pupils were dilated equally and reacted sluggishly to light and in accommodation. Vision in both eyes was nil. Examination of the fundus in the right eye revealed a pink nerve head, the margins of which were slightly blurred at the outer and lower border, but no swelling; in the left eye the nerve head was pink and oblong in shape; otherwise the fundi were negative. A letter from Dr. Litchfield, of Minneapolis, stated that Sept. 23 the patient had had a temporal hemianopsia in the left eye and temporal hemianopsia in the right eye, with contraction of the nasal field. The neurologic examination revealed a static tremor of the tongue, hands, arms, and legs. Deep reflexes were increased. The Babinsky reflex was positive on the right side; the Oppenheim, Rossolimo, and Gordon reflexes were positive on the left side. The Barany test suggested pressure above the stem and beneath the cortex (subcortical). The diagnosis was tumor in the region of the pituitary, probably partially above the chiasm.

Dec. 12, 1919 the patient was operated on by Dr. Adson. The notes dictated at the time of the operation are: "A tumor was found between the optic peduncles; the line of cleavage between the brain and tumor could not be dissected. The left peduncle could not be seen. The right peduncle was about four times normal size; its outer surface was purplish and looked as if it might cover a tumor or hematoma. In the attempt to enucleate the tumor by first opening the capsule severe arterial hemorrhage developed which was difficult to control. Only a por-

tion of the tumor was removed". The pathologist's report was glioma.

The patient died the evening of the operation. On necropsy a glioma of the middle brain was found infiltrating the optic tract, with marked increased intracranial pressure and herniation of the right temporoparietal lobe. The sella turcica was unusually deep.

The ophthalmologic examination in this case gave no suggestion as to the location of the tumor. At the time of our examination the patient's vision was nil and no visual fields could be obtained. The bitemporal hemianopsia reported to us and the normal nerve heads found at our examination led us to believe that the patient had a chiasmal lesion. The neurologic examination revealed a definite localization of the tumor.

Case A317083.--D. O., aged 28 years, was examined May 25, 1920 chiefly because of failing vision in the right eye. The patient was well until October 1919; at this time he suffered severe pain in the region of the inner canthus of the right eye during the evening. The next morning patient noticed the right upper lid drooped considerably and since then there has been no improvement and the eyesight has failed considerably.

The general examination was negative. The ear, nose and throat, and naso-pharynx were negative; the blood Wassermann reaction was negative. The roentgenogram of the sella was reported normal. The vision in the right eye showed ability to count fingers and in the left eye 6/200. The pupils were unequal, the right being larger than the left, and the reactions were slow. This was more pronounced in the right eye. There was a marked ptosis of the right upper lid with a divergent squint of about 20 degrees, patient fixing with the left eye. The extra-ocular movements showed a paralysis of the left inferior, left superior oblique, the right external rectus and the levator palpebral. The fundi showed a slight pallor of the disc in the right eye while the left disc was normal in appearance. The perimetric fields showed concentric contraction for form in both eyes with practically complete bitemporal hemianopsia for blue color,

the patient was unable to recognize red or green color. The blind spot in the left eye was considerably enlarged.

A diagnosis of tumor cerebri was made from the neurological findings. The patient grew progressively worse and died July 10, 1920. Necropsy revealed a tumor of the third ventricle invading the base of the brain with acute internal hydrocephalus, beginning terminal bronchial pneumonia, and mitral endocarditis.

Case A342936.---Mrs. O.D.T., aged 40 years, was examined Dec. 6, 1920 because of poor vision in both eyes. She had first noticed loss of vision in January, 1920, when in reading she could see the last half of the word before she saw the first half. Vision gradually diminished until she was unable to read. About four months ago she had noticed that she could see better out of the inner corners than out of the outer corners of the eyes; this was more noticeable in the right eye. For about fifteen or twenty years she had had infrequent headaches which had incapacitated her for a day or two, but she had had none recently. Her general health had been good and she had had numerous general examinations without finding a definite cause for her trouble. All her teeth had been removed. The physician who referred her to the Clinic reported "bitemporal hemianopsia; vision in the right eye, ability to count fingers at 10 inches in the nasal field, vision in the left eye 20/100; fundus negative. The patient has mild glycosuria."

The general examination revealed blood-sugar 0.136 per cent and no diabetes. The Wassermann test on the blood and the spinal fluid were negative; there were nine lymphocytes to the field. Roentgenograms of the skull were negative. The metabolic rate was -3 per cent. Vision in the right eye was recorded, ability to count fingers 2 feet in the nasal field; vision in the left eye 6/20. The pupils were equal and reacted somewhat sluggishly. On the examination of the media in the right eye a few floating vitreous opacities were noted; the nerve head was round, of good color, perhaps slightly pale in the temporal half; in the left eye the media were clear, the nerve head round, rather pale in the temporal half, with perhaps a slight loss of substance. The pallor of the discs was not sufficient to be typical

of pituitary tumor. The visual fields showed bitemporal hemianopsia with preservation of the upper outer quadrant in the right eye, loss of vision for all colors in the right eye, and loss of vision for green in the left eye. The neurologic examination revealed slight weakness of the left fifth nerve, and apparently slight weakness of the left seventh nerve around the mouth; the deep reflexes were slightly increased. A diagnosis of brain tumor near the chiasm was made, not typical of pituitary tumor. The patient was dismissed Dec. 18 without operation.

Apr. 5, 1921 the patient returned to the Clinic. Examination of the eyes showed vision of the right eye 1/30 nasally, vision of the left 6/60. The fields showed a bitemporal hemianopsia with loss of vision for green color in both eyes. The fundi were not changed. Neurologic examination at this time did not show any material change in the findings. The spinal fluid was negative. The Nonne test was positive; there were two small lymphocytes to the field. The Wassermann reaction on the blood of the husband was negative. Exploration of the chiasmal region seemed to be indicated.

April 12 the chiasmal region was explored (Dr. Adson). A tumor was exposed, granular in appearance, situated between the optic peduncles. Apparently it had broken through its capsule and extended in the sella from behind and underneath the base of the brain; it was purplish red and extremely fibrous.

Fifty milligrams of radium was buried in the growth for twenty-four hours. The patient's convalescence was uncomplicated except for restlessness. The pathologists reported endothelioma.

May 5 the eyes were examined. Vision in the right eye was 6/60, in the left eye 5/60. The pupils were equal, the reflexes normal. The fundus of the right eye was normal; in the left eye the nerve head was pale without loss of substance; otherwise it was negative. The fields showed improvement with return of vision for all colors, but a persisting bitemporal hemianopsia. The neurologic examination at this time did not reveal changes.

The marked pallor of the left nerve head with the slight loss of sub-

stance and the first field, which showed the loss of the lower temporal quadrant with preservation of a sector of the upper temporal quadrant, led us to believe that the tumor in this case was not of pituitary origin.

Case A346907.--Mr. S. W., aged 37 years, was examined Jan. 20, 1921 chiefly because of severe headaches in the left frontal region which had persisted for fifteen years; each attack had lasted for from one to two hours; the pain had varied from a dull to a very sharp pressing type; it had been worse in the daytime. For the past six years he had vomited once or twice during a month without nausea. Five years before examination he had had to give up tailoring because of trouble with his vision. He had used glasses for twelve years with success until the last five, since when his vision had failed gradually; glasses had not improved it. In 1918 the eyes had revealed a left homonymous hemianopsia; since then the eyes had gradually failed, with a persistence of headaches with nausea.

The general examination revealed an essential hypertension; the systolic blood-pressure was 220, the diastolic 138. The ear, nose, throat and naso-pharynx were negative; the Wassermann reaction on the blood was negative. Roentgenograms of the head showed the sella turcica to be greatly enlarged, with destruction of the posterior clinoid processes. The metabolic rate was -17 per cent. Vision in the right eye was 6/30 with correction, in the left eye 6/15 with correction. The pupils were equal and reacted normally. The cornea and media were clear. The fundi showed pallor of both discs without excavation; there was no loss of substance, and no evidence of previous swelling of the disc. The macular regions were negative. The perimetric fields showed a left homonymous hemianopsia. Neurologic examination was practically negative except for a pubic distribution of hair, feminine in type and slight loss of strength. Intelligence and co-operation were slightly below normal. A diagnosis of questionable pituitary tumor was made.

A right subtemporal decompression was performed for exploration of the tumor (Dr. Adson). "A purplish gray tumor was found situated underneath the brain stem posterior to the commissure, but the optical peduncle and commissure in front were perfectly free and not stretched. On account of the extent and position of

the tumor further surgery was not advisable."

The patient convalesced uneventfully and the wound healed by primary intention. Postoperative neurologic and eye findings were the same as before operation, except that the fields were slightly more contracted.

Case A347201.--M. D. T., male aged 46 years, was examined Jan. 22, 1921 because of blindness in both eyes. Patient noticed a year ago that there was a gradual failure of vision so that he was unable to read. His eyes were examined for glasses but did not improve his vision. A little later he noticed that while driving his car he was unable to see the road very well and he had a few minor accidents while driving. Gradually the vision decreased so that he practically could not see at all. He had had no general symptoms such as headache, nausea, or vomiting and his appetite had been very good. In October 1920 he consulted a physician who told him that he had a tumor of the pituitary gland and advised operation. This was not done and two weeks later his vision returned again so that he was able to drive his car. Since that time he has had frequent attacks of loss of vision of two or three weeks duration with a fairly prompt return of good vision. For the past three weeks patient has been unable to see anything and has been more or less mentally unclear.

The general examination was essentially negative. The ear, nose, and throat, and naso-pharynx were negative; blood Wassermann reaction was also negative. Blood sugar .11 per cent and the roentgenogram of the sella turcica was reported negative. The vision of each eye was barely light perception, the eyes were normally placed, and the pupils were dilated to about 6 mm.; right slightly larger than the left, they reacted normally to light. The ocular movements were normal and the fundi were negative throughout. The perimetric fields were taken roughly with the ophthalmoscopic light but because of the mentality of the patient findings were unreliable although the pupils responded better and he seemed to perceive light in the upper nasal quadrants of each eye. Ten days later, while in the hospital, the patient cleared mentally and was able to see again. At this time

the eye examination showed that there was a vision of 6/20 in the right eye and ability to count fingers in the left eye. The fundi remained the same and the perimetric fields showed a definite temporal hemianopsia in the right eye with central color vision. In the left eye there was a small field in the upper nasal quadrant with no color perception. The patient did not desire to have an operation and returned home.

He again returned for examination April 5, 1922 and the examinations were the same as those when first seen Jan. 22, 1921. A diagnosis of tumor of the cerebri was made and April 11 the right parietal area was exposed and a resistance was met. The third ventricle was punctured through the corpus callosum at a depth of 4 inches. Fluid was withdrawn and following the operation patient was mentally quite clear. Convalescence course was quite stormy and the patient died April 17, 1922. Necropsy revealed a glioma of the third ventricle.

Case A358995.--Mrs. W. V. D., aged 45 years, was examined May 23, 1921 because of poor vision. About six months before she had begun to notice that her eyesight was poor; she had been unable to see objects until they were almost in front of her, especially on the left side. She had had slight dizziness for the last two weeks, without headaches, but with a slight tendency to nausea. She had felt well generally, and had not lost weight. Two weeks before she had had a spinal puncture with resulting pain across the hips and back. The roentgenographic report sent with the patient was "erosion of the sella".

A general examination of the patient was negative. The Wassermann reaction on the blood was negative. A roentgenogram revealed the sella to be normal in size and contour. The blood and urine were negative. Vision in the right eye was 6/6, in the left eye 6/30; the pupils and reflexes were normal. The fundi showed slight pallor of the nerve head without loss of substance in the right eye, and marked pallor of the nerve head without loss of substance in the left eye. The fields showed bitemporal hemianopsia with loss of vision for green. The neurologic examination was negative except for a slight diminution of the abdominal

reflexes. A probable pituitary tumor was diagnosed.

May 31 an operation was performed (Dr. Adson). "A granular encapsulated tumor was found resting on the optic commissure, pushing out the right optic peduncle and concealing the left optic peduncle. The capsule was opened, but the tumor could not be enucleated as is usually possible in cases of ordinary pituitary tumor. Tissue was removed which proved to be extremely fibrous. The tumor, which was about 5 cm. in diameter, was coming from the arachnoid and pressing the left optic peduncle down and outward and the right optic peduncle outward. By careful dissection the entire tumor was removed and the sella was left undisturbed. The pathologist's diagnosis was psammoma, meningeal tumor.

The patient reacted normally and was conscious and cheerful the night after the operation. At 2 A.M. she became unconscious, the pulse became irregular, and she threw her hands around wildly. She died suddenly the afternoon of the second day. Necropsy was refused.

Case A362271.—Mr. H. C., a farmer aged 29 years, came to the Clinic June 21, 1921 complaining of loss of vision in the left eye and failing vision in the right eye. The past history was negative except for an attack of influenza in 1918 followed by a good recovery. In 1917 the patient had noticed that his vision was poor in the left eye and had consulted an oculist, who gave him glasses without any improvement in the vision. This examination had revealed lost vision in the left eye and poor vision in the right.

The general examination showed periapical infection of seven teeth. June 30 the basal metabolic rate was -27 per cent and July 14, -15 per cent. The blood-sugar was 0.11 per cent. The roentgenogram of the sella turcica showed a moderate enlargement, but it was otherwise negative. The vision of the right eye was 6/30; fingers could be counted with the left eye. There was marked blepharospasm, with photophobia and slight drooping of the lids. The pupils were equal and reacted normally. The media were clear. The fundi showed marked simple atrophy of both nerve heads with loss of nerve substance; the margins were distinct

and the lamina cribrosa was plainly seen. The macular regions were slightly granular. The perimetric fields revealed a right homonymous hemianopsia. We believed that this was a suprasellar growth, as the fundi were not typical of pituitary growths. The neurologic examination was negative except for the eye findings, and a diagnosis of probable pituitary tumor was made.

Aug. 2, 1921 operation was performed (Dr. Adson). "The right lateral ventricle was drained and about 45 c.c. of cerebrospinal fluid escaped. The right frontal lobe was elevated and the sella exposed. The optic chiasm was found to be pushed backward and upward by a tumor which arose from the base and involved the sella. It was definitely encapsulated, 4 by 3 cm. in diameter, and bluish gray. On splitting the capsule between the optic peduncles a very pulpy cellular content and some blood escaped." Fifty milligrams of radium in a rubber tube was inserted for twenty-four hours. The pathologist's report was cellular glioma.

The patient died Aug. 3, and necropsy revealed a glioma of the left temporosphenoidal lobe, coming forward and involving the sella, and hyperplasia of the thymus and lymphoid tissues.

The marked simple optic atrophy in this case, although the other ophthalmologic findings could have been of pituitary origin, led us to believe this to be an extrasellar growth.

Case A365469.--A.D., female, aged 38 years, was examined July 20, 1921 chiefly because of blindness in the right eye and failing vision in the left eye. The patient noticed that the vision had been failing for the past nineteen years. During her first pregnancy she noticed a swelling of both feet and legs and since the birth of the child she had generalized edema and she noticed then that she was unable to see at night but in the day time her vision was practically normal. During the next three pregnancies the trouble recurred. Following the fifth pregnancy she noticed that her vision failed so that she was unable to read and has never improved since. She thinks that the vision is getting worse slowly and now the vision in the right eye is entirely gone.

The general examination was essentially negative. Ear, nose and throat, and naso-pharynx were negative; the Wassermann reaction on the blood was also negative. The roentgenogram of the head showed the sella to be normal; metabolic rate was -16 per cent. The vision in the right eye was nil, left eye 1/60. The pupils were equal and reacted normally. The fundi showed simple optic atrophy, the rest of the fundi being negative. The perimetric fields showed a temporal hemianopsia in the left eye with complete amaurosis in the right eye.

The neurological diagnosis was pituitary tumor, and a right subtemporal decompression was performed for exploration of the tumor (Dr. Adson). An encapsulated tumor, hard and fibrous, which covered the optic chiasm and peduncles was exposed. In view of the extensiveness of the lesion only a small specimen was removed for diagnosis. The pathological report was psammoma. The patient had an uneventful recovery from her operation and the eyes showed some improvement in vision, the patient being able to read 2/60 with the left eye, vision in the right eye was nil. The fields taken remained practically the same as before the operation.

Case A372765.--P. R., male aged 41 years, was examined Sept. 21, 1921 chiefly because of poor vision in both eyes. The changes in vision were first noticed one year ago following an attack of herpes zoster over the right thorax. He consulted various doctors but the vision was not improved and for the past two months the vision has failed rapidly. One month ago his nose was operated upon (elsewhere) hoping to locate a focus of infection. The operative findings were negative and since then the sight has failed more rapidly and for the past month he has been unable to read.

The general examination was essentially negative except for enlarged septic tonsils. The naso-pharynx was negative as was the Wassermann reaction on the blood and spinal fluid. The roentgenogram of the head showed the sella to be normal, and the right antrum cloudy. The vision in the right eye was moving objects at three feet, left eye 1/60. The extra-ocular movements were normal,

pupils were equal and reacted promptly. There was a slight pallor of both discs with some blurring of the nasal margins, otherwise the fundi were normal. The perimetric fields showed concentric contraction for form with a bitemporal absolute scotomata. In the right eye there was a definite temporal hemianopsia for form; in the left eye, the patient was unable to recognize colors and there was a relative central scotomata. The fields varied from time to time and the color vision varied from a temporal hemianopsia in the right eye to a temporal hemianopsia in the left. The perimetric fields were very changeable as the absolute bitemporal scotomatas changed to a left homonymous relative scotomatas in his last perimetric record.

The neurological diagnosis was a chiasmal lesion. It was thought best at this time to have the tonsils removed because of sepsis and this was done Oct. 1, 1921. His convalescence was uneventful and he returned home.

The patient again returned Jan. 5, 1922 and the eye examination was essentially the same except the vision in the left eye had failed so that he was only able to count fingers. The general and neurological examinations were the same as previously reported and a subtemporal exploration was performed Jan. 30, 1922, (Dr. Adson), who reported "there was a dark area just above the chiasm which was either a round tumor or a mass continuous with the brain. I think there is no doubt that there is a brain tumor in the region of the uncinate hippocampal gyri presenting above the chiasm. Advised radium and no further surgery." The patient had an uneventful convalescence and since the operation has had a total of 900 mg. hours of radium in the naso-pharynx on two separate occasions. The vision and fields have varied somewhat on each examination but have remained practically the same as before operation.

Case A382942.---B. L., male aged 65 years, was examined Jan. 31, 1922 chiefly because of increasing blindness in both eyes. For the past five years he has noticed that the vision has gradually been failing and it was unable to be improved with glasses. He has had no other symptoms and other than the failing

vision has been perfectly well.

The general examination was essentially negative. Ear, nose and throat and naso-pharynx were negative; Wassermann reaction on the blood was negative. The roentgenogram of the head showed the sella to be normal. The vision in both eyes showed ability to count fingers nasally at one foot. The pupils were equal and reacted normally, the ocular movements were normal. The fundi showed a marked pallor of both nerve heads, otherwise negative. The perimetric fields showed bitemporal hemianopsia.

The neurological diagnosis was chiasmal lesion. The patient was operated Feb. 14, 1922 (Dr. Adson) and a reddish, granular mass was exposed above the optic chiasm extending down into the sella between the peduncles. It was impossible to see all the tumor. Tissue was removed for pathological examination which was reported endothelioma (psammoma). The patient had an uneventful convalescence and the postoperative eye examination was the same as before operation except that there was a small island of vision temporally in the left eye and the patient was unable to recognize red and green color in either eye.

Group 4

Chart IV

Intracranial Tumors, not of Pituitary Origin, affecting the Chiasm. (Summary)

Case	Sex	Age	Duration of chief complaint - years	Duration of visual symptoms - years	Roentgenogram of sella turcica	Blood Wasserman	Vision		Pupils	Reflexes	Ocular movements	Fundi	Perimetric fields	Diagnosis	Surgery	Remarks
							Right	Left								
A148006	M	13	Pain in head 1st year	1	Enlarged 4 with erosion of posterior wall	Negative	L.P.?	L.P.?	Equal	Right: stiff, Left: Argyll Robertson	Slight divergence	Secondary optic atrophy both eyes	Unable to obtain	Cerebellar tumor	12/21/15 Puncture Corpus Collosum	Necropsy 12/24/15. Tumor of optic commissure. Bilateral internal hydrocephalus
A152904	M	20	Blindness left eye 2 years	Left eye 6 Yrs.	Normal	Negative	20/70	Nil	Equal	Right: normal, Left: Argyll Robertson	Normal	Right: normal, Left: simple optic atrophy	Temporal hemianopsia right eye. Left eye blind	Questionable pituitary tumor	3/23/16 Right subtemporal decompression (Beckman)	Uneventful convalescence
1/21/20			Vision in right eye failing	4	Enlarged 1 with thinning of posterior clinoid		3/60	Nil	Equal	Right: normal Left: Argyll Robertson	Normal	Right: pallor of nerve head, Left: simple optic atrophy	Temporal hemianopsia right, Left blind	Pituitary tumor		Patient developed influenza and returned home to recuperate

Group 4 continued

A152904 5/10/20						1/60	Nil	Equal	Right: normal Left: Argyll Robertson	Normal	Right: pallor of nerve head Left: simple optic atrophy	Temporal hemianopsia right. Left: blind	Pituitary tumor	5/11/20 Pituitary tumor	Supratentorial basal tumor, malignant, died 5/13/20. No necropsy
A298594	F 33	Blindness 2 years	2	Normal	Negative	Nil	Nil	Equal	Slow	Normal	Slight blurring of discs	Reported bitemporal hemianopsia	Uncinate lesion	12/12/19 Chiasm	Necropsy 12/13/19. Glioma of the mid brain involving the chiasm
A317080	M 28	Failing vision right eye	$\frac{5}{4}$	Normal	Negative	C.f.	6/200	Right: larger than left	Slow	Paralysis of left inferior rectus, left superior oblique. Right external rectus, right levator palpebral	Right: slight pallor of disc, Left: normal	Slight concentric contraction for form with bitemporal color hemianopsia	Tumor cerebri	None	Necropsy 7/10/20. Tumor of third ventricle. Mixed cellular type.
A342936 12/6/20	F 40	Failing vision both eyes	1	Normal	Negative	C.f.	6/20	Equal	Slow	Normal	Right: normal, Left: slight pallor with loss of substance	Bitemporal hemianopsia with preservation of upper quadrant	Brain tumor near chiasm		
4/5/21						1/30	6/60	Equal	Slow	Normal	Right: normal, Left: slight pallor with loss of substance	Bitemporal hemianopsia with loss of green color	Brain tumor near chiasm	4/12/21	Basal celled endothelioma

Group 4 continued

A342936 5/5/21					6/60	5/60	Equal	Slow	Normal	Right: normal, Left: slight pallor with loss of substance	Bitemporal hemianopsia					
A346907 1/21/21	M 37	Head- aches 15 years	15	Enlarged with de- struc- tion of poster- ior cli- noid	4	Nega- tive	6/30	6/15	Equal	Normal	Normal	Pallor of both nerve heads	Left homon- ymous hem- ianopsia	Question- able pituitary tumor	1/28/21 Pituitary tumor	Basal tumor, un- able to remove specimen for examination
2/5/21					6/15	6/15	Equal	Normal	Normal	Pallor of both nerve heads	Left homon- ymous hem- ianopsia, more con- tracted					
A347201 1/22/21 2/1/21	M 46	Blind- ness	1	Normal	Nega- tive	L.P.	L.P.	Equal	Normal	Normal	Normal	Normal	Unable to obtain	Tumor cerebri		
4/5/22						6/20	C.f.	Equal	Normal	Normal	Normal	Normal	Bitemporal hemianopsia, only cen- tral color vision			
						C.f.	Nil	Equal	Slow	Normal	Normal	Normal	Unable to obtain	Tumor cerebri	4/11/22 Right parietal area	Necropsy 4/17/22. Tumor of the third ventricle, glioma
A358995 45	F	Failing vision	2	Normal	Nega- tive	6/6	6/30	Equal	Normal	Normal	Pallor of discs, more in left	Bitemporal hemianopsia	Pituitary tumor	5/31/22 Pituitary tumor	Pathological report - psammoma, meningeal tumor	
A362271 29	M	Failing vision both eyes	4	Moderate enlarge- ment	Nega- tive	6/30	C.f.	Equal	Normal	Normal	Simple optic atrophy both eyes	Right homon- ymous hem- ianopsia	Pituitary tumor	8/2/22 Pituitary tumor	Necropsy 8/3/22. Glioma of left temporosphenoidal lobe coming for- ward and involv- ing the sella	

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Group 4 continued

A365469 7/28/21	F 38	Blind- ness right eye	19	Normal	Nega- tive	Nil	6/60	Equal	Normal	Normal	Simple optic atrophy both eyes	Temporal hem- ianopsia right eye, Left blind	Pituitary tumor	8/6/21 Subtempo- ral de- compres- sion	Pneumoma - tumor encapsulated and covered optic chiasm and peduncle
8/25/21						Nil	2/60	Equal	Normal	Normal	Simple optic atrophy both eyes	Temporal hem- ianopsia right eye, Left blind			
A372765 9/21/21	M 41	Failing vision both eyes	1	Normal	Nega- tive	M.O.	1/60	Equal	Normal	Normal	Slight pal- lor of discs with nasal mar- gins blurred	Concentric contraction with temporal scotomata right eye. Left temporal scotomata with central relative scotomata	Chiasmal lesion	10/1/21 Tonsil- lectomy	
1/5/22						C.f.	C.f.	Equal	Normal	Normal	Slight pal- lor of discs with nasal margins blurred	Concentric contraction with temporal hemianopsia, right eye. Left temporal hemianopsia with central relative scotomata	Chiasmal lesion	1/30/21 Subtempo- ral ex- ploration	Dark area above the peduncle in region of the uncinate and hippocampal gyrus pressing on the chiasm
7/13/22						1/60	6/10	Equal	Normal	Normal	Slight pal- lor of discs with nasal margins blurred	Concentric contraction with temporal hemianopsia, right eye. Left temporal hemianopsia with central relative scotomata			Prescribed radium

Group 4 continued

A382942	M	Failing 65 vision	5	Normal	Nega- tive	C.f.	C.f.	Equal	Normal	Normal	Pallor of both nerve heads	Bitemporal hemianopsia with isles of vision in temporal field left eye	Chiasmal lesion	2/14/22 Pituitary tumor	Mass above chiasm extending down between the peduncles. Pathologi- cal report - endothelioma.
3/13/22						C.f.	C.f.	Equal	Normal	Normal	Pallor of both nerve heads	About the same

Types of field changes produced by tumors not of pituitary origin affecting the chiasm. Fig. VI to Fig IX.

Types of field changes produced by tumors not of pituitary origin affecting the chiasm. Fig. I to Fig. XIV.

Types of perimetric field changes found in two cases of third ventricle tumors.

Fig. 1, case (A-317080). Concentric contraction of the peripheral field with a bitemporal absolute scotomata. Practically complete bitemporal hemianopsia for blue color. No red or green color vision in either eye.

Fig. 11, case (A-347201). Temporal hemianopsia for form and color in the right eye. Upper nasal quadrant practically preserved for form in left eye. No color vision in left eye.

Fig. 1.

Fig. 11.

Types of intracranial lesions not of pituitary origin involving the chiasm. Fig. 1. Nasopharyngeal sarcoma with intracranial extension. Fig. 11. Mixed cellular tumor of the third ventricle.

Naso-Pharyngeal Tumors

That the anterior lobe of the pituitary gland takes its origin from the embryonic buccal mucosa as an upgrowth from the primitive mouth called Rathke's pouch is an established fact. It pushes upward through the hypophysis-pharyngeal duct where it meets a protrusion, the infundibulum, from the fore brain, and the main mass of the pituitary gland is made up from the epithelial structure. Erdheim¹³ in 1904 found a small epithelial body situated in the pharyngeal mucosa, called the Rachendachhypophyse, which was situated just behind the alae of the vomer. He prophesied at that time that a neoplasm may be expected to take its origin from such an anlage. Haberfeld¹⁶ in 1909 confirmed Erdheim's work when he found a small glandular strand varying from 1 to 7 mm. in length, situated in the pharyngeal mucosa just behind the alae of the vomer in fifty-one human subjects of various ages. Crentzfeldt³ in 1909 showed that 35 per cent of fifty-five cases of pituitary tumor without acromegaly, at necropsy were found to be hypophysis-pharyngeal duct tumors.

Cushing⁴ in 1912 reported two cases of pituitary tumor which showed a naso-pharyngeal mass. One case was autopsied and an inter peduncular tumor originating from a congenital rest was found. Jackson¹⁸ in 1916 made a study of thirty-eight cases from the literature in which twenty-six cases had ocular disturbances such as failing vision, optic neuritis and choked disc. Unfortunately no perimetric field examinations were recorded.

Stahli²⁸ in 1920 reported two cases of naso-pharyngeal tumors. The fields were reported normal in one and a concentric contraction to an outstretched hand was found in one eye in the other case. Duffy¹² in 1920 reported three cases of hypophyseal duct tumors, especially from the gross and cellular pathological standpoint.

New²³ and also Woltman³⁹ have reported seventy-nine cases of naso-pharyngeal tumors, thirty-one of which had ocular symptoms. The perimetric field, however, was recorded in only one case (A206023) of this series. The four cases here reported show perimetric field changes. Group 5.

Chart V

Group 5
Naso-Pharyngeal Tumors affecting the Chiasm

Case	Sex Age	Duration of chief complaint - years	Duration of visual symptoms - years	Roentgenogram of sella turcica	Blood Wasserman	Vision		Pupils	Reflexes	Ocular movements	Fundi	Perimetric fields	Diagnosis	Surgery	Remarks
						Right	Left								
A216363	M 33	Blind in right eye	3	Complete erosion with destruction of sphenoid body and cells	Negative	Nil	6/7	Right larger than left	Right stiff, Left direct light and in accommodation	Normal	Right simple optic atrophy, Left hyperemia of disc	Right nil, left temporal hemianopsia	Pituitary tumor	1/9/18 Pituitary tumor	Necropsy 1/11/18. Large naso-pharyngeal sarcoma eroding base of skull and destroying sella turcica
A387424	M 52	Pain in right ear	3	Not taken	Negative	6/7	6/6	Equal	Normal	Paralysis of left external rectus	Normal	Slight temporal contraction for form, Left homonymous notching of colors	Naso-pharyngeal tumor	None	Prescribed radium
A389759	M 33	Swelling of neck + blindness right eye	1	Not taken	Negative	L.P.	6/7	Equal	Right Argyll Robertson. Left normal	Proptosis right eye	Right early choked disc, Left normal	Right concentric contraction with absolute central scotomata. Left normal	Naso-pharyngeal tumor	None	Prescribed radium. Pathological report - Lympho-sarcoma

Group 5 continued

A395809	M	Glands 15 of neck	$\frac{1}{8}$	Not taken	Nega- tive	C.f.	6/6	Equal	Right normal Left slow	Weakness of right sixth, slight propto- sis	Right early choked disc, left normal	Right con- centric con- traction with absolute cen- tral scotomata, Left normal	Naso-pharyn- geal tumor	None	Prescribed radium, Pathological report - Lymphosarcoma.
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The first case of this group was extremely interesting in that the naso-pharynx was not examined before operation as it was thought that the condition was an uncomplicated pituitary tumor. Since necropsy of this case every person suspected of having an intracranial lesion has had a routine naso-pharyngeal examination.

Case A216363.--F. A., male, aged 33 years, was examined Dec. 11, 1917 because of blindness in the right eye and headaches. Patient first noticed three years ago that the vision in the right eye was failing and in six months he was entirely blind. During these six months he had had some headache and vertigo and up to one month ago had had no discomfort. Since Nov. 20, 1917 patient noticed severe headache with painful and stiff neck and vomiting. During this time he had one attack of unconsciousness in which he fell to the floor. He consulted a physician in Chicago who did a lumbar puncture and the pain was immediately relieved. A blood and spinal fluid Wassermann was done at that time and reported negative.

The general examination was essentially negative. Ear, nose and throat examination was negative but a naso-pharynx examination was not done. The blood Wassermann examination was negative. The roentgenogram of the head showed complete erosion with destruction of the sphenoid bone and cells. The vision in the right eye was nil, left eye 6/7. The pupils were unequal, the right being larger than the left, reflexes were stiff in the right eye but the left reacted to direct light and in accommodation. The ocular movements were normal. The fundi showed a simple optic atrophy of the right disc and a slight hyperemia of the left disc, otherwise the fundi were normal. The perimetric fields showed a temporal hemianopsia in the left eye and complete amaurosis in the right eye.

The neurological diagnosis was pituitary tumor and the patient was operated Jan. 9, 1918 (Dr. Adson). The chiasmal tumor was snared out and some of the cystic membranes removed by dissection. The right olfactory nerve was sacrificed and there was some trauma to the lower part of the frontal lobe. The tumor mass was situated underneath the right optic nerve and commissure but the greater por-

tion of it presented laterally to the right. The tumor was well encapsulated and could be loosened from the surrounding tissue down to the dura covering the pituitary gland. Patient had a very stormy convalescence and died Jan. 11, 1918. The necropsy showed a large naso-pharyngeal neoplasm eroding the base of the skull at a level of and destroying the sella turcica. The pathological report was naso-pharyngeal sarcoma. Fields.

Types of field changes produced by Naso-pharyngeal tumors.
Fig. 1 to Fig. V.

Types of field changes produced by naso-pharyngeal tumor.
as started with the Lloyd Stereocamploter. Fig. VI to Fig. IX.

-66-

Syphilis affecting the Chiasm.

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Fuchs in 1911 reported six cases of visual field defects attributed to a tabetic affection of the chiasm and found that the upper nasal quadrants remained

4

most frequently. In 1912 Cushing reported one case of syphiloma of the pituitary gland and another case of diabetes insipidus diagnosed cerebral syphilis. de

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Schweinitz in 1921 reported five cases of hypophysis disease that had acquired syphilis. One of these cases at necropsy proved to be a large extra sellar sarcoma. The two cases here reported are definitely syphilitic but the type of lesion causing the chiasmal field changes is not definitely proven, although the most probable diagnosis would be a basal gummatous meningitis. This would certainly agree with the description of Wilbrand und Saenger in their cases collected from the literature and their own personal observations.

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Chart VI

Group 6
(Luetic) Basal Meningitis affecting the Chiasm

Case	Sex Age	Duration of chief complaint - years	Duration of visual symptoms - years	Roentgenogram of sella turcica	Blood Wasserman	Vision		Pupils	Reflexes	Ocular movements	Fundi	Perimetric fields	Diagnosis	Surgery	Remarks
						Right	Left								
A398209	M 36	Lost vision left eye	4	Normal	Blood negative. Fluid positive	6/7	Nil	Left larger than right	Stiff	Normal	Pallor of nerve heads, no loss of substance	Temporal hemianopsia right, left blind	Central nervous system lues		Prescribed anti-luetic treatment.
A400901	M 54	Uncertain gait	2	Not taken	Positive	6/7	6/60	Irregular	Argyll Robertson	Normal	Pallor of discs without loss of substance	Left homonymous hemianopsia with relative central scotomata left eye.	Central nervous system lues		Prescribed anti-luetic treatment.

Types of field changes found in two cases of Central Nervous System Leses involving the Chiasm.

Fig. I, case (A-398209). Temporal hemianopsia for form and color in the left eye with marked contraction of the nasal field. Complete amaurosis right eye.

Fig. II, case (A-400901). Left homonymous hemianopsia for form and color with considerable contraction of the remaining fields.

Fig. III, case (A-400901). Physiological blind spot in the right eye enlarged. Relative central scotoma in the left eye with complete amaurosis of the temporal field.

The ophthalmoscopic changes can be readily divided into four main divisions.

- I. Changes in visual acuity.
- II. Changes of the optic disc.
- III. Changes in the perimetric field.
- IV. Oculo-motor changes.

I. Practically every case, regardless of the exact cause or location of the lesion, came to the Clinic because of failing or loss of vision in one or both eyes. The duration of the visual changes did not vary to any great extent, in the different types of lesion. At least there was not enough difference in the duration of the visual changes to make it pathognomonic of any one group. The loss of vision is usually slow if the history can be obtained from reliable sources, except perhaps in the scotomatous types of field changes, which early encroach upon the macular area. The gradual loss of vision is probably the reason why so many of the patients do not consult a physician until definite hemianopsia has developed, as usually a temporal quadrant still remains intact, or islands of temporal vision are still present. When the temporal fields are lost the changes usually have encroached upon a portion of the macular area so that the visual changes are noticed by the patient. The one point which stands out consistently is that the vision does not improve to any appreciable extent by refraction, even though an error of one or more diopters, either spherical or cylindrical is present. In this series of cases in which there was an opportunity to study the changes of vision before and after operation, the improvement was always in the cases in which there was a normal fundus or pallor of the discs without loss of substance. Neither the visual acuity or the fields in an eye which showed a definite simple optic atrophy improved to any appreciable extent following operation.

II. Changes in the optic disc. The typical ophthalmoscopic appearance
1
of the discs has been described by Benedict and the pallor without loss of sub-

stance is so frequent a finding that the expression should be universally used instead of the so-called primary optic atrophy so frequently recorded. This is in accord with Walker³⁴ who concludes that

(1). "Despite the so-called atrophic pallor of the discs in patients having visual-field defects resulting from lesions in the chiasmal regions, the histological examination of the nerves fails to show the expected degree of fiber degeneration unless the process has been of long duration.

(2). "Our cases serve to illustrate the facts that in the presence of chiasmal pressure of known long duration associated with sharply cut hemianopsias, even when to the ophthalmoscope the nerve shows the pallor of presumed atrophy, there may be no corresponding sharp delimitation of the areas of atrophy in the cross-sections of the nerve."

When one stops to consider the frequency in which the perimetric fields improve or return to normal following the removal of the pressure at the chiasm, it is apparent that the loss of function is purely a "block" and not due to atrophy. Those in which the pressure has been of such long duration as to produce a simple atrophy of the optic nerves, the perimetric fields do not improve following operation.

In many of the cases herein reported it may be seen from their returned visits and examinations following operation that those in which the discs were reported "pallor without loss of substance", usually show improvement in their vision and perimetric fields while those in which the discs were reported "simple optic atrophy" generally show no improvement either in vision or perimetric fields following operation. Again, in some cases, the visual and perimetric field changes are out of proportion in respect to the appearance of the discs, especially in one case with normal discs in which the vision was nil in each eye.

III. Changes in the Perimetric Fields.

A. Technique.

All of the perimetric fields recorded here have been plotted on the

Skeel Perimeter, the radius of which is 280 mm. Artificial illumination has been used constantly, the source of supply originating from 7 - 100 watt nitrogen bulbs placed in silvered glass reflectors. These in turn are placed two feet apart on a large inverted U frame, seven feet in height and four feet side. The table on which the perimeter is placed is one meter forward from the center of the inverted U standard. In this way illumination is constant as is the distance and the examiner so that any changes in the visual results must be on the part of the patient. I think one of the greatest assets to good careful perimetry is to have the patient comfortable, and attention in this direction cannot be overdone. Unlike Walker³⁷, I firmly believe the color fields have a great diagnostic value in perimetry, and I have been able to detect defects with colors when the form fields with a 1 mm. white object has been within normal limits. Of course, one can argue that a smaller form object would show the same defect as the larger color object. This undoubtedly is true, but why use from five to seven different form objects of varying sizes on each meridian of the perimeter, when the same defect can be elicited with a 6 mm. color object? In some of the fields reported in this study the color fields have been normal for blue and red while marked quadrant defect has been found in green. In this way the greatest number of objects a patient has to distinguish in one meridian would be four, and the fatigue element is less marked. My usual procedure is to use a 2 mm. white object for form and a 6 mm. color object, except in cases where the vision is too poor for an object of this size. I then proceed to use the smallest object the patient can distinguish.

The central field defects have been charted on the Lloyd Stereo Campimeter as this instrument gives binocular fixation and also is reliable when the patient has only one good fixing eye. A 1 mm. white object is used routinely with this instrument. All these fields have been with artificial light, the standard lamp being used as manufactured by the makers of the instrument.

B. Field defects.

Walker and Cushing³⁶ in discussing the mechanism of Chiasmal hemianopsia

think that Pressure and Traction are the chief factors, but the scotomata and isles of temporal vision may be the result of hypersensitiveness or possibly toxic edematous action or both.

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Traquair thinks that Pressure and Traction are not enough to explain the field defects, but that Local Intoxication at the Chiasm secondary to the tumor or disease offers a better explanation for the defects. From his observations he gives the following conclusions:

1. The perimetric defects in bitemporal hemianopsia follow a typical or normal course of development. Commencing in the upper-outer quadrant the field is involved in a circular manner, the loss proceeding clockwise in the right field and counter-clockwise in the left, so that the upper nasal quadrant remains longest. This is the typical course and occurs in the majority of cases, but, naturally, not in all.
2. The central defect or scotoma behaves in the same way, developing like a little field within a field.
3. This type of field defect is due to interference with the chiasmal fibres, but is largely independent of the exact nature of the ultimate cause; it occurs in bitemporal hemianopsias from a variety of causes.
4. The immediate cause is very probably a chiasmal neuritis, a lesion comparable to that which, acting in the optic nerve, produces the symptoms of retrobulbar neuritis.
5. The cause of this chiasmal neuritis is not definitely known. In all probability it is set up in some way by pressure in many cases. The access to the chiasmal fibres of irritating toxic substances derived from the causal lesion may be the cause; and the presence of these substances may in some cases indirectly arise from pressure. In some cases the chiasma may directly participate in an inflammatory process. The relation of the infundibulum to the chiasma is very probably of importance.
6. In tumor cases, and probably in some cases without tumor, mechanical

pressure effects also act, mainly in the later stages when the tumor has reached a relatively large size.

7. In the later stages the normal type of progress of the field changes may be "swamped" by pressure effects and greatly altered.

8. These observations provide evidence from the clinical side in support of the looped arrangement of the fibres in the chiasma.

9. They also indicate that the papillo-macular bundle forms a little chiasma within a chiasma and that its fibres are similarly arranged.

The perimetric field defects found in these groups of cases, can be classified as follows:

1. Bitemporal Hemianopsia, partial or complete.
2. Homonymous Hemianopsia, partial or complete.
3. Temporal Hemianopsia in one eye, blind in the other.
4. Quadrant defects, one or both eyes.
5. Scotomatous field defects.
6. Normal Fields.

(1) Thirty-two of the cases of all groups showed a bitemporal hemianopsia, either partial or complete. The hemianopsia varied from color defect in one or both eyes, with an early enlargement of the physiological blind spot, to more definite hemianopic color and form defects. Almost all known types of defects were found, and some cases showed a marked variation in the fields on frequent examinations. In nearly all the cases in which the blind spot was charted, an enlargement was found. Some of the fields were within normal limits, except for slight quadrant defects in the green color fields.

(2) Seven of the cases showed an homonymous type of hemianopsia, either partial or complete, varying from definite homonymous hemianopsia for form and colors, to a homonymous defect for only one color. These defects also show considerable variation on repeated examinations.

(3) Ten of the cases showed temporal hemianopsia in one eye, and complete

amaurosis in the other. Varying degrees of contraction of the form and color fields were found, and in some a loss of one or more color fields.

(4) Four of the cases showed quadrant defects in one or both eyes. These varied from small defects of one or more colors to a definite quadrant defect for form and colors. Usually the enlargement of the physiological blind spot encroached in the field of the color defect.

(5) Twelve of the cases showed definite scotomatous changes. The scotomata are usually continuous with the physiological blind spot, or if the process has been of long duration, the quadrant or temporal loss of vision is continuous with the physiological blind spot. Many varieties of temporal defects for form and color accompanied the scotomatous changes. If the fields are taken frequently, the temporal return of vision usually precedes the shrinking of the scotomata. When the blind spots are carefully charted on the Lloyd's Stereo Campimeter they are found to be enlarged early in the course of the disease, and the temporal scotomata have always been continuous with the blind spots. Also in the fields in which there are temporal isles of vision present, the loss of fields is continuous with the blind spots. This has not been found in some of the earlier records and is probably due to faulty technique. The reverse also seems to be true, in that in the return of visual fields, the blind spots and scotomata persists, while the form fields return more rapidly.

(6) Four of the cases showed normal perimetric fields both for form and colors. The blind spots were also of normal size.

IV. The ocular motor changes.

Ocular motor changes were less frequent, except in the Nase-Pharyngeal Group. Any one or all of the ocular motor nerves are involved, the most common being the Sixth Cranial Nerve. In thirty of the cases pupillary disturbances were noted, varying from a slow reaction to a complete internal ophthalmoplegia.

Plate 23 shows different positions of pituitary tumor affecting the chiasm.

Chart VII summarizes and compares the roentgenologic findings and ocular

phenomena of the six groups.

Conclusions.

1. All of the cases, sixty-four, except four showed some change in visual acuity of one or both eyes.

2. The patients in whom the optic discs were normal in appearance, or showed a pallor of the disc without loss of substance, obtained the greatest gain in visual acuity and perimetric fields following surgery.

3. The scotomatous field changes are practically always, at one time or other, continuous with the physiological blind spot, and the blind spot is almost always incorporated in the temporal field defect either for form or colors.

4. The presence or absence of color field defect is as important as that of form defects.

5. The roentgenogram of the sella turcica is normal in a higher percentage of cases with intracranial lesions not of pituitary origin, than in those of pituitary origin.

6. All persons suspected of having intracranial lesions affecting the chiasm should have a thorough naso-pharyngeal examination.

7. The origin of lesions affecting the chiasm can not be definitely determined from ophthalmologic examination.

Exposure of the pituitary tumors with their relations to the optic nerve and commissure producing the different types of field changes.

- Fig. 1 (A-207279). Total blindness of the right eye with a left temporal hemianopsia.
 Fig. 11 (A-210605). Bitemporal hemianopsia.
 Fig. 111 (A-207693). Total blindness of the left eye with temporal hemianopsia of the right eye.
 Fig. 1V (A-219216). Total blindness left eye with temporal hemianopsia right eye.
 Fig. V (A-43560). Total blindness in right eye with temporal hemianopsia left eye.
 Fig. VI (A-216363). Exposure of intracranial projection of the nasopharyngeal sarcoma producing total blindness in the right eye and temporal hemianopsia in the left eye.

Fig. VII.

(A-250408) Bitemporal hemianopsia.

Fig. VIII.

(A-254897) Bitemporal hemianopsia.

Fig. IX.

(A-253290) Bitemporal hemianopsia.

Fig. X.

(A-265097) Bitemporal hemianopsia.

Chart VII

Summary of Roentgenologic Findings and Ocular Phenomena of the Six Groups

Groups	Number of cases	Roentgenogram of sella turcica			Disturbances of				Appearance of the optic discs						Changes in the visual fields					
		Normal	None recorded	Enlarged	Vision	Pupils	Reflexes	Muscles	Normal	Pallor	Atrophy	Edema	Pallor of one disc Atrophy of other	Atrophy of one disc Other normal	Partial or complete		Temporal hemianopsia one, blind in other	Quadrant defects	Sectomatous	Normal
Group 1 Pituitary tumors without glandular disturbances	27	5	0	22	27	7	11	4	3	13	10	1	2	1	17	0	3	3	7	1
Group 2 Pituitary tumors with acromegaly	17	1	0	16	14	3	8	5	7	2	5	1	0	2	8	2	3	1	1	2
Group 3 Pituitary tumors with diabetes insipidus	2	1	1	0	2	0	1	0	0	1	0	1	0	0	1	1	0	0	0	0
Total Groups 1, 2 and 3	46	7	1	38	43	10	20	9	10	16	15	3	2	3	26	3	6	4	8	3
Group 4 Intracranial lesions not of pituitary origin	12	8	0	4	12	1	5	2	1	4	3	1	1	2	6	2	2	0	1	0
Group 5 Nasopharyngeal tumors	4		3	1	3	1	3	3	1	0	1	2	0	0	0	1	1	0	2	1
Group 6 Lues	2	1	1	0	2	2	2	0	0	2	0	0	0	0	0	1	1	0	1	0
Total	64	16	5	43	60	14	30	14	12	22	19	6	3	5	32	7	10	4	12	4

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