Neurologic Symptoms and Signs in 347 Cases of Verified Brain Tumor

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In making the diagnosis of a brain tumor, the only sure method is by surgical exploration and microscopic analysis. However, in order to make a tentative diagnosis of a space taking intracranial lesion there must be a strong suspicion initiated by the patient's symptoms and confirmed by a careful neurologic examination. In analyzing the records of 347 brain tumors seen over a ten year period at the University Hospital, Ann Arbor, a purely statistical summary has been made of the symptoms and signs which occurred with sufficient frequency to be significant in the diagnosis. The purpose of this paper is to tabulate these findings according to proven anatomic location of the tumor.

The criterion of case selection was that an anatomically localizing diagnosis had been verified either by surgery, autopsy, or occasionally (as in 14 cases of pinealomas and posterior third ventricle tumors) by x-rays with contrast media only. Case selection was limited to those tumors which involved the brain directly, and not by secondary compression through the dura. The latter excluded category include tumors of the calvarium and cerebellopontine angle neoplasms such as acoustic neurinomas. Meningiomas are included in this report since they tend to invade cortical tissue by subdural extension. For the sake of clarity all percentage figures have been compiled to the nearest percentile.

IDENTIFYING DATA

Of 347 brain tumors presented, 93 (27 per cent) were infratentorial, and the remaining 254 (73 per cent) were supratentorial. The latter were divided anatomically into 18 separate categories. By far the majority were located in the frontal lobes (65 cases or 19 per cent), exclusive of parietal or temporal extension. The infratentorial tumors were placed in only two categories. These were rather arbitrarily separated anatomically with one group including those lesions occurring anterior to the fourth ventricle (midbrain, pons and medulla), and the other including fourth ventricle, cerebellar, and posterior fossa tumors.

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TABLE I

IDENTIFYING DATA

Location	*Total No.*	*% of Total*	*Left*	*Right*	*Bilateral*	*Male*	*Female*	*Age*
Frontal	65	19	34	22	0	44	21	5 to 70
Frontoparietal	18	5	7	11		15	3	15 to 67
Frontotemporal	7	2	5	2		6	1	14 to 68
Temporal	29	8	18	11		20	9	9 to 60
Parietal	25	7	10	14	1	19	6	4 to 66
Temporoparietal	17	5	7	10		12	5	12 to 64
Parieto-occipital	11	3	3	8		9	2	6 to 57
Occipital	5	1	1	4		3	2	13 to 43
Diffuse (more than two lobes)	10	3				5	5	17 to 51
Corpus callosum	5	1				3	2	19 to 50
Lateral ventricles	9	3	2	6		3	6	13 to 60
Third ventricle	7	2				4	3	7 to 33
Pineal	16	5				13	3	13 to 59
Pituitary	8	2				3	5	5 to 59
Craniopharyngioma	2	1				1	1	15 to 19
Basal ganglia	5	1				2	3	10 to 21
Meningioma of sphenoidal wing	6	2	4	2		4	2	33 to 60
Optic nerve and chiasm	9	3				6	3	4 to 58
Cerebellum								
Fourth ventricle	78	23				44	34	1 to 53
Posterior fossa								
Midbrain								
Pons	15	4				11	4	9 to 60
Medulla								
TOTALS	347	100	91	90	7	227	120	1 to 70
% OF TOTALS	100	100				65	35	

In 181 cases (52 per cent) the tumor was found to be lateralized to one hemisphere. No attempt was made to lateralize the infratentorial tumors. An even division was found with 91 cases in the left hemisphere and 90 in the right. There were 227 males (65 per cent of the total) and 120 females (35 per cent). The age incidence was found to run from one year in a posterior fossa tumor to 70 years in a frontal lobe tumor. No mean age was established, but in the posterior fossa tumors there was a significantly younger age group than in the supratentorial neoplasms.

SYMPTOMS

Mental changes were found in 24 per cent of all cases. These included loss of memory, personality change, depression, confusion, and extreme lethargy. It was not surprising to find that 80 per cent of the basal ganglia, 60 per cent of the corpus callosum, and 50 per cent of the craniopharyngioma groups revealed this symptom complex. In these cases increased intracranial pressure, diffuse

TABLE 2

SYMPTOMS

Location	*Mental Changes* Total No.	%	*Headache* Total No.	%	*Vomiting* Total No.	%	*Convulsions* Total No.	%	*Weakness* Total No.	%	*Ataxia* Total No.	%	*Dizziness* Total No.	%	*Miscellaneous* Total No.	%
															(Incontinence)	
Frontal	21	32	37	57	18	28	36	53	14	22	10	15	4	6	4	6
Frontoparietal	4	22	13	72	6	33	5	28	7	39	3	17				
Frontotemporal	2	29	2	29	1	14	3	43								
Temporal	11	38	21	72	4	14	14	48							(Hypalgesia)	
Parietal	4	16	16	64	3	12	16	64	7	18	2	8			3	12
Temporoparietal	4	24	11	65	9	53	6	35	4	24						
Parieto-occipital	5	45	9	82	5	45	2	18	5	45						
Occipital			4	80	4	80					1	20				
Diffuse (more than two lobes)	3	30	7	70	5	50	4	40			2	20				
Corpus callosum	3	60	3	60			4	80			1	20				
Lateral ventricles	1	11	9	100	7	78	3	33			1	11				
Third ventricle			7	100	5	71			1	14					("Polys")	
Pineal	4	25	14	88	11	69	1	6					3	19	3	19
Pituitary	2	25	6	75	1	14									(Acromegaly)	
Craniopharyngioma	1	50	1	50							1	50			2	25
Basal ganglia	4	80	3	60	3	60	1	20	2	40						
Meningioma of sphenoidal wing	1	17	6	100	1	17	2	33							(Hypothalamic syndrome)	
Opti nerve and chiasm			7	78											1	11
Cerebellum															(Increasing head size)	
Fourth ventricle	10	13	52	67	55	71	9	13	10	13	48	62	12	15	6	8
Posterior fossa																
Midbrain																
Pons	3	20	8	53	3	20	3	20	3	20	4	27	5	33		
Medulla																
TOTALS	83		236		141		109		53		73		24			
% OF TOTALS		24		68		41		32		15		21		7		

brain involvement, and endocrine changes undoubtedly accounted for a large part of the mental impairment. It seems quite significant that 38 per cent of the temporal lobe tumors and only 32 per cent of the frontal lesions revealed changes in mentation. The neurology textbooks as a rule do not even mention mental alterations as a temporal lobe symptom, except of course for the variations of the aphasias. Some form of abnormal mental symptomatology was absent only in three tumor locations: the occipital lobe, the third ventricle, and the optic nerve and chiasm regions.

Headache was a prominent symptom and present in 236 (68 per cent) of this series of brain tumors. Three locations were found to stimulate headache in 100 per cent of cases: third ventricle, lateral ventricle, and meningioma of the sphenoidal wing. Headaches were found in over 70 per cent of the following regions: pineal, parieto-occipital, optic nerve and chiasm, occipital, pituitary, frontoparietal, and temporal lobes. It is interesting to note that the posterior fossa tumors were accompanied by headache in 67 per cent or slightly less than the average percentage of cases.

Vomiting was found in 41 per cent of the total group. As might be expected the incidence of this symptom in specific locations roughly paralleled that of headache. The exception was in the posterior fossa, where vomiting occurred in 71 per cent or almost twice that of the average incidence.

Convulsions were present in some form in 32 per cent of these brain tumors. Three locations had greater than a 50 per cent incidence, namely: 80 per cent of corpus callosum, 64 per cent of parietal, and 53 per cent of frontal lobe lesions. The temporal lobe was close behind with a 48 per cent incidence. The latter figure would probably have been higher had all the various forms of temporal lobe fits (uncinate, déjà vu, psychomotor, etc.) been recorded on the patients' charts. (Unfortunately in any tabulation such as this one is often dependent on the findings of the original examiner, and many of the recorded examinations were obviously incomplete.)

Weakness of a localizing nature was recorded on 15 per cent of the charts. Surprisingly enough 45 per cent of the parieto-occipital group revealed some degree of paresis. This was the highest percentage in any one group. Only 22 per cent of the frontal lobe lesions caused focal weakness.

An ataxic gait was a symptom in 21 per cent of the total number of tumors. This was mainly accounted for by 62 per cent of the posterior fossa group (48 cases).

Dizziness was complained of in a total of 24 or 7 per cent of patients. This was found recorded in only four categories, namely: brain stem, frontal lobe, pineal, and the largest number (12 cases representing 15 per cent) in tumors of the posterior fossa.

MENTAL SIGNS

Disorientation (and/or confusion) was found in 57 cases, or 16 per cent of the total. The greatest number of these were found in the frontal (13 cases)

TABLE 3

MENTAL SIGNS

Location	*Disorientation* Total	No.	%	*Asphasia* Total	No.	%	*Psychic Changes* Total	No.	%	*Intellectual Slowing* Total	No.	%
Frontal	13		20	5		8	13		20	24		32
Frontoparietal				4		22	1		6	7		39
Frontotemporal	3		43	2		29				4		57
Temporal	7		24	10		35				8		28
Parietal	3		12	6		24				6		24
Temporoparietal	6		35	2		12	3		18	6		35
Parieto-occipital	5		45	1		9				3		27
Occipital	1		20							1		20
Diffuse (more than two lobes)	3		30							3		30
Corpus callosum										2		40
Lateral ventricles				1		11				1		11
Third ventricle	2		28	1		14				3		43
Pineal	2		12							4 (drowsy)		25
Pituitary										3		38
Craniopharyngioma												
Basal ganglia	2		40							4 (drowsy)		80
Meningioma of sphenoidal wing	1		17	2		33	1		17			
Optic nerve & chiasm												
Cerebellum												
Fourth ventricle	6		86							11		14
Posterior fossa										(drowsy)		
Midbrain												
Pons	3		20							6		40
Medulla										(drowsy)		
TOTALS	57			34			18			96		
% OF TOTALS			16			10			5			28

and temporal (seven cases) lobes. Higher percentages (but fewer total numbers) were found in some other more diffusely situated tumors.

Aphasia was a symptom recorded in only 10 per cent of the material. The outstanding group was the temporal lobe, with ten cases (an incidence of 35 per cent).

Psychic changes (depression, euphoria, or increased emotionalism) were found almost solely in the frontal lobe localization. The latter tumors had such changes in 20 per cent or 13 cases. It is interesting to note that the temporal lobe group had a high incidence of mental deterioration but no recorded psychic changes.

Intellectual slowing was used here to denote drowsiness, lethargy, loss of memory, and even occasional cases of semi-stupor. This diminished mentation

was found in 96 cases, or 28 per cent of the total number of tumors. The frontal lobe group had the greatest number (24 cases), but the percentage incidence was quite evenly divided among all anatomic groups.

PAPILLEDEMA

The incidence of papilledema was 59 per cent, being reported for 206 of the 347 cases. Tumors which were infratentorial in location demonstrated papilledema in 70 of the 93 cases, an incidence of 75 per cent. Where the lesions could be classified as supratentorial, papilledema was present in 54 per cent (137 out of 254 cases). The process was observed to be bilateral in 199 of the 206 individuals.

TABLE 4
PAPILLEDEMA

Location	*Total No.*	*% of Total*	*Bilateral*	*Unilateral*
Frontal	30	46	29	1
Frontoparietal	9	50	7	2
Frontotemporal	3	43	3	
Temporal	15	52	15	
Parietal	13	52	13	
Temporoparietal	10	59	10	
Parieto-occipital	9	82	9	
Occipital	4	80	4	
Diffuse (more than two lobes)	7	70	7	
Corpus callosum	2	40	2	
Lateral ventricle	7	78	6	1
Third ventricle	5	71	5	
Pineal	10	63	10	
Pituitary				
Craniopharyngioma	1	10	1	
Basal ganglia	3	60	3	
Meningioma of sphenoidal wing	3	50	3	
Optic nerve and chiasm	5	56	3	2
Cerebellum				
Fourth ventricle	60	77	60	
Posterior fossa				
Midbrain				
Pons	10	67	9	1
Medulla				
TOTALS	206	59	199	7

OPTIC ATROPHY

Optic atrophy was found in 11 per cent of the cases studied. In 23 patients the changes were those of secondary atrophy; in 16 primary optic atrophy was

TABLE 5
OPTIC ATROPHY

Location	Primary Atrophy Bilateral	Primary Atrophy Unilateral	Secondary Atrophy Bilateral	Secondary Atrophy Unilateral	Total	% of Total
Frontal	2		5		7	11
Frontoparietal		2			2	11
Frontotemporal						
Temporal						
Parietal						
Temporoparietal						
Parieto-occipital						
Occipital			1		1	20
Diffuse (more than two lobes)			1		1	10
Corpus callosum						
Lateral ventricles		1	1	1	3	33
Third ventricle			1		1	14
Pineal	1		5		6	38
Pituitary						
Craniopharyngioma	3	1			4	40
Basal ganglia			1		1	20
Meningioma of sphenoidal wing						
Optic nerve and chiasm	2	2			4	44
Cerebellum						
Fourth ventricle	1		7		8	10
Posterior fossa						
Midbrain						
Pons	1				1	7
Medulla						
TOTALS	10	6	22	1	39	11

present. The greater number of cases presented atrophy in both eyes. In general, primary atrophy was associated with lesions affording direct pressure effects upon the optic nerves, while those with atrophy of a secondary type followed papilledema which resulted from obstruction of cerebrospinal fluid circulation early in the disease.

VISUAL FIELDS

A visual field examination was performed in 223 of the 347 cases. Positive findings were obtained in 73 instances, therefore the chance of demonstrating visual field changes in such cases is almost one in three. For the most part results showed either homonymous hemianopsia, bitemporal hemianopsia or peripheral constriction. The homonymous defects were mainly found in hemispheric lesions, the bitemporal changes localized almost completely to the chiasmal region, and the peripheral constrictions were of little value in placing the site of disease. Where recorded it is of interest to note the preponderance of macular sparring with the homonymous defects. The absence of quadrantanopsias in association with temporal lesions is surprising.

TABLE 6

VISUAL FIELD FINDINGS

Location	*Fields Done*	*Homonymous Hemianopsia*	*Macula Split*	*Macula Spared*	*Bitemporal Hemianopsia*	*Quadrant-anopsia*	*Peripheral Constriction*	*Central Scotoma*	*Binasal Hemianopsia*	*Percent of Positive Findings*
Frontal	39	2		1			7	1		
Frontoparietal	14	1		1		1	1			
Frontotemporal	5						1			
Temporal	16	9		5		1	1			
Parietal	22	5					1			
Temporoparietal	9	5		2						
Parieto-occipital	8	4		2		2				
Occipital	5	3		2		1				
Diffuse (more than two lobes)	7	2	1				1	1		
Corpus callosum	5	1								
Lateral ventricles	7	1	1		1	1	4			
Third ventricle	4					1				
Pineal	10	1					2			
Pituitary										
Craniopharyngioma	8				7					
Basal ganglia	2									
Meningioma of sphenoidal wing	5						1			
Optic nerve and chiasm	8				3		1		2 (unilateral)	
Cerebellum										
Fourth ventricle	36	1	1				4			
Posterior fossa										
Midbrain										
Pons	13						2			
Medulla										
TOTALS	223	35	3	13	11	7	26	2	2	33%

CONJUGATE MOVEMENT

Defects in conjugate ocular movement were noted in the records of only 20 of the 347 cases. It is likely that some instances were overlooked in the examinations. Most of the cases were those in which the tumor location was such as to involve the pathways for ocular movement, either in the frontal lobe or the brain stem. Particular emphasis may be placed upon the upward gaze palsies found in the group of pineal tumors.

NYSTAGMUS

That nystagmus is a finding more often associated with cerebellar tumors is evident. It will also be noted that the majority of the cases demonstrating this finding were those in which the coordinative mechanism of the cerebellum,

TABLE 7

CONJUGATE MOVEMENT DEFECTS

Location	*Upward Gaze Palsy*	*Lateral Gaze Palsy*	*Miscellaneous*	*Total Cases*	*% of Total*
Frontal	2	1		3	4
Frontoparietal					
Frontotemporal					
Temporal	1		1 (weakness all directions)	2	7
Parietal					
Temporoparietal					
Parieto-occipital					
Occipital					
Diffuse (more than two lobes)	1			1	10
Corpus callosum					
Lateral ventricles					
Third ventricle					
Pineal	8	4*		8	50
Pituitary		1		1	10
Craniopharyngioma					
Basal ganglia					
Meningioma of sphenoidal wing		1		1	17
Optic nerve and chiasm	1			1	11
Cerebellum					
Fourth ventricle	1			1	1
Posterior fossa					
Midbrain					
Pons	1		1	2	13
Medula			(upward and downward gaze)		
TOTALS	15	7	2	20	6

*In 4 of the 8 cases listed.

TABLE 8

NYSTAGMUS

Location	*Vertical*	*Horizontal*	*Mixed Horizontal and Vertical*	*Total*	*% of Total*
Frontal		3		3	5
Frontoparietal					
Frontotemporal					
Temporal		1		1	3
Parietal					
Temporoparietal					
Parieto-occipital					
Occipital		1		1	20
Diffuse (more than two lobes)			1	1	10
Corpus callosum					
Lateral ventricles		1		1	11
Third ventricle					
Pineal	1	1		2	13
Pituitary					
Craniopharyngioma					
Basal ganglia					
Meningioma of sphenoidal wing					
Optic nerve and chiasm					
Cerebellum					
Fourth ventricle	1	14	8	23	30
Midbrain					
Pons		3		3	20
Medulla					
TOTALS	2	24	9	35	10

the brain stem, or the motor pathways was likely to be disturbed. The incidence of nystagmus was 10 per cent.

EXTRAOCULAR MOVEMENTS

Individual palsies of extraocular muscles were present in 47 cases of the group, an incidence of 14 per cent. Involvement of the abducens nerve occurred in 34 cases. The oculomotor nerve was affected in 11 instances, and the trochlear nerve was implicated in only two patients. The lack of localizing values of these findings is evident. The relatively more frequent lateral rectus palsy reflects the usual thought regarding the anatomic vulnerability of the abducens nerve.

TABLE 9

EXTRAOCULAR MUSCLE PALSIES

Location	*6th Palsy*	*3rd Palsy*	*4th Palsy*	*Total Cases*	*% of Total*
Frontal	2	1 inc.		3	5
Frontoparietal	1			1	6
Frontotemporal					
Temporal	2	1 compl.		3	10
Parietal					
Temporoparietal	2	1 inc.		3	18
Parieto-occipital					
Occipital					
Diffuse (more than two lobes)	2			2	20
Corpus callosum					
Lateral ventricles	1			1	11
Third ventricle					
Pineal	5	1 inc.		6	38
Pituitary					
Craniopharyngioma	1		1	2	20
Basal ganglia	2	1	1	4	80
Meningioma of sphenoidal wing	1			1	27
Optic nerve and chiasm	2			2	22
Cerebellum					
Fourth ventricle	10	6 inc.		16	21
Posterior fossa					
Midbrain					
Pons	3			3	20
Medulla					
TOTALS	34	11	2	47	14

OTHER CRANIAL NERVE SIGNS

The only two cranial nerve signs other than eye findings which appeared with enough regularity to be statistically significant were anosmia and facial weakness. Anosmia was reported in only 3 per cent of the total cases. Five, or 8 per cent, of the frontal lobe tumors and one, or 17 per cent, of the meningiomas of sphenoidal wing exhibited this sign.

Facial pareses were a relatively common finding, occurring in 116 cases, or 34 per cent of the total. This sign was remarkably evenly distributed among all the anatomic variants. The only exceptions were the pituitary and craniopharyngioma groups in which no cases were recorded to have facial weakness.

TABLE 10
OTHER CRANIAL NERVE SIGNS

Location	*Anosmia* Total No.	%	*Facial Weakness* Total No.	%
Frontal	5	8	25	38
Frontoparietal			6	33
Frontotemporal			4	57
Temporal	2	7	13	45
Parietal			7	18
Temporoparietal	1	6	7	41
Parieto-occipital			4	36
Occipital			1	20
Diffuse (more than two lobes)			1	10
Corpus callosum			2	40
Lateral ventricles			4	44
Third ventricle			3	43
Pineal			4	25
Pituitary				
Craniopharyngioma				
Basal ganglia			2	40
Meningioma of sphenoidal wing	1	17	3	50
Optic nerve and chiasm			3	33
Cerebellum				
Fourth ventricle			21	27
Posterior fossa				
Midbrain				
Pons			6	40
Medulla				
TOTALS	9		116	
% OF TOTALS		3		34

MOTOR SIGNS

Hemipareses, from slight weakness to hemiplegia, were found in 95 cases or 27 per cent of the total. Like facial weakness, hemiparesis was found to be remarkably evenly distributed percentage-wise among the different anatomic locations. Again the pituitary and craniopharyngioma groups exhibited no motor signs of any sort. Only six or 8 per cent, of the posterior fossa tumors were recorded to show hemiparesis. Somewhat surprising was the finding that the highest percentage (seven cases or 64 per cent was found in the parieto-occipital region.

Monoplegia of an arm was found in only 20 of the total cases (6 per cent). Paresis of a leg was found in half that number. Both these findings occurred in scattered locations.

TABLE 11
MOTOR SIGNS

	Hemiparesis Total		——Monoparesis—— Arm Total		Leg Total		Ataxia of One or More Extremity Total		Ataxic Gait Total	
Location	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Frontal	22	34	2	3	3	5	10	15	8	12
Frontoparietal	6	33	4	22	1	6	2	11	1	6
Frontotemporal	2	35	2	29	1	14			1	14
Temporal	12	41	2	7	2	7	6	21	1	4
Parietal	12	48	4	16			1	4	2	8
Temporoparietal	7	41	2	12	1	6	3	18	4	24
Parieto-occipital	7	64			1	9	1	9	1	9
Occipital							2	40		
Diffuse (more than two lobes)	3	30					3	30	2	20
Corpus callosum	2	40					1	20		
Lateral ventricles	2	22					3	33	3	33
Third ventricle							2	18	3	43
Pineal	3	19					3	19	4	25
Pituitary										
Craniopharyngioma									1	50
Basal ganglia	1	20					1	20		
Meningioma of sphenoidal wing	2	33	1	17	1	17	1	17		
Optic nerve and chiasm										
Cerebellum										
Fourth ventricle	6	8	3	4			40	51	53	68
Posterior fossa										
Midbrain										
Pons	7	47					5	33	6	40
Medulla										
TOTALS	95		20		10		84		90	
% OF TOTALS		27		6		3		24		26

Ataxia of gait was present in 90 cases (26 per cent of total). By far the major portion of these were found in the posterior fossa tumors (53 cases or 68 per cent of the latter). Lack of coordination, or ataxia, of one or more extremities was found in 84 cases, or 24 per cent of the total. This sign was found in 51 per cent (40 cases) of posterior fossa lesions.

SENSATION

A diminution in some form of cutaneous sensation (36 cases, or 10 per cent of the total) and astereognosis (19 cases, or 5 per cent of the total) were the only sensory findings recorded with sufficiency to be significant in this series.

TABLE 12

SENSATION

Location	*Diminished Cutaneous Sensation* Total No.	%	*Astereognosis* Total No.	%
Frontal	9	14	5	8
Frontoparietal	2	11		
Frontotemporal	1	14	1	14
Temporal	4	14	1	4
Parietal	5	20	5	20
Temporoparietal	4	24	4	24
Parieto-occipital	4	36	1	9
Occipital	1	20		
Diffuse (more than two lobes)	2	20		
Corpus callosum	1	20		
Lateral ventricles			1	11
Third ventricle				
Pineal	1	6	1	6
Pituitary				
Craniopharyngioma				
Basal ganglia				
Meningioma of sphenoidal wing				
Optic nerve and chiasm				
Cerebellum				
Fourth ventricle				
Posterior fossa				
Midbrain				
Pons	2	13		
Medulla				
TOTALS	36		19	
% OF TOTALS		10		5

Those cases in which the parietal lobe was involved by tumor had by far the highest incidence of sensory findings. These signs were present in 25 cases, or 35 per cent of tumors which were located in or invaded the parietal lobes.

REFLEXES

Hyperactive tendon reflexes of one or more extremity were found in a total of 116 cases or 34 per cent. This finding did not appear to be predominantly in either arm or leg in any of the anatomic groups. Surprisingly enough the parieto-occipital group had as large a percentage of hyper-reflexic cases as the frontal lobe tumors, both having 55 per cent incidence. The fronto-parietal group had the largest percentage of any anatomic location, 61 per cent of these being hyper-reflexic.

TABLE 13

REFLEXES

	Hyperactive Tendon Reflexes: Arm Total		Hyperactive Tendon Reflexes: Leg Total		Hyperactive Tendon Reflexes: No. Patients Total		Hypoactive Tendon Reflexes Total		Babinski: Unilateral Total		Babinski: Bilateral Total		Stiff Neck Total		Clonus Total	
Location	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Frontal	31	48	25	38	36	55	3	5	25	38	6	9	1	2	5	8
Frontoparietal	9	50	9	50	11	61	1	6	6	33	3	17			3	17
Frontotemporal	2	29	2	29	2	29			3	43	1	14				
Temporal	11	38	10	35	11	38			7	24	1	4	2	8	1	4
Parietal	10	40	7	18	10	40	1	4	6	24	1	4			1	4
Temporoparietal	4	24	4	24	5	29			5	29	2	12			1	6
Parieto-occipital	6	55	5	45	6	55	1	9	6	55						
Occipital	1	20	1	20	1	20	1	20	1	20						
Diffuse (more than two lobes)	1	10	2	20	2	20	2	20	5	50						
Corpus callosum			1	20	1	20			1	20						
Lateral ventricles	2	22	1	11	2	22			2	22	1	11	1	11		
Third ventricle	1	14			1	14			2	28			1	14		
Pineal	2	12	2	12	2	12			5	31	1	6	2	12		
Pituitary																
Craniopharyngioma			1	50	1	50										
Basal ganglia	2	40	2	40	2	40			2	40					1	20
Meningioma of sphenoidal wing	2	33			2	33	1	17	1	17						
Optic nerve & chiasm	1	11	3	33	3	33	2	22	3	33						
Cerebellum																
Fourth ventricle					16	21	16	21	20	26	11	14	9	13	3	4
Posterior fossa																
Midbrain																
Pons	1	7	2	13	2	13	2	13	2	13	1	7	2	13	2	13
Medulla																
TOTALS					116		30		102		28		18		17	
% OF TOTALS						34		9		30		8		5		5

TABLE 14
SUMMARY

	Total Number of Patients	Percent of Total
INDENTIFYING DATA:		
Total number	347	100
Left hemisphere	91	52
Right hemisphere	90	
Male	227	65
Female	120	35
SYMPTOMS:		
Mental change	83	24
Headache	236	68
Vomiting	141	41
Convulsions	109	32
Weakness	53	15
Ataxia	73	21
Dizziness	24	7
MENTAL SIGNS:		
Disorientation	57	16
Aphasia	34	10
Psychic change	18	5
Intellectual slowing	96	28
CRANIAL NERVE SIGNS:		
Anosmia	9	3
Papilledema	206	59
Optic atrophy	39	11
Visual field findings	73	33*
Conjugate movement defects	20	6
Nystagmus	35	10
Extraocular muscle palsies	47	14
Facial weakness	116	34
MOTOR SIGNS:		
Hemiparesis	95	27
Monoparesis		
Arm	20	6
Leg	10	3
Ataxia of extremities	84	24
Ataxic gait	90	26
SENSATION:		
Diminished cutaneous sensation	36	10
Astereognosis	19	5
REFLEXES:		
Hyperactive tendon reflexes	116	34
Hypoactive tendon reflexes	30	9
Babinski	102	30
Babinski (bilateral)	28	8
Stiff neck	18	5
Clonus	17	5

*Percentage of positive findings in total number of cases having visual field examinations.

Hypoactive reflexes were found to be very unreliable localizing signs. These were recorded in 30 cases, or 9 per cent of the total. Sixteen cases (21 per cent) of posterior fossa tumors were found to have hyporeflexia. In other groups in which this finding was recorded one becomes suspicious of hyporeflexia as only reflecting the hyper-reflexia of the contralateral side.

An extensor plantar response (Babinski) was noted in 102, or 30 per cent of total cases, and a bilateral Babinski in 28 cases, or 8 per cent. The unilateral response was remarkably evenly distributed throughout all the anatomic groupings.

Stiff neck was a finding in 13 per cent of both posterior fossa (nine cases) and the midbrain, pons, and medulla (two cases) groups. The percentage of cases in the above mentioned groups was directly proportional to the meticulous care with which the neurologic examination had been recorded. This sign is thought to be far more significant than might be expected from the 11 positive findings recorded.

SUMMARY

Three hundred forty seven cases of proved brain tumors are reported in terms of their anatomic location and the significant neurologic symptoms and signs produced.

Neurologic Symptoms and Signs in 347 Cases of Verified Brain Tumor

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