CLINICAL STUDY OF OCULAR MANIFESTATIONS OF INTRACRANIAL SPACE OCCUPYING LESIONS

Krishnadeo V. Nalawade[1], Smita Dileep Javadekar[2]

[1]Assistant Professor, Department of Ophthalmology, Prakash Institute of Medical Sciences and Research, Urun-Islampur, Maharashtra.
[2]Professor and HOD, Department of Ophthalmology, Prakash Institute of Medical Sciences and Research, Urun-Islampur, Maharashtra.

ABSTRACT

BACKGROUND

The aim of this study is to find out various extraocular and intraocular manifestations of Intracranial Space Occupying Lesions (ICSOL), so as to reach an early diagnosis of ICSOL.

MATERIALS AND METHODS

Study was carried out in Prakash Hospital and Research Centre over a period of two years attending OPD (Ophthalmology as well as other clinical departments), so also IPD patients from Medicine, Paediatrics and other relevant Departments. Detailed clinical history was taken and detailed clinical, slit lamp, funduscopic examination was done in each case. Visual fields were tested by automated perimetry in all co-operative patients. Radiological investigations were done in all cases. Relevant laboratory investigations were done in all cases. All ocular manifestations were noted in tabular form and were co-related with clinical diagnosis.

RESULTS

The incidence of intracranial space occupying lesions and ocular manifestations was high in adult age groups (11 yrs. to 40 yrs.). Males (48%) and females (52%) were almost equally affected in intracranial space occupying lesions and ocular manifestations were also almost equal in both males (46%) and females (44%). Most common ICSOL was Brain Tumour (50%) followed by Brain Abscess (20%), Intracranial Haematomas (14%), Metastatic Deposits in brain (2%) and others (14%). There was no case of Intracranial Aneurysm. Ocular manifestations increased as the level of consciousness deteriorated. The most common symptom was Diplopia (26%) and most common signs were of cranial nerve palsies (22%) followed by Ptosis (12%), Cataract (8%), Black Eye (4%), Subconjunctival Haemorrhage, Exposure Keratitis, Proptosis, Nystagmus (1%) each. The most common fundus finding was Established Papilloedema (28%) followed by Early Papilloedema (14%), Retinal Haemorrhages (14%), Optic Atrophy (12%), and Optic Neuritis (4%). The most commonly affected cranial nerve was Abducent, i.e. 6th nerve (6 cases) due to its long intracranial course. The other nerves were 3rd oculomotor (5 cases), 4th Trochlear (2 cases). Visual acuity changes were most common in Brain tumours followed by Brain abscess and others. Fundus changes were more common (37 cases) than extraocular signs (23 cases). The incidence of visual field defects was more common in brain tumours (75%) followed by brain abscess (16%).

CONCLUSION

ICSOLs are more common in adult age group. Ocular manifestations in ICSOLs indicate severity of the disease. Prognosis of ICSOLs is poor if ocular manifestations are present.

KEYWORDS

Intracranial Space Occupying Lesions, Cranial Nerves, Brain Tumours, Papilloedema, Optic Atrophy, Ptosis, Diplopia, Squint.

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BACKGROUND

Eye is the window to look into brain as eye is the prolongation of the brain, i.e. central nervous system. Eye symptoms and signs appear with significant frequency in patients with Intracranial Space Occupying Lesions (ICSOL), which help in correlating the site of the lesion.[1] Good association of Ophthalmology and Neurology helps in diagnosis of these lesions.[2] These lesions may be in the form of benign tumours, primary/secondary malignancies, parasitic cysts, haematomas or brain abscesses.

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Corresponding Author:
Dr. Krishnadeo V. Nalawade,
'Aditya,' Onkar Colony,
Peth - Sangli Road,
Islampur, Walwa, Sangli-415409.
E-mail: krishnaeye7261@gmail.com
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Various SOLs found are as follows

Primary Intracranial Tumours

Intrasellar- Pituitary adenoma and Pituitary carcinoma.

Extrasellar- Craniopharyngioma, Meningioma, Tuberculoma, Teratoma, Glioma.

Primary Cranial Tumours

Sarcoma, Chondroma, Multiple Myeloma, Giant Cell Tumours.

Metastatic Tumours- Direct spread from nasopharyngeal tumours.

Haematogenous spread from breast, lung, stomach, kidney and colonic tumours.

SOLs other than Tumours

- Brain abscess, cysts (hydatid, parasitic).
- Intracerebral/subdural haematoma.
- Intracranial aneurysms (Internal carotid, intracranial part of ophthalmic artery, caratico-cavernous fistulae).
- Pseudotumour cerebri.

Ocular Manifestations of SOL

Symptoms- Diminished vision, Ptosis, Diplopia, Squint, Proptosis, Nystagmus.

Signs- Reduced vision, Field defects, Restriction of eye movements, Abnormal pupillary reactions, Fundus changes like Papilloedema, Optic Neuritis, Optic Atrophy, one-sided optic atrophy with papilloedema on the other side (Foster-Kennedy syndrome in frontal lobe tumours[3]), subhyaloid retinal and macular haemorrhages.

Systemic Manifestations of SOL

Headache, vomiting, tachycardia, arrhythmia, bradycardia, increased respiratory rate, clouding of consciousness ranging from slight somnolence to severe coma, epilepsy.[4]

MATERIALS AND METHODS

All patients attending Outpatient Department (OPD) of Medicine, Paediatrics, Surgery, Ophthalmology as well as patients admitted in wards in Prakash Hospital and Research Centre, Islampur were studied clinically.

Total 50 cases of ocular manifestations of intracranial SOL were studied from January 2015 to January 2017.

Detailed history was taken and meticulous local routine Ophthalmological examination as well as systemic examination was done. Automated perimetry was done in cooperative and conscious patients.

Visual acuity, perimetry and eyeball movements were not possible in semiconscious and unconscious patients.

In unconscious patients, gaze was observed and conjugate deviations were ruled out.

Detailed direct and indirect ophthalmoscopic examination was carried out after dilating the pupils with Tropicamide 1% and Phenylephrine 10% eye drops. Fundus photograph was taken with fundus camera.

External photographs of extraocular signs were taken with zoom lense camera.

X-ray orbit, x-ray skull were done wherever required. Diagnosis was confirmed by investigations, especially computerised tomography by Radiologist.

RESULTS

Age in Years	ICSOL Cases and %		Ocular Manifestations and %	
0 - 10	5	10%	5	10%
11 - 20	15	30%	13	26%
21 - 30	8	16%	8	16%
31 - 40	14	28%	11	22%
41 - 50	4	8%	4	8%
51 - 60	2	4%	2	4%
> 60	2	4%	2	4%

Table 1. Age Distribution

The incidence of intracranial space occupying lesions was high in adult age groups (11 yrs. to 40 yrs.). Maximum number of ocular manifestations were also found in the same group, i.e. 26% in 11 - 20 years' age group, 16% in 21 - 30 years' age group and 22% in 31 - 40 years' age group. Children and old people were less affected.

Sex	ICSOL	%	Ocular Manifestations	%
Male	24	48%	23	46%
Female	26	52%	22	44%

Table 2. Sex Distribution

Males (48%) and females (52%) were almost equally affected in intracranial space occupying lesions. Ocular manifestations were also almost equal in both males (46%) and females (44%).

ICSOL	Male	Female	Total	%
Brain Tumour	6	19	25	50%
Brain Abscess	5	5	10	20%
Intracranial Haematoma	7	0	7	14%
Metastatic Deposits	1	0	1	2%
Aneurysms	0	0	0	0%
Others	5	2	7	14%

Table 3. Incidence of various Intracranial Space Occupying Lesions

Most common ICSOL was Brain Tumour (50%) followed by Brain Abscess (20%), Intracranial Haematomas (14%), Metastatic Deposits in brain (2%) and others (14%). There was no case of Intracranial Aneurysm.

Level of Consciousness	Total	Ocular Manifestations	%
Conscious	31	27	86%
Semiconscious	11	10	99%
Unconscious	8	8	100%

Table 4. Level of Consciousness and Ocular Manifestations

Ocular manifestations increased as the level of consciousness deteriorated. In all (100%) cases of unconscious patients, ocular manifestations were present. In conscious patients, ocular manifestations were present in 86% of cases.

Extraocular Signs	No. of Cases	%
Ptosis	6	12%
Proptosis	1	2%
Cranial Nerve Palsies	11	22%
Black Eye	2	4%
Subconjunctival Haemorrhage	1	2%
Exposure Keratitis	1	2%
Cataract	4	8%
Diplopia	13	26%
Nystagmus	1	2%

Table 5. Extraocular Signs Found in ICSOL

The most common symptom was Diplopia (26%) and most common signs were of Cranial Nerve Palsies (22%) followed by Ptosis (12%), Cataract (8%), Black Eye (4%), Subconjunctival Haemorrhage, Exposure Keratitis, Proptosis, Nystagmus (1%) each.

Fundus Changes	No. of Cases	%
Early Papilloedema	7	14%
Papilloedema	14	28%
Optic Atrophy	6	12%
Optic Neuritis	2	4%
Retinal Haemorrhages	7	14%

Table 6. Fundus changes in ICSOL

The most common fundus finding was Established Papilloedema (28%) followed by Early Papilloedema (14%), Retinal Haemorrhages (14%), Optic Atrophy (12%) and Optic Neuritis (4%).

ICSOL	Normal	Semi-dilated Sluggish	Semi-dilated Fixed	Normal Size Sluggish
Brain Tumour	17	5	0	3
Brain Abscess	7	2	0	1
Intracranial Haematoma	1	1	3	2
Metastatic Deposit	0	1	0	0
Aneurysm	0	0	0	0
Others	4	3	0	0

Table 7. Pupillary changes in ICSOL

Commonest pupillary change found in ICSOL was semidilated and sluggish reaction (12 cases) followed by normal size sluggishly reacting (6 cases) and semidilated fixed (3 cases).

Out of 50 cases of ICSOL, 29 cases had normal size and normally, equally reacting pupils.

ICSOL	III Nerve	IV Nerve	VI Nerve	Multiple
Brain Tumour	1	1	3	2
Brain Abscess	2	0	3	1
Intracranial Haematoma	0	0	0	0
Metastatic Deposit	1	1	0	1
Aneurysm	0	0	0	0
Others	1	0	0	1

Table 8. Cranial Nerve Palsies and ICSOL

The most commonly affected cranial nerve was Abducent, i.e. 6th nerve (6 cases) due to its long intracranial course. The other nerves were 3rd Oculomotor (5 cases), 4th Trochlear (2 cases). Multiple nerves were affected in 5 cases.

Visual Acuity	Brain Tumour	Brain Abscess	Haematoma	Metastatic Deposit	Aneurysm	Others
6/9 - 6/6	3	0	0	0	0	1
6/60 - 6/12	7	1	0	1	0	0
Less than 6/60	11	3	0	0	0	1
Total Loss of Vision	1	2	0	0	0	0

Table 9. Visual Acuity changes and ICSOL

Visual acuity changes were most common in Brain tumours followed by Brain abscess and others. Patients had minimum-to-moderate loss of vision. Three patients had total loss of vision. Visual acuity could not be tested in children below 4 years of age, semiconscious and unconscious patients. Systemic and Ocular manifestations in ICSOL.

ICSOL	Systemic Manifestations				Ocular Manifestations	
	Headache	Vomiting	Convulsions	Others	External Signs	Fundus Changes
Brain Tumours	20	15	10	21	10	17
Brain Abscess	8	5	5	9	5	9
Intracranial Haematoma	1	7	0	3	3	7
Metastatic Deposit	1	0	0	1	1	0
Aneurysms	0	0	0	0	0	0
Others	5	4	1	5	5	4

Table 10. Systemic and Ocular Manifestations in ICSOL

The most common systemic manifestation in patients with ICSOL was headache (35 cases) followed by vomiting (31 cases), convulsions (16 cases) and others (39 cases).

Fundus changes were more common (37 cases) than extraocular signs (23 cases). Patients having Brain tumours had more systemic and ocular manifestations than others.

Treatment	ICSOL		Ocular Manifestation	
	Cases	%	Cases	%
Medical	50	100%	43	86%
Surgical	12	24%	11	22%

Table 11. Treatment Modality in ICSOL

Out of 50 cases of ICSOL all had medical line of treatment, only 12 patients underwent surgery. Forty-three cases having ocular manifestations received medical line of treatment and 11 underwent surgery. Lower incidence of surgery was due to poor socioeconomic status of patients and non-availability of neurosurgery in this hospital.

ICSOL	Mechanism	Modes of Presentation				
		Extraocular Signs	Papilloedema	Optic Atrophy	Optic Neuritis	Retinal Haemorrhages
Brain Tumour	↑ICT, Direct Pressure, Vessel Involvement	10	12	2	2	2
Brain Abscess	↑ICT, Local Pressure, Infective	5	7	2	0	0
Intracranial Haematoma	Head Injury, Local Pressure, Vessel Injury	3	5	0	0	5
Metastatic Deposit	↑ICT, Pressure, Haematogenous Spread	1	0	0	0	0
Aneurysm	↑ICT	0	0	0	0	0
Other	Pressure, Infective, Direct Extension	4	2	2	0	0

Table 12. Ocular Manifestations- Mechanism and Mode of Presentation

The most common mechanism of action in ICSOL was raised intracranial pressure followed by direct pressure effect of lesion on visual pathway, head injury, infection and haematogenous spread.

Papilloedema was due to raised intracranial pressure. Optic atrophy was due to direct pressure effect on visual pathway. The retinal haemorrhages were due to injury to vessels in case of head injury.

ICSOL	Visual Field Defects				Normal Fields
	Constriction	Scotomas	Bitemporal	Homonymous	
Brain Tumours	5	3	0	1	10
Brain Abscesses	1	1	0	0	2
Intracranial Haematoma	0	0	0	0	0
Metastatic Deposits	0	0	0	0	1
Aneurysms	1	0	0	0	1
Others	1	0	0	0	1
Total	**7**	**4**	**0**	**1**	**14**

Table 13. Visual Field Defects and ICSOL

The most common visual field defect was constriction of fields (7 cases) followed by scotomatous visual field defects (4 cases), homonymous hemianopia (1 case). Out of 50 cases perimetry was done in 26 cases, out of which 14 cases showed normal fields.

The incidence of visual field defects was more common in brain tumours (75%) followed by brain abscess (16%). Perimetry was not done in 24 patients due to unconscious, semiconscious, drowsy, irritable patients and children below 4 years.

ICSOL	Cases	Death	%
Brain Tumours	25	1	4%
Brain Abscesses	10	1	10%
Intracranial Haematoma	7	6	85.7%
Metastatic Deposits	1	0	0
Aneurysms	0	0	0
Others	7	0	0

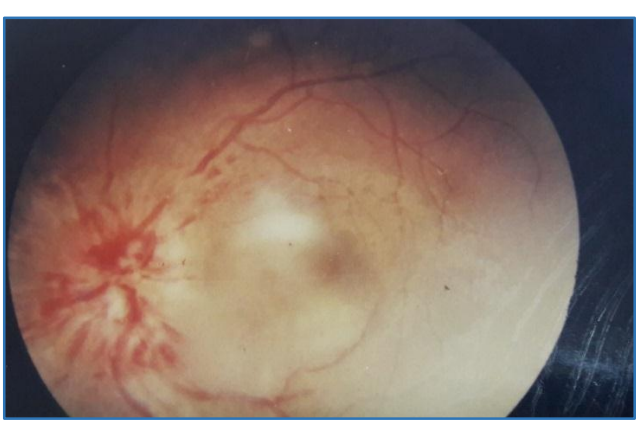
Table 14. Number of ICSOL Cases and Death

Death was more common in intracranial haematomas (85.7%) due to road traffic accidents followed by brain abscess (10%) and brain tumours (4%).

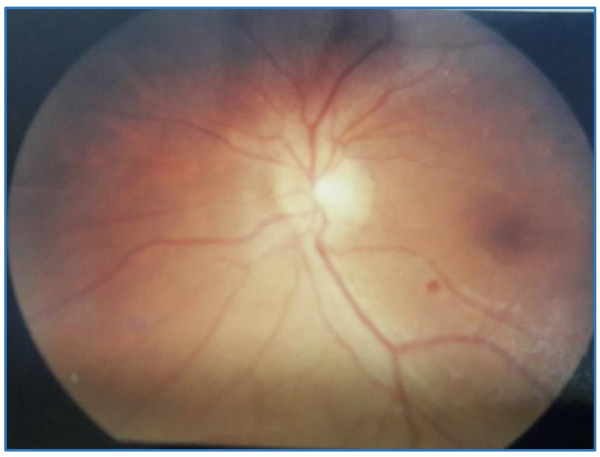
ICSOL	Ocular Manifestations	Death
Brain Tumours	23	1
Brain Abscesses	9	1
Intracranial Haematoma	7	6
Metastatic Deposits	1	0
Aneurysms	0	0
Others	5	0

Table 15. Ocular Manifestations and Death

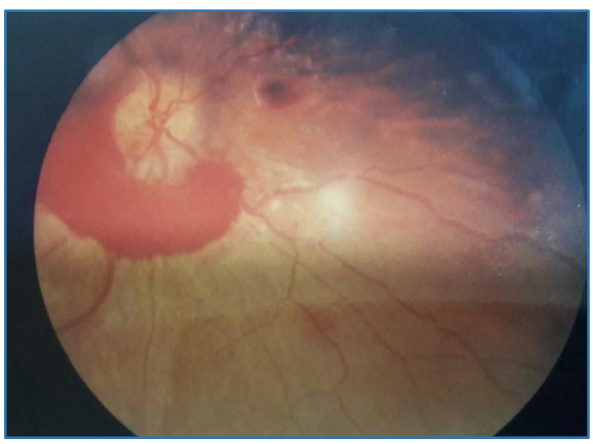
Death was most common in ocular manifestations with intracranial haematomas followed by brain abscess and brain tumours.



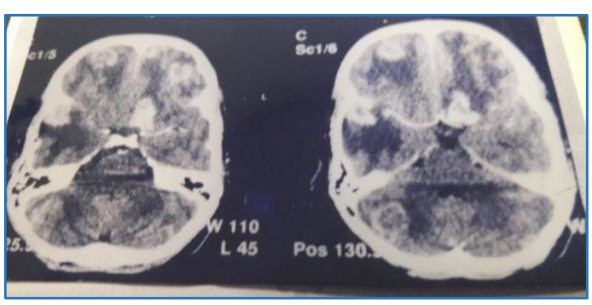
Papilloedema in a Patient having Nasopharyngeal Angiofibroma with Intracranial Extension



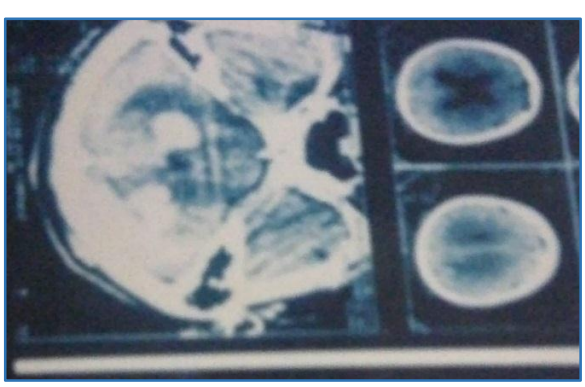
7-Year-Old Female Child showing Both Eyes Optic Atrophy. She had Tuberculoma on C.T. Scan



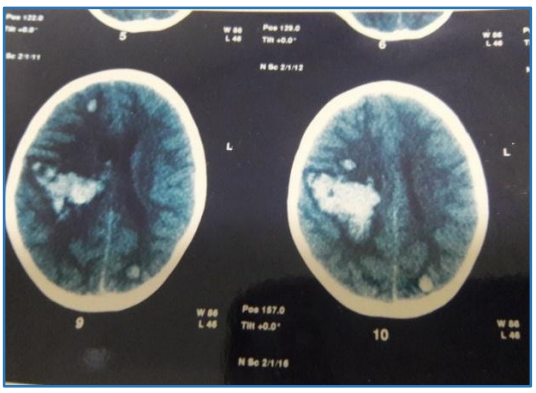
Subhyaloid Haemorrhage with Early Papilloedema in 1½ Year Male Child having Astrocytoma on C.T.



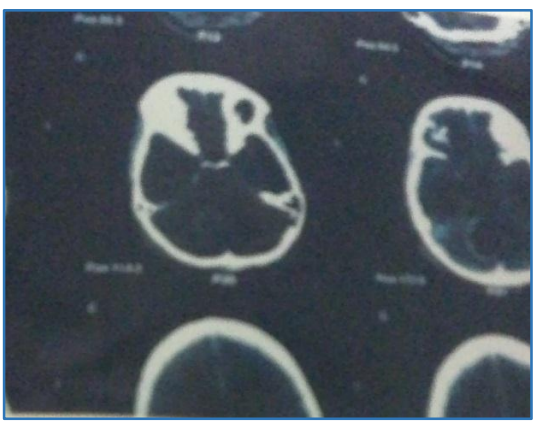
C.T. Scan of 27 Years Old Female showing Multiple Cerebral and Cerebellar Tuberculomas. She had Both Eyes Primary Optic Atrophy



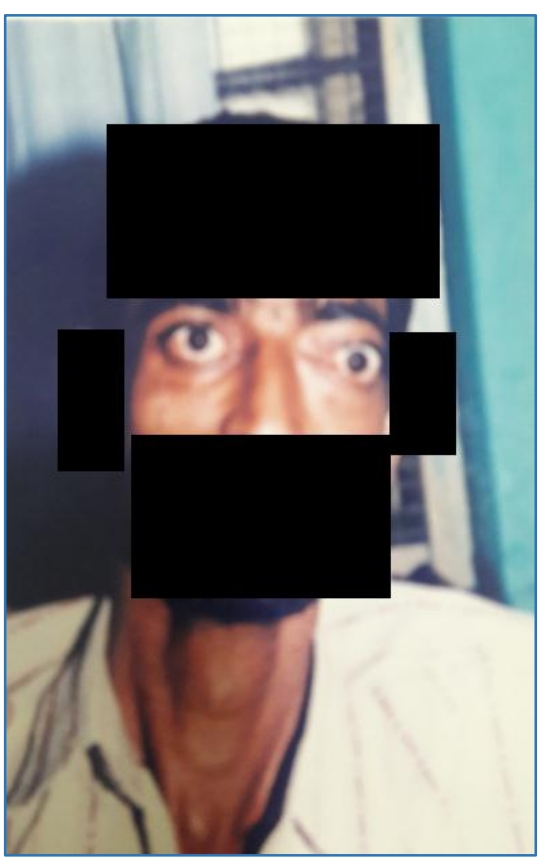
C.T. Scan of 20-Year-Old Male showing Cerebellar Tumour. He had Both Eyes Papilloedema



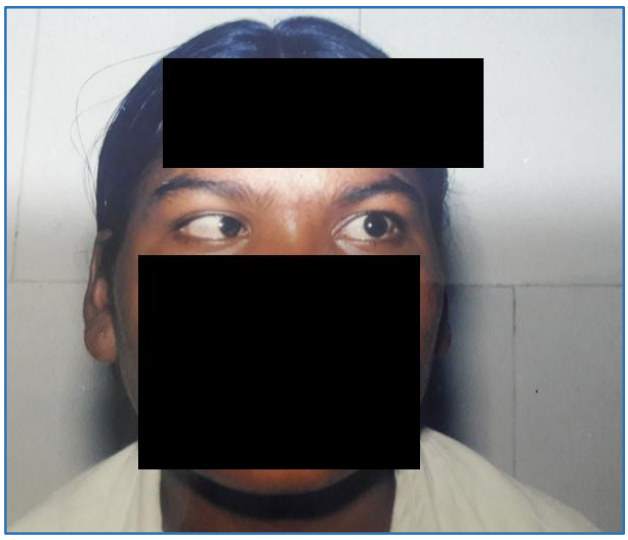
C.T. of 33-Year-Old Male showing Intracerebral Haematoma



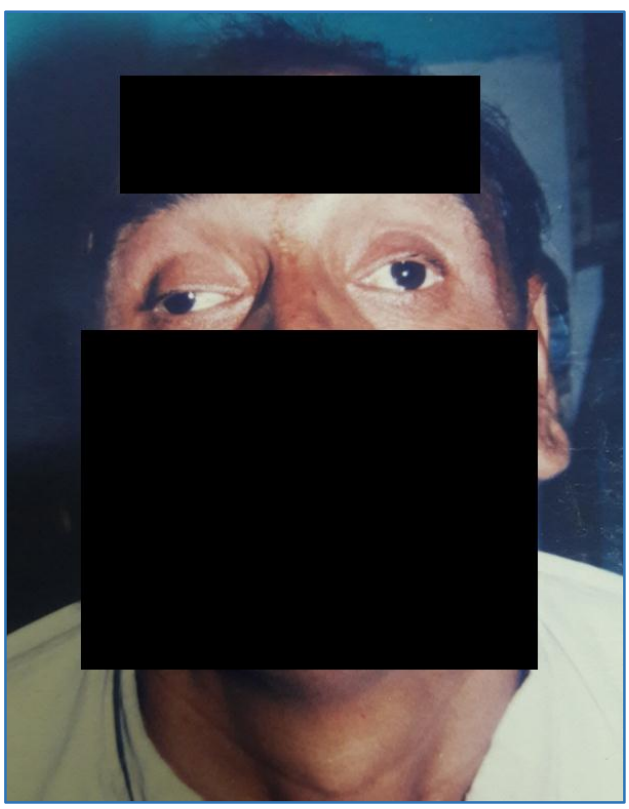
C. T. Scan of 14-Year-Old Female Patient having Cystic Astrocytoma. She had Left Lateral Rectus Palsy and Both Eyes Papilloedema



35-Year-Old Male showing Proptosis Left Eye. He had Nasopharyngeal Angiofibroma with Intracranial Extension on C.T. and Papilloedema in Both Eyes



14 Year Old Female Patient of Cystic Astrocytoma showing Left Lateral Rectus Palsy. She also had Papilloedema in Both Eyes



45 Years Old Male showing IIIrd and IVth Nerve Palsy. He had Non-Hodgkin's Lymphoma. He showed Metastatic Deposits on C.T. Brain

DISCUSSION

Eye symptoms and signs appear with significant frequency in patients with Intracranial Space Occupying Lesions (ICSOL). Ocular signs and symptoms alone allow fairly accurate localisation of ICSOL in about 25% of patients, if it is situated near the visual pathway.[5]

In present study of 50 cases, incidence of brain tumours was maximum (50%) followed by brain abscess (20%), intracranial haematomas (14%), metastatic deposits in brain (2%) and other ICSOLs (14%). No case was found of intracranial aneurysm. This correlates well with study by Irfan A and Qureshi A.[6]

It was found that ICSOL is more common in adult age group.[3,7] Maurice Croll's[8] study of frontal lobe tumours, Elkington's[9] study of pituitary adenoma, so also Lawrence[10] and Chautorian[3] found ICSOL in younger population.

James A Rush and Brain R Young[11] studied 1000 cases of cranial nerve palsies (III, IV, VI) with ICSOL. They also found 90% cases in younger age group.

There is no sex prevalence of ICSOL. Its incidence is equal in both sexes. This is similar to other studies.[3,8,11,12]

Incidence of Headache and Vomiting is significantly higher than other systemic manifestations.[4,12] It may be due to raised intracranial pressure in ICSOL.

Ocular manifestations increased as the level of consciousness deteriorated. Cranial nerve palsies[3,11,13] and papilloedema,[3,12] may be due to raised intracranial pressure. As the intracranial pressure increases, level of consciousness decreases. This also indicates bad prognosis if there are ocular manifestations.

Optic atrophy is common in frontal lobe tumours along with papilloedema in other eye (Foster Kennedy syndrome)[35] Cranial nerve palsies[3,11,13] are also due to local pressure effects of ICSOL.

Proptosis, black eye, subconjunctival haemorrhage, retinal haemorrhages are more commonly found in haematomas due to trauma.

Visual acuity changes cannot be accessed in drowsy, semiconscious, unconscious and children below 4 years. These changes are more common in frontal lobe tumours and optic nerve tumours.[8,14]

Local pressure of ICSOL has significant effect on visual fields.[12] Constriction of visual fields was found in significant number of cases. Hemianopia (Bitemporal/homonymous) is commonly found in pituitary and frontal lobe tumours due to local pressure effects.[3,8,9] Binasal hemianopia results due to crowding of optic nerves against the resistant vessels of anterior part of circle of Willis.[3]

Increased intracranial pressure was first controlled by hyperosmotic solution like Mannitol intravenously. Infection was controlled by giving appropriate antibiotics. Anticonvulsant therapy in case of convulsions was given.

Surgical treatment by Neurosurgery in cases of Brain tumours by doing craniotomy was considered. Burr hole in cases of Brain abscess and Haematoma was done. Actually, Neurosurgery has good results,[15] but in our study poor socioeconomic status of patient and high cost of neurosurgery only 11 patients underwent neurosurgery.

Death is more common in intracranial haematomas followed by Brain abscess, Brain tumours and other lesions. Prognosis is poor in cases which had ocular manifestations. Death in ICSOL may be due to cerebral involvement following raised intracranial tension or due to localised pressure on adjacent cerebral tissue leading to epilepsy, respiratory and circulatory changes.

Nowadays death rate is reduced due to early diagnosis and recent advances in Neurosurgery as well as Neuro-ophthalmology.

CONCLUSION

Maximum number of ICSOLs are of Brain tumours followed by Brain abscess, Intracranial Haematomas, Metastatic deposits and other lesions.

ICSOLs are more common in adult age group.

Ocular manifestations in ICSOLs indicate severity of the disease.

Most common ocular symptom is diplopia in ICSOLs.

Cranial nerves III, IV, VI are affected in ICSOLs. Most commonly affected nerve is Abducent (VIth).

Commonest fundus finding is papilloedema followed by retinal haemorrhages and optic atrophy.

Most common pupillary abnormality is semidilated sluggishly reacting pupil followed by semidilated fixed pupil.

Headache is seen in significant number of cases followed by vomiting and convulsions.

Vision is affected in ICSOLs, especially in tumours. It may be partial loss to total loss depending upon affection of optic nerve.

Field defects are common in ICSOLs. Depending upon site of tumour it is constriction, scotoma or hemianopias.

Ocular manifestations are reversible in cases of early diagnosis and prompt treatment. If optic atrophy is present, it is incurable.

Prognosis of ICSOLs is poor if ocular manifestations are present. Nowadays, death rate is reduced in ICSOLs due to early detection, prompt diagnosis and effective management which is possible due to advanced diagnostic aids and Neurosurgery as well as Neuro-ophthalmology.

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