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Clinical profile and yield of neuroimaging in Papilledema

[1] Keerthivarman Rukmangathan, [2] Ranjan Chandrasekaran, [3] Ramusiddharthan Ravichandran, [4] Shankar Radhaktrishnan
[1] Assistant Professor, Department of Ophthalmology, Annapoorana Medical College & Hospital, Veerapandi, Salem, Tamil Nadu, India
[2] Consultant, Annai Eye Hospital, Ramanathapuram, Tamil Nadu, India
[3] Consultant, Sri Ramana Maharishi Eye Hospital, Somavarakula Street, Tiruvannamalai, Tamil Nadu, India
[4] Associate Professor, Department of Preventive Medicine, VMKVMCH, Salem, Tamil Nadu, India

Abstract
Background: Studies had shown that untreated papilledema can lead to progressive irreversible visual loss and secondary optic atrophy in up to 31% of patients. The first diagnostic step in the evaluation of a patient with papilledema is a neuroimaging study, either by CT or MRI, as well as contrast-enhanced CT venography or MR venography.
Aim: To assess the diagnostic yield of neuroimaging studies among the patients presenting with papilledema.
Methodology: A hospital based prospective study was conducted in the ophthalmology department of our hospital for a period of one year between May 2015 and June 2016. A total of 120 patients with clinically diagnosed papilledema were included in our study. The patients were enquired about the past medical and surgical history, systemic illness, treatment history, personal history and family history. Complete ophthalmological examination including fundus examination was conducted on the patients. Later on a complete neurological evaluation was done on every patient including general consciousness, cranial nerve examination, motor system and sensory system evaluation. Neuro imaging was done in all patients either CT brain or MRI with MRV depending on the need and affordability of patients.
Results: The yield of neuroimaging had shown that 80% of the patients had idiopathic intracranial hypertension and 9% had cerebral venous thrombosis and the remaining 10.9% had space occupying lesions in the form of meningioma, acoustic neuroma, astrocytoma, glioma and tuberculoma. In the management aspect all the 13 patients who had space occupying lesions were referred to neurosurgery department and for other patients with IIH and CVT drugs in the form of Diamox, heparin and acitrom was given and all patients with IIH weight reduction measures were advised and during the follow-up period 2 patients underwent lumbar puncture and optic nerve sheath decompression as a mode of treatment.
Conclusion: Neuroimaging helps in early diagnosis of several intracranial lesions in patients with papilledema, which provides better prognosis and saves the life of the patient by early intervention.

Keywords: papilledema, neuro-imaging, idiopathic intracranial hypertension

Introduction

Papilledema (optic disc swelling) is the most common manifestation of increased intracranial pressure (ICP) which usually develops within hours to several days from the onset of the disease [1, 2]. But certain times if this finding is not present it does not rule out an intracranial lesion [3]. Papilledema often produces brief episodes of monocular or binocular visual loss, called transient visual obscurations (TVOs) [4, 5]. TVOs are thought to occur due to transient ischemia of the swollen optic nerve head and not a sign of impending permanent visual loss [6].

Studies had shown that untreated papilledema can lead to progressive irreversible visual loss and secondary optic atrophy in up to 31% of patients [7]. Raised intracranial pressure (ICP) is a potentially life threatening condition, which can also lead to visual loss and blindness [8]. A relatively common cause of papilledema is idiopathic intracranial hypertension, which affects approximately 1 in 100,000 population and is more among females with a high body-mass index [9]. Visual field tests may be normal in papilledema, and while medical tests such as lumbar puncture and neuroimaging can help in establishing elevated intracranial pressure with few possibilities of false-positive and false-negative results [10].

The first diagnostic step in the evaluation of a patient with papilledema is a neuroimaging study, either by CT or MRI, as well as contrast-enhanced CT venography or MR venography. Contrast-enhanced MR venography is more reliable than the standard flow-related MR venography, which is subject to signal loss unrelated to stenosis or occlusion of venous sinuses [11]. Evidence of an intracranial mass lesion or hydrocephalus should be sought. Imaging findings that are supportive (but not diagnostic) of a diagnosis of idiopathic intracranial hypertension include dilation of the optic nerve sheaths, flattening of the posterior globe, and an empty (or partially empty) pituitary sella [12]. Diagnostic confusion with regard to the MR venogram is based on the fact that narrowing of the transverse venous sinuses is frequently found in patients with idiopathic intracranial hypertension. Demonstration of stenosis resolution after acute therapeutic lowering of intracranial pressure suggests that the stenosis may be a consequence of elevated intracranial pressure [11, 13]. However,

the true relationship between increased intracranial pressure and transverse sinus stenosis remains unclear, as persistent stenosis has been demonstrated in some patients following reduction of intracranial pressure and resolution of symptoms [14]. Awareness of this diagnostic confusion with MR venography is essential to avoid unnecessary anticoagulation in idiopathic intracranial hypertension patients.

If MRI and MR venography were found to be unremarkable, lumbar puncture is usually performed keeping 3 goals in mind: (1) complete evaluation of the cerebrospinal fluid content, including cytology and flow cytometry; (2) measurement of the opening pressure in the lateral decubitus position; and (3) determination of headache improvement in the 24 to 48 hours following the lumbar puncture. If imaging and cerebrospinal fluid contents are normal and elevated opening pressure (greater than 20 cm H20 in a thin patient, 25 cm H20 in an obese patient, or 28 cm H2O in a pediatric patient) is confirmed, a diagnosis of isolated elevated intracranial pressure is established [15]. If causative medications have been excluded, the patient may be diagnosed with idiopathic intracranial hypertension.

As of today very few studies in India had done on neuroimaging evaluation for papilledema, as most of the studies had done only a fundoscopic examination and so the current study would help us to assess the yield of neuroimaging in identifying the various causes in patients with papilledema.

Aim

To assess the diagnostic yield of neuroimaging studies among the patients presenting with papilledema.

Methodology

A hospital based prospective study was conducted in the ophthalmology department of our hospital for a period of one year between May 2015 and June 2016. A total of 120 patients with clinically diagnosed papilledema were included in our study. Patients without consciousness and already known case of neurological diseases were excluded from the study**.** The patients particulars like name, age, sex, address were documented in a proforma specially designed for this study and was filled by the examining doctor.

A detailed history of each and every symptom of the patient was taken such as onset, duration, progression, associated factors aggravating and relieving factors were documented.

The patients were also enquired about the past medical and surgical history, systemic illness, treatment history, personal history and family history. The following ophthalmological examinations were conducted among the study subjects

- Visual acuity by snellen's chart
- Refraction
- Assessing status of pupillary reaction
- General ophthalmic examination using torch light and slit lamp biomicroscopy.
- Intraocular pressure measurement by noncontact tonometry
- Fundus examination by direct ophthalmoscope, 90 dioptre lens and indirect ophthalmoscopy.
- Extraocular movement examination using torch light.
- Colour vision by pseudo isochromatic Isiharas chart
- Central fields by Bjerrums screen

Later on a complete neurological evaluation was done on every patient including general consciousness, cranial nerve examination, motor system and sensory system evaluation. Neuro imaging was done in all patients either CT brain or MRI with MRV depending on the need and affordability of patients.

During the follow up visits, visual acuity, pupillary reaction, colour vision, central fields and fundus examination was done at one month and later at three months. All data were entered and analysed using SPSS version 21.

Results

The age and gender wise distribution of the study population was shown in table 1. Majority of the study subjects were females (77.5%) and most of them were in the age group between 20- 30 years with a mean age of 31.37 years. The most common presenting complaint among the study subjects was headache (95%) followed by transient visual obscuration (66.7%), field defects was present in 16.7% of the study subjects (table 2). 15% of the patients had cranial nerve abnormality and the most common cranial nerve involved was the 7th nerve, whereas the other cranial nerve which were involved were 3rd, 4th, 6th and 8th (table 3). The best corrected visual acquity for majority of the patients was between 6/6 – 6/12 and for nearly 10% of the eyes had BCVA in the range of 6/12 – 6/60 and for 3% it was <6/60 (table 4).

For about 60% of the patients the fundus findings had shown a established papilledema and 37% of the eyes had features of early papilledema and 3 of the eyes had features of chronic papilledema and secondary optic atrophy (table 5). Among the 120 patients only 8 patients were advised CT and in that 5 patients had shown thickening of optic nerve sheath complex and the remaining 3 patients had findings of partial empty sella. The remaining 112 patients were advised MRI and their findings were tabulated in table 6 and all these patients had also undergone MRV and in that 68% of the patients had a normal picture and the remaining 32% had certain pathologies reported among which CVT (cerebral venous thrombosis) was found to be more common followed by hypoplasia of left transverse sinus (table 7).

The yield of neuroimaging had shown that 80% of the patients had idiopathic intracranial hypertension and 9% had cerebral venous thrombosis and the remaining 10.9% had space occupying lesions in the form of meningioma, acoustic neuroma, astrocytoma, glioma and tuberculoma (table 8). In the management aspect all the 13 patients who had space occupying lesions were referred to neurosurgery department and for other patients with IIH and CVT drugs in the form of Diamox, heparin and acitrom was given and all patients with IIH weight reduction measures were advised and during the follow-up period 2 patients underwent lumbar puncture and optic nerve sheath decompression as a mode of treatment. All the patients were followed up for 2 months except the patients who were referred to neurosurgery department and in that 95% of the patients had shown resolving signs of papilledema and 5% had signs of secondary optic atrophy (table 9).

Table 1: Age and sex wise distribution of the study population.

Age group	Gender		P value
	Male	Female	
<20	1 (3.7%)	2 (2.1%)	0.531
20 – 30	13 (48.1%)	50 (53.7%)	
31 – 40	8 (29.6%)	32 (34.4%)	
41 – 50	5 (18.5%)	9 (9.6%)	
Total	27 (100%)	93 (100%)	
Mean ± SD	33.5 ± 5.8	31.8 ± 6.2	

Table 2: Distribution of the study subjects based on their presenting complaints.

Complaint	Frequency	Percentage
Head ache	114	95.0
Transient Obscuration of vision	80	66.7
Field defects	20	16.7
Vomiting	60	50.0
Diplopia	5	4.2
Neck pain	10	8.3
Giddiness	30	25.0
Total	120	100

Table 3: Distribution of the study population based on their cranial nerve abnormality.

Cranial nerve abnormality	Frequency	Percentage
3rd Cranial Nerve	5	4.2
4th Cranial Nerve	1	0.8
6th Cranial Nerve	4	3.3
7th Cranial Nerve	6	5.0
8th Cranial Nerve	2	1.7
Nil	111	92.5
Total	120	100

Table 4: Distribution of the study population according to their best corrected visual acquity (BCVA).

BCVA	Right eye	Left eye
<6/60	4 (3.3%)	2 (1.6%)
6/12 – 6/60	12 (10%)	11(9.2%)
6/6 -6/12	104 (86.6%)	107 (89.1%)
TOTAL	120 (100)	120 (100)

Table 5: Distribution of the study subjects based on their findings of the fundus examination.

Fundus findings	Right eye	Left eye
Early Papilledema (EP)	46 (38.3%)	42 (35%)
Established Papilledema (ESP)	70 (58.3%)	76 (63.3%)
Chronic Papilledema (CP)	2 (1.7%)	1 (0.8%)
Secondary Optic Atrophy (SOA)	2 (1.7%)	1 (0.8%)
TOTAL	120 (100)	120 (100)

Table 6: Distribution of the study population based on the MRI findings among the study population.

MRI findings	Frequency	Percentage
Thickening Of Optic Nerve Sheath Complex	60	53.6
Partial Empty Sella	28	25.0
SOL	13	11.6
CVT	11	9.8
Total	112	100

Table 7: Distribution of the study population based on the MRV findings among the study population.

MRV findings	Frequency	Percentage
CVT	11	9.8
HLSS	1	1.0
HLTS	10	10.1
HLTS,HLSS	2	2.0
HRTS	1	1.0
LTS,LSS	5	5.0
RTS,RSS	6	6.0
Normal	76	67.9
Total	112	100

CVT – CEREBRAL VENOUS THROMBOSIS
RTS - RIGHT TRANSVERSE SINUS STENOSIS
HLSS - HYPOPLASIA OF LEFT SIGMOID SINUS
HLTS - HYPOPLASIA OF LEFT TRANSVERSE SINUS
HRTS - HYPOPLASIA OF RIGHT TRANSVERSE SINUS
LTS - LEFT TRANSVERSE SINUS STENOSIS
LSS - LEFT SIGMOID SINUS STENOSIS
RSS – RIGHT SIGMOID SINUS STENOSIS

Table 8: Distribution of the study population according to the yield of neuroimaging.

Findings		Frequency		Percentage
Idiopathic Intracranial Hypertension (IIH)		96		80
Cerebral Venous Thrombosis		11		9.1
Space Occupying Lesion (SOL)	Meningioma	2	13	10.9
	Acoustic Neuroma	2		
	Astrocytoma	2		
	Medulloblastoma	1		
	Glioma	3		
	Tuberculoma	2		
	Obstructive Hydrocephalus	1		
Total		120		100

Table 9: Distribution of the study subjects based on their type of management.

Management	Ist visit (n=120)	IInd visit (n=102)	IIIrd visit (n=90)
DMX	22 (18.3%)	26 (25.5%)	20 (22.2%)
DMX,WR	72 (60.0%)	70 (68.6%)	62 (68.9%)
DMX,WR,IS	4 (3.3%)	4 (3.9%)	-
ACM	2 (1.7%)	-	-
HEP	1 (0.8%)	-	-
ACM,HEP	1 (0.8%)	-	-
DMX,ACM,HEP	3 (2.5%)	-	-
LP	2 (3.3%)	-	1 (1.1%)
ONSD	-	2 (1.9%)	1 (1.1%)
WR	-	-	6 (6.7%)
Neurosurgeon referral	13 (10.8%)	-	-
Total	120 (100%)	102 (100%)	90 (100%)

DMX- Diamox
WR – weight reduction
HEP – heparin
ACX – acitrom
LP – lumbar puncture
ONSD – optic nerve sheath decompression

Discussions

Papilledema can present with varied clinical symptoms, neuro-ophthalmic features and radiological features. It is a disorder of elevated cerebrospinal fluid pressure of various causes. In the present study we found majority of the study subjects were females and were in the age group between 25 and 35 years. A study by Lee *et al.* [16] reported that papilledema due to various causes of raised intracranial pressure may develop at any age of either sex in contrast to idiopathic intracranial hypertension which commonly occurs in females of child bearing age groups which was almost in par with the current study.

The present study had shown that 80% of the patients with papilledema were due to idiopathic intracranial hypertension

and their mean age of presentation was 31.3 years, a similar kind of results was shown in a study done by Ambika S *et al.* in a tertiary referral ophthalmic centre in India [17] and another study done in North America they found the most common age of presentation was between 29 and 30 years [18]. A study done by John chen and Michael Wall had quoted that female gender is a risk factor for IIH since almost 90% of the affected population were obese females [19].

The most common symptoms of IIH include headache, transient obscuration of vision, pulsatile tinnitus, and diplopia. In a prospective study [20] of 50 idiopathic IIH patients, symptoms included headache (94%), transient visual obscuration (68%), intracranial noises (58%), sustained visual loss (26%), photopsia (54%), diplopia (38%), and retrobulbar pain (44%).Similar to the above mentioned study in our study also we found headache and transient visual obscuration as the most common presenting complaint. A study done by Timoteo *et al.* had reported that headache as the sole presentation of cerebral venous thrombosis [21].

A noncontrast CT was earlier considered as an adequate imaging study because it could exclude ventriculomegaly or mass lesion. However, conditions that increase ICP without producing ventriculomegaly or mass lesions, such as gliomatosis cerebri, meningitis, and cerebral venous thrombosis, may mimic IIH and yet not have associated CT abnormalities to provide a clue to the true underlying condition. Unless there are external constraints (weight limitations, availability), MRI with MRV is currently the study of choice [22]. In the present study only 8 patients were subjected to CT imaging and the remaining 112 patients had underwent MRI and MRV. Using a special technique, three-dimensional, gadolinium enhanced MRV appears to be more sensitive than conventional MRV for detecting areas of subtle cerebral venous stenosis.

In our study it was found that 69.2% were overweight and 11% were obese among the patients with IIH and it was supported by the study done by Daniels AB *et al.* where he had reported that higher BMIs were associated with greater risk of IIH [23] and a other study done by Szewka etal had shown that higher BMI at diagnosis is associated with increased severe visual loss in patients with IIH [24]. A study done by Michael wall reported that horizontal diplopia with sixth nerve paresis were found in 10-20% of cases, which was contradicting to the results of the present study where we found 7th nerve paresis to be more common in our patients.

Central fields were normal in 208 eyes (86.6%) defective in 32 eyes (13.3%) of our study population. In this 18 eyes (56.2%) had enlarged blind spots remaining patients had bitemporal hemianopia, homonymous hemianopia, superior and inferior quadrantonopia. Raju K V *et al.* reported in their study that most of the field defects of neuro-ophthalmic significance are located in central 30 degree field and 56% of the patient in their study showed field defect with enlargement of blind spot which was in par with the present study [25].

Out of 112 patients who underwent MRV isolated thrombosis of superior sagittal sinus involvement was seen in 4 patients, isolated transverse sinus was involved in 2 patients and multiple sinus involvement (superior sagittal sinus, transverse sinus and sigmoid sinus) were seen in 5 patients suggestive of cerebral venous thrombosis in these 11 patients (9.1%), of the total study patients presented with papilledema. Remaining 25 patients had either congenital hypoplasia or stenosis of transverse or sigmoid sinus or both and 76 patients showed normal MRV findings. Our findings are well supported by the study done by AI Hashel JY, in his prospective study of cerebral venous thrombosis he found that superior sagittal sinus thrombosis (54.5%) occur most commonly than transverse sinus thrombosis (52%) [26], and a retrospective study done by Brodsky MC and Vaphiades M on the patients with pseudotumour cerebri had reported almost similar findings in the MRI [27]. Raju K.V *et al.* in their study on patients with space occupying lesions reported that 56% of the patients presented had papilledema [25]. Also he mentioned that posterior fossa tumours presented with papilledema earlier but cortical and pituitary tumours present with late papilledema. Miller in his book had mentioned that the etiology is brain tumors in 71% of patients who had presented with bilateral papilledema [29]. Ridha *et al.* reported that findings suggestive of raised intracranial tension in a patient with IIH like presentation should prompt a careful evaluation of cerebral venous sinus with MR venogram which will be missed with MRI alone [30].

Conclusion

Ocular features are considered as the portal to the brain from which neurological disorders can be diagnosed. Early detection of intracranial space occupying lesions and cerebral venous thrombosis could be possible through ocular examination and it should be confirmed by imaging techniques. Thus neuroimaging helps in early diagnosis of several intracranial lesions in patients with papilledema, which provides better prognosis and saves the life of the patient by early intervention.

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