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Research Article

Diagnostic Yield of Neuroimaging with Magnetic Resonance Imaging in Glaucoma Clinics in A District General Hospital

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Abstract

Purpose:

To assess the diagnostic yield of neuroimaging with magnetic resonance imaging (MRI) ordered from glaucoma clinic in Ophthalmology department and compare it to the published literature.

Methods:

This retrospective case analysis included 50 consecutive eligible cases referred by the glaucoma team at The Worcestershire Acute Hospitals NHS Trust for neuroimaging with MRI between the period of 2018-2023.

Results:

The overall diagnostic yield was in 34% cases which is comparable to the published data from neuro-ophthalmology clinic where diagnostic yield was 28.9%. There are no published reports on diagnostic yield of neuroimaging from glaucoma clinics. Our diagnostic yield in cases of visual field progression with normal eye pressure was 28% which also matches the diagnostic yield from neuro-ophthalmology.

Conclusions:

In comparison to the diagnostic yield of neuroimaging studies in other specialties, neuroimaging with MRI of the brain requested by glaucoma service provide significant and relevant data. A more detailed study with large number is needed to fully establish the diagnostic yield from glaucoma clinics.

Introduction

Improvements in diagnostic imaging in the past several decades, has increased the ability of the clinicians to diagnose and treat disease.1 Neuroimaging provides valuable information about various conditions of the head and neck but at a considerable cost.2,3 Neuro-imaging diagnostic studies such as magnetic resonance imaging (MRI) are ordered frequently in ophthalmic practice. There are concerns raised about overuse of imaging, which may do little to alter outcome or management.4 In an era of rising litigation, costs and long waits, clinicians are expected to choose a diagnostic test that is high yield and cost-effective. There is paucity of data on the diagnostic yield of such investigations. The diagnostic yield of MRI tests has been reported for some specific conditions.4-9 We could not find a single study where diagnostic yield of MRI was assessed from general ophthalmology and glaucoma service.

We assessed the diagnostic yield of neuroimaging across all patients evaluated in a glaucoma service at the Worcestershire Acute Hospitals NHS Trust.

Methods

This retrospective review included 50 consecutive referrals for neuroimaging by our glaucoma service in ophthalmology to radiology department in last 5 years at the Worcestershire Acute Hospitals NHS for head and orbit evaluation for the following studies: CT (computerised tomography), CT angiography, MRI (Magnetic Resonance Imaging), MRA (Magnetic resonance angiogram) and Magnetic resonance venography(MRV).

The data was collected for a period of 5 years (2018-2023) from the practice of glaucoma service at the Worcestershire Acute Hospitals NHS Trust. There were no specific criteria for referral to radiology department for neuroimaging. This was solely based on clinical opinion of the specialist in the glaucoma clinic. Follow up imaging for known lesions were excluded. The audit approval was taken from the clinical governance division of the ophthalmology directorate at the Worcestershire Acute Hospitals NHS Trust.

Abnormal imaging findings were categorised as significant (one that elicited changes in management and or relevant (one that related to patient's ophthalmic complaint).

Data collected included demographic information, reason for imaging referral, imaging modality, and findings. Clinical data was obtained from ophthalmology electronic medical records including history, symptoms, examination results, diagnosis and management. Imaging findings were described by significance and relevance. Findings were defined as significant if they led to change in the clinical management. A finding was defined as relevant if it was related to the clinical symptoms & signs.

Results were then divided in to 1 of 5 groups:

1. Significant and relevant
2. Significant but not relevant,
3. Not significant but relevant,
4. Neither significant nor relevant,
5. Normal.

The percentage of tests with significant and relevant findings was defined as the diagnostic yield.

Subgroup analyses were performed by evaluating the diagnostic yield based on clinical presentation. The clinical presentation was divided in to the following categories:

1. Visual field progression with normal eye pressure
2. Reduced vision
3. visual field defect respecting vertical meridian
4. Suspected cranial nerve palsy
5. Headaches
6. Atypical optic nerve appearance.

Patients with multiple presentations, the chief presentation was used to assign the presentation category.

Results

The data from 50 patients met the inclusion criteria for this study. Mean age of this cohort was 54.7 years (range, 13-92 years). There were 34 female patients (68%) and 16 male patients (32%).

Out of 50 neuroimaging studies, 34% (17 patient) had significant and relevant findings to the patient's presentation. Majority of the patients (36%) were imaged for progressive visual field changes with normal eye pressure. 4% (2 patients) had unrelated significant findings – aneurysm & cyst which required further evaluation. In only 2 patients MRI revealed a finding that was relevant to the diagnosis but did not change the management. These included dilated optic nerve sheaths in a patient with bilateral papilledema and an empty Sella in a patient with headache. 16% (8 patients) cases had findings were not significant and not relevant. These cases mostly represented small vessel white matter ischaemic disease and thickening of mucosa of the sinuses. Of the 50 imaging studies performed, 31 (62%) were reported as normal.

Neuroimaging findings	% of total (exact number)
Significant & relevant	34% (17)
Significant & not relevant	4% (2)
Not significant and relevant	4% (2)
Not significant and not relevant	16% (8)
Normal	62% (31)

Table 1. Proportion of Significant and relevant imaging findings (N=50 patients)

Table 2 shows the diagnostic yield based on indication for neuroimaging. Patients with optic neuritis had a diagnostic yield of 71.4%, those with cranial nerve palsy had a diagnostic yield of 66.7%, and individual with optic disc oedema had a diagnostic yield of 75.0%. The neuroimaging done for atypical visual fields, atypical optic disc /pallor and reasons for increasing headaches did not result in any significant & relevant neuroimaging findings.

Indication	Total Number Out of 50	Significant & Relevant finding	%
Normal Tension glaucoma suspect	25	7	28.00%
Optic neuritis / neuropathy	7	5	71.40%
Cranial nerve Palsy	3	2	66.70%
Suspected disc oedema	4	3	75.00%
Headache	4	0	00.00%
Atypical disc +/- Pallor	5	0	00.00%
Atypical fields	2	0	00.00%
Total	50	17	34.00%

Table 2. Proportion of significant and relevant findings by indication for neuroimaging.

Discussion

The neuroimaging is quite common in glaucoma clinic as 20% of all glaucoma are normal tension glaucoma which is a diagnosis of exclusion. This is the first ever study reporting the diagnostic yield of neuroimaging in glaucoma clinic especially in normal tension glaucoma suspect cases. We found only one study reporting the diagnostic yield in neuro-ophthalmology cases.10 Mehta et al found that 28.9% of neuroimaging tests requested by neuro-ophthalmologists resulted in an abnormal finding relevant to the patient's neuro-ophthalmic condition and was clinically significant for the management of this condition.10 In our study we found that 28% of patients who were worsening with normal eye pressure had significant and relevant finding on neuro-imaging. It was surprising to see that most of these cases were older than 60 years. The most common teaching in glaucoma clinics is to consider neuroimaging in normal tension glaucoma suspect if younger than 60 years of age. This is a very useful finding and gives a useful benchmark for future comparisons but needs confirmation by a bigger study and other authors. The diagnostic yield was highest in cases of optic neuritis or disc oedema. This is in agreement with the publish data.

The diagnostic yield of CT and MRI in acute isolated third, fourth, and sixth nerve palsies to be 14% by Chou5 & 63% by Bendszus et al 6 in acute isolated sixth nerve palsy. We found a very high yield in cases of optic neuritis and disc oedema but numbers are really small. Mehta et al also reported high diagnostic yields were also observed in patients with thyroid eye disease, optic neuropathy, and optic neuritis.10

In our study, neuroimaging for increasing headaches & atypical visual fields or disc did not result in any significant & relevant neuroimaging findings, which is consistent with other similar studies.11-12

Our study has several limitations. The most obvious one is a very small sample size. Any analysis can be skewed significantly just by 1-2 cases. Second, in our study we defined significance as an abnormal imaging finding that elicited changes in management. It is important to realise that a normal imaging study also can elicit changes in management. In the current economic climate, it is important to use our limited resources to the best possible level. In the era of post-pandemic delays affecting the waiting times for such investigations, we need to improve the diagnostic yield of neuroimaging. The decision making by clinicians should be based on the patient's chief complaint, neuro-ophthalmic findings, and indications for imaging. Our results will form a basis for further research and will act as a useful benchmark for future comparisons.

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