ORIGINAL ARTICLE

The Urgency of Neuroimaging Among UK Neuro-Ophthalmologists: Consensus and Disagreement

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ABSTRACT

The timing of imaging in neuro-ophthalmology is critical. There are few published studies, however, that address the question of how urgently to request imaging for neuro-ophthalmic clinical scenarios. We therefore conducted a national survey of expert opinion on the urgency of neuroimaging in neuro-ophthalmology. We devised a list of 40 clinical scenarios, reflecting a wide range of neuro-ophthalmic presentations. For each scenario, respondents were asked to state how urgently they would obtain neuroimaging in day-to-day NHS (National Health Service) practice. There were five response options: “Emergency” (i.e., within 1 d), “Urgent” (i.e., within 1 week), “Semi-urgent” (i.e., within 1 month), “Observation” (only if not resolving after a period of observation [greater than 1 month]), and “Not normally scanned unless new features appear.” Respondents were recruited by e-mailing individuals who were on the UKNOSIG (UK Neuro-Ophthalmology Special Interest Group) mailing list. All were Consultant Ophthalmologists or Neurologists specialising in neuro-ophthalmology. Consensus was set at an a priori level of 80% agreement. Only 17 out of 40 scenarios met the criterion for consensus. Nine of these were for emergency/urgent imaging, three were for not imaging, and five were for semi-urgent imaging. For the remaining 23 scenarios, consensus was not reached. Unanimity (100% agreement) was not reached for any scenario. Agreement between neuro-ophthalmologists on the urgency of neuroimaging is patchy, with consensus for some clinical scenarios and disagreement for many. There is a need for a prospective study of neuroimaging in neuro-ophthalmology to determine whether timing of imaging influences outcomes.

Keywords: CT, imaging, MRI, neuroimaging, neuro-ophthalmology

INTRODUCTION

The risk of life-threatening pathology is higher in neuro-ophthalmology than in other ophthalmic subspecialties. Neuro-ophthalmic signs are frequently the presenting features of intracranial space-occupying lesions¹ and neuroimaging is therefore often required to exclude serious intracranial disease. For some patients, neuroimaging may also have an important role in reassurance and reducing health care utilisation.² Moreover, there are significant medicolegal consequences to missed or delayed diagnoses when patients with serious neurological conditions present first to ophthalmology. Malpractice claims arising

from neuro-ophthalmic cases have higher average payouts than most other ophthalmic subspecialties and also are harder to defend.³ For the aforementioned reasons, there is need for guidance on when to request neuroimaging in a range of clinical scenarios in neuro-ophthalmology. However, there are few published studies that address this question. Consequently, clinicians base their decisions regarding urgency on personal experience or expert opinion. Furthermore, advances in neuroimaging technology result in the need to regularly update any guidelines proposed.

The situation is complicated by health economic factors. In an idealised health care system with

unlimited resources, rapid neuroimaging might be offered to a wide range of neuro-ophthalmic presentations. However, in the NHS (National Health Service) there are constraints on radiology resources. As a result, imaging for neuro-ophthalmic conditions may occur less urgently than the requesting clinician would like.⁴ The urgency of neuroimaging in day-to-day practice in the NHS is therefore determined by a pragmatic balance between clinical judgement and pressures on imaging services.

Given the lack of an evidence base to resolve this issue, and the consequent absence of authoritative guidelines to direct clinicians, we aimed to conduct a national survey of expert opinion on the urgency of neuroimaging in neuro-ophthalmology. For a wide range of clinical scenarios, we sought to determine in which areas there was agreement between practitioners and where views differed. We aimed for this to serve as a guide to ophthalmologists and neurologists without specialist training in neuro-ophthalmology in determining scanning urgency, and as an aid to radiologists in allocating scan priorities.

MATERIALS AND METHODS

We devised a list of 40 clinical scenarios reflecting a wide range of neuro-ophthalmic presentations. We focused on areas where there is known difficulty in judging neuroimaging urgency, and introduced subtle variations between scenarios to probe factors that might influence practitioners' judgement. The first 14 scenarios dealt with III, IV, and VI nerve palsies (Table 1). The next 13 scenarios dealt with the anterior

visual pathway (Table 2). The final 13 scenarios covered Horner syndrome, nystagmus, and some miscellaneous conditions (Table 3). We kept the scenario descriptions intentionally brief to reduce the time needed to complete the survey. A standardised scenario format was used, to include age and any relevant additional risk factors. We instructed respondents to assume that there were no further hidden clinical details so that the clinical presentation could be considered isolated.

For each scenario, we asked respondents to state how urgently they would obtain neuroimaging (irrespective of whether it was computed tomography [CT] or magnetic resonance imaging [MRI]). We emphasised in the instructions that the question was about the *achievable* urgency of scanning in their day-to-day NHS practice, rather than the *ideal* urgency they would prefer. There were five response options (with definitions) for each scenario:

- "E: Emergency" (i.e., within 1 d)
- "U: Urgent" (i.e., within 1 week)
- "S: Semi-urgent" (i.e., within 1 month)
- "O: Observation" (only if not resolving after a period of observation [greater than 1 month])
- "N: Not normally scanned unless new features appear"

We sought to elicit responses from a representative body of recognised neuro-ophthalmologists in the UK so we e-mailed individuals who were on the UKNOSIG (UK Neuro-Ophthalmology Special Interest Group) mailing list. A filter on the survey required respondents to confirm that they were a Consultant Ophthalmologist or Neurologist, and further that they considered neuro-ophthalmology to be their main area of specialisation. Respondents who

TABLE 1. Survey responses for the 14 scenarios dealing with III, IV, VI nerve palsies.

Question no.	Scenario	E	U	S	O	N
1	Unilateral VI in 60-year-old diabetic	0	1	1	9	4
2	Bilateral VI in 60-year-old diabetic	1	6	4	3	1
3	Unilateral VI in a healthy 40-year-old	4	7	4	0	0
4	Sudden-onset unilateral IV in a healthy 40-year-old with no longstanding features and no head trauma	0	6	6	3	0
5	Sudden-onset unilateral IV in a healthy 65-year-old with no longstanding features and no head trauma	0	5	1	7	2
6	Vague-onset unilateral IV in a 40-year-old with longstanding (congenital) features	0	1	0	0	14 ^a
7	Complete III with pupil involvement in a 65-year-old diabetic	9 ^b	4 ^b	1	1	0
8	Complete III with no pupil involvement in 65-year-old diabetic	0	2	4	7	2
9	Partial III with pupil involvement in a 65-year-old diabetic	8 ^b	6 ^b	1	0	0
10	Partial III with no pupil involvement in a 65-year-old diabetic	2	2	4	5	2
11	Complete III with pupil involvement in a healthy 40-year-old	14 ^a	1	0	0	0
12	Complete III with no pupil involvement in a healthy 40-year-old	7 ^b	6 ^b	2	0	0
13	Partial III with pupil involvement in a healthy 40-year-old	14 ^a	1	0	0	0
14	Partial III with no pupil involvement in a healthy 40-year-old	7 ^b	5 ^b	2	1	0

The numbers refer to the number of respondents for a given urgency category. See Materials and Methods section for definitions of E (Emergency), U (Urgent), S (Semi-urgent), O (Observation), and N (Not normally scanned).

^aAreas of consensus on a single urgency category.

^bAreas of consensus for the combined (E/U) category.

TABLE 2. Survey responses for the 13 scenarios dealing with the anterior visual pathway.

Question no.	Scenario	E	U	S	O	N
15	Bilateral optic disc swelling with recent-onset headache in a 30-year-old	5 ^b	10 ^b	0	0	0
16	Asymptomatic bilateral optic disc swelling with drusen and normal visual function in a 30-year-old	0	4	2	1	8
17	Asymptomatic bilateral optic disc swelling with drusen and reduced visual function in a 30-year-old	0	6	4	1	4
18	Asymptomatic unilateral optic atrophy with mildly reduced visual function in a 60-year-old picked up incidentally by optician	0	0	14 ^a	1	0
19	Asymptomatic bilateral optic atrophy with mildly reduced visual function in a 60-year-old picked up incidentally by optician	0	2	12 ^a	1	0
20	Suspected unilateral typical (MS type) optic neuritis in a 30-year-old	0	1	8	4	2
21	Optic neuritis in a 30-year-old that does not fit the pattern for typical (MS type) optic neuritis	0	12 ^a	2	1	0
22	Unexplained bilateral visual loss in a 25-year-old (i.e., claims NPL; normal pupils, disc, fundus; but no positive functional features)	2	8	2	3	0
23	Suspected unilateral functional visual loss in a 25-year-old (i.e., claims 6/60 but no RAPD, normal exam, and positive functional features)	0	1	5	6	3
24	Suspected bilateral tobacco-alcohol/nutritional amblyopia in a 40-year-old alcoholic	0	0	12 ^a	1	2
25	Unexplained bilateral central scotomas in a 20-year-old (normal exam, normal retinal imaging, no functional features)	0	7	8	0	0
26	Asymptomatic bitemporal hemianopias picked up incidentally by optician in a healthy 45-year-old	1	9	5	0	0
27	Acute unilateral typical non-arteritic AION in a 55-year-old with hypertension	0	0	2	1	12 ^a

The numbers refer to the number of respondents for a given urgency category. See Materials and Methods section for definitions of E (Emergency), U (Urgent), S (Semi-urgent), O (Observation), and N (Not normally scanned).

^aAreas of consensus on a single urgency category.

^bAreas of consensus for the combined (E/U) category.

TABLE 3. Survey responses for the 13 scenarios dealing with Horner syndrome, nystagmus, and miscellaneous conditions.

Question no.	Scenario	E	U	S	O	N
28	Acute painful isolated Horner in a 40-year-old	8 ^b	6 ^b	1	0	0
29	Asymptomatic isolated Horner in a 40-year-old picked up incidentally by optician	0	1	9	3	2
30	Horizontal jerk nystagmus with 6-month history of oscillopsia in a 60-year-old	0	1	13 ^a	1	0
31	Horizontal jerk nystagmus in a 30-year-old picked up by optician, no oscillopsia	0	1	4	2	8
32	Downbeat nystagmus in a 60-year-old with 6-month history of oscillopsia	0	2	13 ^a	0	0
33	Superior oblique myokymia in a 40-year-old	0	1	5	2	7
34	Hemifacial spasm in a 40-year-old	0	1	9	2	3
35	Blepharospasm in a 40-year-old	1	0	4	0	10
36	Spasm of the near reflex (convergence spasm) in a 40-year-old	0	1	1	0	13 ^a
37	Convergence insufficiency in a 15-year-old	0	0	1	5	9
38	Unexplained deep orbital pain with no signs in a 30-year-old	0	1	7	3	4
39	Complex visual hallucinations in a 60-year-old with normal visual function	0	1	11	2	1
40	Repeated infrequent bilateral transient loss of vision in a 60-year-old	0	3	5	3	4

The numbers refer to the number of respondents for a given urgency category. See Materials and Methods section for definitions of E (Emergency), U (Urgent), S (Semi-urgent), O (Observation), and N (Not normally scanned).

^aAreas of consensus on a single urgency category.

^bAreas of consensus for the combined (E/U) category.

did not confirm these were excluded from the analysis. The survey was converted into an online tickbox format and was hosted on the UKNOSIG website for a period of three weeks. Responses were made anonymously.

An a priori level of 80% agreement was the criterion for defining consensus, as has been used in studies in other areas of medicine.⁵⁻⁷ Raw responses

of each respondent were pooled for each scenario. In addition, for further analysis, we also combined the first two response categories ("emergency" and "urgent") into a single category of "emergency/urgent." This was due to feedback from some respondents that even emergency scan requests would take more than 1 d in their hospitals, and therefore fall into the urgent category.

RESULTS

There were 15 respondents who all confirmed that they were Consultants with neuro-ophthalmology as their main area of specialisation. Of the 15, 2 were Consultant Neurologists and 13 were Consultant Ophthalmologists. Responses were complete for each respondent. The scenarios and corresponding response frequencies are given in Tables 1, 2, and 3. Areas of consensus have been highlighted.

Seventeen out of 40 scenarios met the criterion for consensus. Nine of these were for emergency/urgent imaging. Of these nine, six were for presentations of III nerve palsy: namely all of the four scenarios stating pupil involvement, as well as two scenarios without pupil involvement but in a younger patient. The other three scenarios for which there was consensus on emergency/urgent imaging were papilloedema with headache; an atypical optic neuritis; and an acute painful Horner syndrome.

Consensus was reached for semi-urgent imaging (within a month) for five scenarios. These were asymptomatic optic atrophy found incidentally in a 60-year-old, whether unilateral or bilateral; a typical presentation of suspected tobacco-alcohol/nutritional amblyopia; and two scenarios involving nystagmus (horizontal jerk or downbeat) in a 60-year-old with a 6-month history of oscillopsia.

No consensus was reached for any scenario for the response category of observation. However, for the response "not normally scanned," there were three scenarios that reached consensus. These were classic presentations of a decompensated IV nerve palsy; a non-arteritic anterior ischaemic optic neuropathy; and spasm of the near reflex.

For the remaining 23 out of the 40 scenarios, consensus was not reached. Unanimity (100% agreement) was not reached for any scenario using the urgency categories offered for selection, nor even with the adapted combined "emergency/urgent" response category.

DISCUSSION

To our knowledge, this is the first attempt at assessing areas of consensus and disagreement regarding the urgency of imaging in neuro-ophthalmology. The respondents were all Consultants in the UK whose main specialisation was neuro-ophthalmology, and can therefore be considered to be a representative body of experts in this area. The total number of respondents was small ($n=15$); however, neuro-ophthalmology is a small field and the respondents comprise the majority of neuro-ophthalmologists in the UK. The principal weakness of this study is that it reports neuro-ophthalmologists' *stated* practice, which may be influenced by recall bias. Audit of *actual*

practice would be more accurate but would be logistically difficult across so many hospitals. In addition, there are many neuro-ophthalmic scenarios that were not addressed in this survey. Furthermore, the simplification of the scenarios is not truly reflective of real patients, where multiple additional clinical and psychosocial factors play a part. We would therefore caution against a simplistic interpretation of the findings. Nevertheless, we believe this serves as a valid qualitative reflection of expert opinion in a controversial area where an adequate evidence base is lacking.

Consensus was reached regarding the need for emergency/urgent imaging in all III nerve palsy scenarios, except for the case of an older diabetic patient without pupil involvement (whether complete or partial). Established neuro-ophthalmic teaching states that non-involvement of the pupil in a III nerve palsy is reassuring with the following exceptions: in younger patients; when the palsy is not complete; or when the palsy is not isolated.⁸ Our respondents agreed with the need for urgent scanning in younger patients, regardless of the pupil status. However, they did not all agree that an isolated, complete III nerve palsy with no pupil involvement in an older diabetic is automatically reassuring. There was also complete disagreement about the urgency of scanning an older diabetic patient without pupil involvement when the palsy was partial.

There was no consensus in five of the six scenarios relating to VI and IV nerve palsies. This lack of agreement mirrors the conflicting conclusions of several series of ocular motor mononeuropathies in the recent literature.^{9–13} Variant conclusions are not unexpected in these series due to their differing designs, study populations and imaging protocols. The only area of agreement in this section of the survey was for the case of a longstanding, decompensated, congenital IV nerve palsy where consensus was achieved that imaging was not normally performed. This is the established teaching, with some authors arguing further that even vasculopathic IV nerve palsies do not need neuroimaging if they are isolated.¹⁴

There was consensus on the need for emergency/urgent imaging in a young patient with optic disc swelling and recent headache, but no agreement on imaging in disc swelling where drusen were present. Papilloedema is universally recognised as a red-flag sign in headache,¹⁵ but the presence of drusen is not necessarily reassuring as drusen can coexist with papilloedema.¹⁶ Some, but not all of the respondents felt that the presence of drusen did not obviate the need for urgent neuroimaging, especially with reduced visual function. Consensus was reached for semi-urgent imaging in unilateral or bilateral optic atrophy in an older patient diagnosed incidentally by an optician, associated with mildly reduced

visual function. There was no agreement for imaging of multiple sclerosis-type optic neuritis, but consensus was reached for urgent imaging in the scenario of atypical optic neuritis, in line with recent recommendations.^{17,18}

There was disagreement regarding the urgency of imaging of incidentally diagnosed Horner syndrome, whereas for acute painful Horner syndrome, there was consensus on emergency/urgent imaging. Internal carotid artery (ICA) dissection can present as Horner syndrome, with accompanying pain highly suggestive of this aetiology. It has been found that the period of risk for embolic events following ICA dissection is approximately 1 month.¹⁹ An incidental finding of Horner presumes that the onset was likely to be long ago, meaning the patient is past the period of embolic risk from carotid dissection even if that were the underlying cause.

The aim of this study was not to provide didactic guidance regarding the urgency of neuroimaging in neuro-ophthalmology, but rather to assess the range of accepted practice amongst a representative body of specialists. This topic would be advanced considerably by a national, prospective audit with case ascertainment from radiology departments for unbiased capture, which included follow-up to find out whether variations in the timing of scanning actually affect outcomes.

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