Original

A 6-year Retrospective Review of Indications and Computed Tomographic Imaging Findings of Neuro-ophthalmic and Orbital Disorders in Kaduna

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Abstract

Background: Neuroimaging is an important modality for the investigation of neuro-ophthalmic and orbital conditions. These investigations are expensive but describe the diagnostic yield of neuroimaging in patients referred for neuro-ophthalmic services. The aim of this article is to find the common clinical indications for orbito-cranial computed tomography (CT), and to compare the CT findings.

Method: Retrospective review of records for referral indications and CT findings of 211 patients referred to the radiology department of National Ear Care Centre (NECC) for imaging between January 2017 and December 2022. Statistical Package for Social Sciences version 26 software was used for data analysis.

Result: Both presenting complaints and CT findings were diverse, with proptosis having the highest frequency (14.75%), followed by those with loss of vision (11.27%). The CT showed periodontal mass and soft tissue swelling (16.26%) as the lead finding, followed by proptosis (12.67%) and paranasal masses (12.04%).

Conclusion: Computed tomography has become the primary radiological procedure for the diagnosis and management of most orbital and ocular disorders. It is useful in characterizing and localizing almost all lesions in ophthalmology.

Keywords: Clinical Indications, CT imaging, neuro-ophthalmic, disorders.

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Introduction

The invention of CT, coupled with the use of high resolution multi-planar scanners, has changed the diagnosis and management of ocular and orbital diseases, hence, presently, making it an indispensable imaging tool in the evaluation of most orbital and ocular lesions.[1,2] It has been shown to be useful for demonstrating the detailed anatomy and pathology of the orbit and its surrounding soft structures, which ordinarily would not have been visualized.[3,4] This modality allows the researchers to discern the location, extent and configuration of the lesion and its effect on adjacent structures.[2]

Computed tomography has superior spatial resolution, aided by the natural contrast between bone, soft tissues, air, and fat.[1] It is also, a valuable tool in the management of patients with proptosis, because it provides useful information regarding possible etiology and extent of causative lesion.[4] The short scanning time is advantageous to reduce motion effects and to avoid the need for sedation. It is also the modality of choice for evaluating traumatic injury and for visualizing foreign bodies,[5-9] but it is expensive and may not be affordable by many people in the developing countries.[10] However expensive and unavailable this modality is, a good diagnostic workup and collaboration between the radiologist and ophthalmologist will always give an optimal diagnostic yield with subsequent efficient management.[1] This article aims to both find the common clinical indications for orbito-cranial CT and the imaging findings.

Method

This retrospective review included data of the patients referred to the Radiology department for CT imaging at NECC Kaduna from January 2017 to December 2022. Data collection included indications for imaging referrals and findings both from within and from other hospitals following the clinical diagnoses of suspected neuroophthalmic diseases. Clinical history was obtained, including principal symptoms, examination results and diagnosis. An analysis of their request forms, folders, duplicate copies of radiology reports, and soft copies of CT images of the patients were reviewed independently by two consultant radiologists and a consultant ophthalmologist. A proforma was developed and used to document the obtained information about the patients. All data was tabulated, entered and analyzed using the Statistical Package for Social Sciences (SPSS 26, Armonk, NY: IBM Corp).

Results

Two hundred and eleven (211) patients were included in this 6-year review, 103 males (48.8%) and 108 females (51.2%), sex ratio 1:1 (table 1). The age range was between 8 months and 75 years, with a mean age of 28 years. The age range with the highest frequency of occurrence was 0-10 years which constituted 30.3% of the population, followed by those within the 20-29 (18%), while the least frequency (3.8%) was among those that are 70 years and above.

Proptosis had the highest frequency of presentation (14.75%), followed by those with loss of vision (11.27%). Presentation due to road traffic accident (RTA) contributed 8.61% of the patients (table 2). Other indications, which constituted 1.86%, included fever, weight loss or gain, neck swelling and retroviral disease (RVD).

Periorbital mass and soft tissue swelling (16.26%) was the lead finding, followed by proptosis (12.67%) and paranasal masses (12.04%) (table 3). Also, 3.61% of the patients had periodontal bone fractures. Other findings which included eroded mandible, zygomatic fracture, carotid space mass, temporal fossa mass and ballooned frontal sinus constituted 5%. However, 37 patients (7.44%) had normal CT images.

Table 1: Age and sex distribution of the patients

Age	M	F	T	Percent
0-9	20	44	64	30.3
10-19	8	9	17	8.1
20-29	15	23	38	18.0
30-39	20	11	31	14.7
40-49	15	4	19	9.0
50-59	20	4	24	11.4
60-69	2	8	10	4.7
70+	3	5	8	3.8
Total	**103**	**108**	**211**	**100**

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Table 2: The distribution of clinical information of the patients

Clinical information	Freq	Percent
Proptosis	72	14.75
Loss of vision	55	11.27
Eye pain/swelling	52	10.66
RTA	42	8.61
Orbital/lid/Palpebral mass/dermoid cyst	40	8.20
Leukocoria/retinoblastoma/ neuroblastoma	39	7.99
Ptosis/eye palsy/frozen globe/ Inability to close eye	29	5.94
Headache	28	5.74
Optic atrophy /papillodema /glaucoma	21	4.30
Eye redness/ discharge /teary	15	3.07
Ocular injury/mass	10	2.05
Double vision/ squint/ nystagmus	8	1.64
Conjunctival cyst/mass	7	1.43
Nasal fracture/depressed bridge/reconstruction	7	1.43
Sinus mucocele	7	1.43
Hypertension	6	1.23
Head swelling	5	1.02
Reduced eye size	5	1.02
Loss of consciousness/convulsion	5	1.02
Lymphadenopathy syndrome	4	0.82
Dystopia	4	0.82
Facial swelling/pain	4	0.82
Nausea/vomiting	4	0.82
Photophobia	3	0.62
Diabetic	3	0.62
Crepitus orbicularis	2	0.41
Vertigo	2	0.41
Others	9	1.86
Total	**488**	**100**

Table 3: The distribution of CT findings among the patients

CT findings	Freq	Percent
Orbital/periorbital mass/soft tissue swelling	81	16.26
Proptosis, displaced/distorted globe	63	12.67
Para-nasal-sinus masses/opacifications	60	12.04
Normal findings	**37**	**7.44**
Calcifications	32	6.43
Intracranial lesions	26	5.22
Peri-sinus bony Erosion	25	5.02
Enlarged/narrowed optic nerve/canal	22	4.43
Periorbital bone fractures	18	3.61
Enlarged recti muscles	15	3.01
Eroded/expanded orbital bone	12	2.41
nasolacrimal duct mass/blockage	10	2.01
lid mass/soft tissue swelling	9	1.81
Nasal mass/ opacification	8	1.61
Chiasm/Suprasellar mass	7	1.41
Thickened cornea/mass	7	1.41
Compressed/displaced optic chiasm/nerve	7	1.41
Temporal mastoids sclerosis	6	1.20
Eroded/opaque tegmen	5	1
Obscured auricular chain	5	1
Entrapped/Ill-defined rectus	5	1
Obscured optic nerve	5	1
Non-visualised/Blurred lens/	5	1
Eroded pterygoid bone/plate	3	0.60
Nasal bone fracture	3	0.60
Petrous pyramid fracture	3	0.60
Stretched superior orbital vein	2	0.40
Herniated orbital fat	2	0.40
Fractured lamina papereae	2	0.40
Deviate oropharyngeal airway	2	0.40
Sclerosed base of skull	2	0.40
Enlarged intrachoanal space	2	0.40
Infraocular mass	2	0.40
Others	5	1
Total	**498**	**100**

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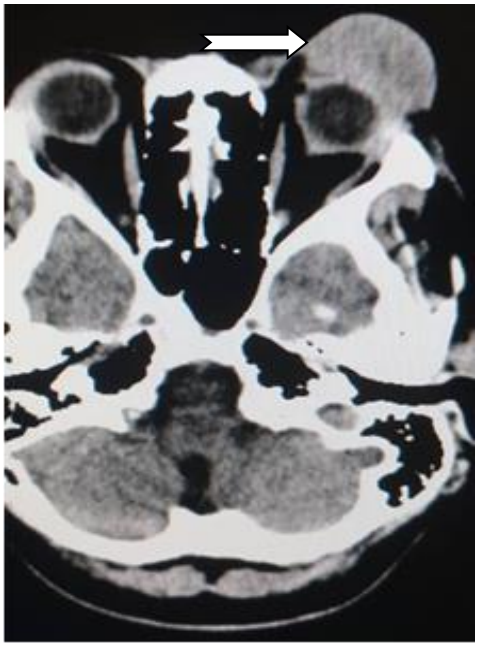

Figure 1: CT axial slice showing a soft tissue mass in the left eye lid (white arrow)

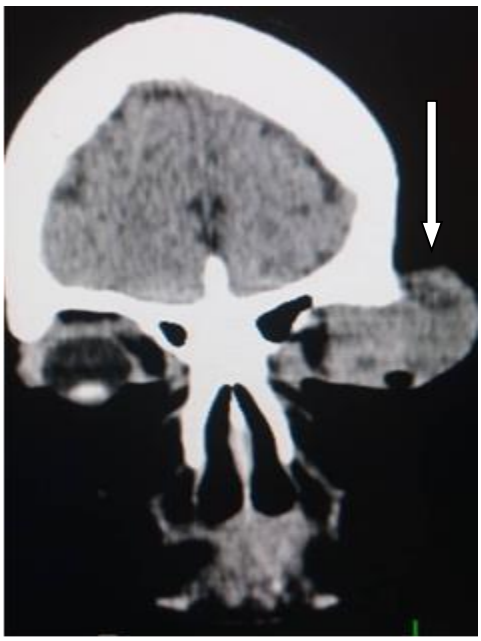

Figure 2: CT coronal slice showing same soft tissue mass in the left eye lid (white arrow)

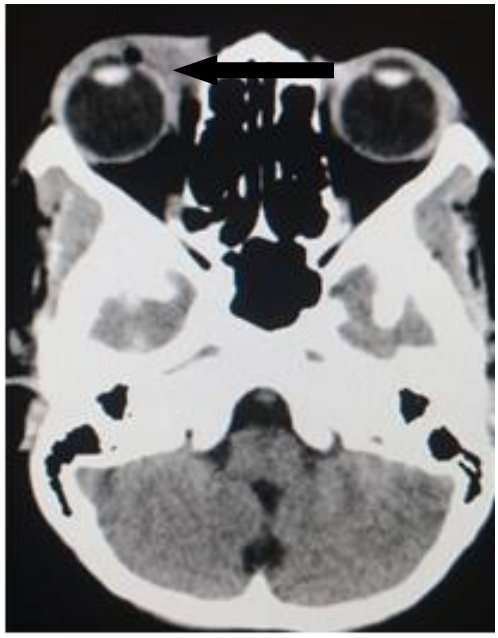

Figure 3: Axial slice shows a lachrymal tumour (black arrow) in the medial aspect of the right orbit

Figure 4: Separated CT of the facial bone. The tumor which originated from the right orbit, shows lytic destruction of the orbital floor, medial wall and the entire ipsilateral maxillary bone, with extension to the contralateral side (see arrow)

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Discussion

Often the ophthalmologist is the first clinician to evaluate patients with orbital abnormalities, who then refer such cases to the radiologist. The imaging of such cases by the CT show details of the orbits and visual pathways, which becomes crucial for the diagnosis and management of these conditions.[7,9] With the advent of the first CT imaging by Hounsfield in 1973, the diagnoses and management of ophthalmic diseases became easier.[2,11] In the decades following this discovery, there have been countless advances in this imaging modality that have revolutionized image resolution, evaluation and management of neuro-ophthalmic disorders.[12] Two hundred and eleven patients were included in this six-year review, with 103 males (48.8%) and 108 females (51.2%) involved, giving a ratio of 1: 1. The age range was between 8 months and 75 years. These findings differed from those of Osaguona and Pradhan whose age ranges were 5 months to 82 years each.[5,7] However, Osaguona et al had a comparative sex ratio of 1: 1.33 in favour of the females.[5] Our findings showed a relatively young population, with a mean age of 28 years while Osaguona had a mean age of 33 years.[5] The age range with the highest frequency of occurrence is that within the first decade of life which constituted 30.3% of the population, followed by those within the third decade of life (18%) while the least was among those that are 70 years and above, making up 3.8%. The high occurrence in the 3rd decade is probably attributed to incidence of trauma among the youths which are within the most productive segment of society.

In our study, proptosis has the highest frequency of presentation (14.75%) for CT scan, followed by loss of vision (11.27%). Compared to the finding of Osaguona, visual loss (32.1%), proptosis (22.3%), and headache (19.6%) were the most common presenting features.[5] Mehta et al also found that 19% of the patients referred to them for scanning were as a result of visual loss,[13] while Wu et al reported 13% of proptosis as the commonest reason for orbital imaging.[14] Farooq et al found out that neoplasms were the most common causes of proptosis in their sample population in Pakistan, constituting 33%.[15] In their different studies, Kim et al and Chalwa et al had higher values of 55% (4.8 times) and 47% (4.17 times) of loss of vision as reasons for CT scans.[12,16] Presentation due to road traffic accident (RTA) contributed 8.61% among our patients. This value is higher than Farooq's 5% in Pakistan[15] but lower than the value of 12.1% obtained by Ogbeide et al in Nigeria.[4]

The CT showed periodontal mass and soft tissue swelling (16.26%) as the lead finding, followed by proptosis (12.67%) and paranasal masses (12.04%). However, Osaguona et al's findings were optic atrophy (14.3%), optic-disc swelling (8%), and proptosis (8%) as the most common signs.[5] Also, 3.61% of the patients had periodontal bone fractures. Other findings which included eroded mandible, zygomatic fracture, carotid space mass, temporal fossa mass and ballooned frontal sinus constituted 5%. Generally, our patients presented relatively early enough, implying that patients have good management. Our study showed that 37 patients (7.44%) had normal CT images. This finding is low compared to the 25% of normal CT findings in the study by Osaguona et al.[5] The difference between these findings could be since our patients were from different health facilities from within and outside Kaduna who will normally visit our facility just for the CT imaging.

Computed Tomography is useful in the characterization of the nature and precise location of a lesion within the orbit; and to demonstrate the extension of the orbital lesion into contiguous structures.[1] However, MRI has many advantages, including high soft tissue contrast and multiplanar imaging capability. When compared to CT, its major drawbacks are poor bone imaging, comparatively high cost, longer image acquisition times and less availability.[5] A combination of CT with MRI may offer greater accuracy in evaluating the status of the surrounding bony structures.[9, 16-18]

Implications of the findings of this study

The implication of this study is that CT has immensely changed the pathways of neuro-ophthalmic disease management, since edges of pathologic lesions are well identified and surgically taken care of. This imaging modality has made diagnoses and management of these patients easier and efficient.

Strengths and limitations of the Study

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Although the use of CT has been greatly diminished by magnetic resonance imaging (MRI), it is still the technique of choice for the investigation of patients under certain conditions, such as lower cost, fast scan, easily accessible, and easy to use. It is essential to emphasize that there are few disadvantages of CT, which include limited availability in small facilities or rural medical centres, high cost for a scan session, and the use of ionizing radiation.

Conclusion

Computed tomography has become the primary radiological procedure for the diagnosis and management of most orbital and ocular disorders. It is useful in characterizing and localizing almost all lesions in ophthalmology.

Declarations

Ethical Consideration: Ethics approval for the conduct of this review (NECC/ADM/214/VIII/255 dated 30th June 2023) was given by the ethics committee of the National Ear Care Centre, Kaduna

Authors' Contribution: TS Baduku (Concept development, coordinated data collation, contributed to writing the script). AB Silas (Helped to check for more clinical information from the archives of the hospital, contributed to writing the script). OO Omisakin (Helped to check for more clinical information from the archives of the hospital, contributed to writing the script). EA Brai (encouraged the research, helped to check for more clinical information from the archives of the hospital, contributed to writing the script)

Conflict of interest: There is no conflict of interest.

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