Case Report

Neurofibromatosis with pulsating exophthalmos

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Abstract

Background: Neurofibromatosis (NF) is a neurocutaneous disorder which involves many organs in the body. There are two types: NF-1 and NF-2. Orbital manifestation is a rarity in NF-1, and it involves dysplasia of the sphenoid bone resulting in herniation of the temporal lobe and subarachnoid space into the orbit culminating in pulsating exophthalmos.

Aim: To highlight the clinical presentation and radiological investigation of this rare ocular manifestation of NF-1.

Methods: A case report.

Results: The case of a 20-year-old male student presenting with a pulsating right eye swelling of about 17-year duration is presented. There was a family history of a first-degree relative with multiple skin swellings. Plain skull radiograph and cranial computed tomography (CT) scan were done and both revealed absence of the right sphenoid bone with herniation of the right temporal lobe and cerebrospinal fluid space into the right orbit. The patient was subsequently lost to follow-up.

Conclusion: Pulsating exophthalmos is a complication of sphenoid dysplasia, a rare component of NF-1. Plain skull radiograph and cranial CT scan are two important radiological imaging modalities for investigating patients with such presentation.

Keywords: Computed tomography scan, neurofibromatosis, pulsating exophthalmos, skull radiograph

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INTRODUCTION

Neurofibromatosis (NF) is the most common of the phakomatoses or neurocutaneous disorders which are a group of diseases of different aetiologies but characterised by common lesions in the skin, retina and nervous system and are developmental.[1,2] Other phakomatoses are tuberous sclerosis, Sturge–Weber syndrome, Von Hippel–Lindau disease, basal cell nevus syndrome, ataxia-telangiectasia and oculocutaneous melanosis.[2-4] NF is an inherited disorder resulting from dysplasia of the derivatives of the primary germ layers that may affect any organ system.[5] NF is broadly divided into two types: NF-1 and NF-2. NF-1 is referred to as von Recklinghausen's disease or peripheral NF while NF-2 is referred to as central NF. Both are autosomal dominant with a defect in the long arm of chromosome 17 in NF-1 and chromosome 22 in NF-2.[2,3,6,7]

NF-1 is the most common of the phakomatoses and occurs in every 2000–3000 births.[1,6] Although autosomal

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dominant, 50% of cases are due to spontaneous mutation.[1,2,7,8] Paternal age <35 years is a predisposing factor to developing NF-1.[9] NF-1 accounts for 90% of all cases of NF. The diagnosis of NF-1 is made based on the presence of at least two of the major criteria listed below.[3,5,6]

1. More than 6 café au lait spots >5 mm in greatest diameter (>15 mm in post-pubertal patients)
2. Two or more neurofibromas of any type or one plexiform neurofibroma
3. Axillary or inguinal area freckling
4. Optic glioma
5. Two or more lisch nodules of the iris
6. Distinctive osseous lesions, for example, sphenoid dysplasia and pseudoarthrosis
7. First-degree relative with NF-1 as diagnosed by above criteria.

There are also minor criteria which support the diagnosis. These include small stature, macrocephaly, scoliosis, pectus excavatum, hamartomatous lesions and neuropsychological abnormalities.[3]

Apart from optic glioma, which can present with ocular symptoms, sphenoid wing dysplasia with herniation of the temporal lobe into the orbit can present with pulsating exophthalmos or enophthalmos.[9]

This case is being presented because of its rarity. To the best of our knowledge, this is the first reportable case of pulsating exophthalmos investigated with computed tomography (CT) scan in our centre. This case report will help elucidate the clinical presentation and radiological management of pulsating exophthalmos in NF.

CASE REPORT

E.O, a 20-year-old male student, presented at the Ophthalmology Clinic of the University of Benin Teaching Hospital with right eye swelling of about 17-year duration (swelling was noticed when patients were about 3 years old) which had increased progressively. The swelling was not painful and was not associated with visual loss. The patient's younger brother had multiple swellings on the skin which were noticed at birth. On presentation at the ophthalmology clinic, there was proptosis of the right eye with visible pulsation. There was no conjunctival injection, chemosis or corneal ulceration. Visual acuity (VA) was mildly reduced on the right (VA – 5/6 for the right eye and 6/6 for the left eye). Fundoscopy revealed an essentially normal optic disc with no evidence of cupping. Ultrasound scan showed a normal eye globe with axial length of 22 mm with a normally sited intraocular lens. The vitreous humour, retina and retrobulbar structures

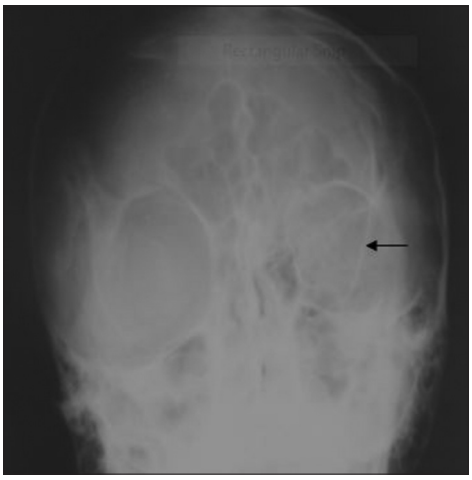

Figure 1: Postero-anterior skull radiograph showing absence of the innominate line on the right and its presence on the left (black arrow)

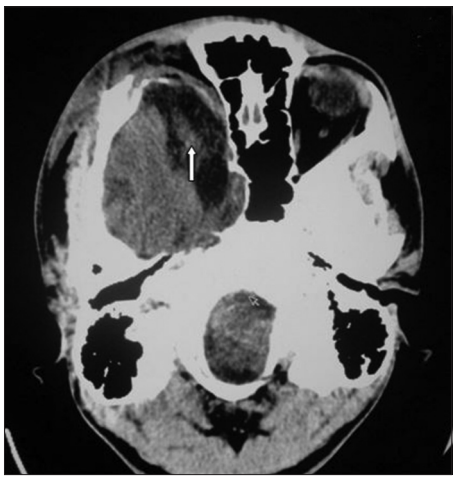

Figure 2: Cranial computed tomography scan showing absent right sphenoid and presence of the temporal lobe and some cerebrospinal fluid in the ipsilateral orbit (white arrow)

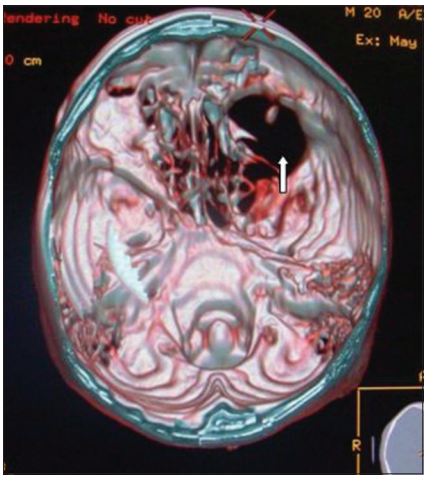

Figure 3: Volume-rendered computed tomography image showing absence of the greater wing of the right sphenoid bone (white arrow)

were essentially normal. Plain radiographs of the orbit revealed absence of the innominate line on the right often described as bare orbit [Figure 1]. The enhanced CT scan revealed right sphenoid wing absence with herniation of the temporal lobe into the right orbit [Figure 2]. This was further demonstrated on CT scan volume-rendered image [Figure 3]. There was no demonstrable intracerebral lesion. The patient was lost to follow-up as he could not afford the workup for surgery.

DISCUSSION

NF-1 is an autosomal dominant disorder caused by mutations of the NF gene; a tumour suppressor gene located in the long arm of chromosome 17.[10,11] The defective gene results in dysplasia of the mesodermal and neuroectodermal tissues, hence almost all germ cell layers of the body are affected. NF-1 occurs worldwide amongst all races. Males and females are equally affected.[5] In NF-1, the skin, nervous system, bones, endocrine glands and sometimes other organs show the presence of congenital anomalies which are often benign. Pulsating exophthalmos is one of the ocular manifestations of NF-1.[5] Other ocular features include buphthalmos, pigmented iris hamartoma (lisch nodules seen on the slit lamp), optic nerve glioma and choroidal hamartoma.[5] Pulsating exophthalmos, which is often unilateral, results from absence of the sphenoid wing with subsequent enlargement and herniation of the temporal lobe and subarachnoid space into the ipsilateral orbit.[3,5,12] Sphenoid dysplasia may show as hypoplasia or aplasia of the greater wing of the sphenoid bone or as hypoplasia and upwards displacement of the lesser wing of the bone.

Jacquemin *et al.*[10,11] proposed that the sphenoid wing changes occur only in the presence of tumour in the superficial temporal fossa or deep orbit. This is in contradistinction to the case presented as no intracerebral or orbital tumour was seen. Sutural defects in the lambdoid suture which are often irregular but sharply demarcated are seen in NF-1.[13] Bone margins are not sclerosed and it is not related to overlying cutaneous or underlying intracranial tumours. Macrocranium and macrocephaly have also been reported amongst patients with NF-1.[5] Pathogenesis has been suggested to be due to increased glial cell production resulting in symmetric or asymmetric increase in brain size.[5] Other skeletal manifestations in the skull include optic foramen enlargement, deformity and decreased size of the ipsilateral ethmoidal and maxillary sinuses and dysplasia of the mandible and zygomatic bones.[14]

A neurofibroma of a spinal nerve root is dumb-bell shape, having both intra- and extra-spinal components causing widened neural foramina.[14] Meningeal diverticula through the widened neural foramina, called lateral intrathoracic meningocele, can occur producing posterior vertebral scalloping, kyphosis and scoliosis (often short segment and sharp angle).[13,15] However, there was no clinical sign of kyphosis or scoliosis in this case being presented.

The imaging modalities that can be used to investigate patients with pulsating exophthalmos in NF include plain film, CT scan, magnetic resonance (MR) imaging and angiography.

Plain skull radiographs may show soft tissue swelling over the orbit with absence of the innominate line giving the appearance of a "bare" orbit.[16] This description of bare orbit was seen in the case being presented. However, orbital meningioma and metastases can also produce "bare" orbit.[16]

Cranial CT scan will better demonstrate plain film findings, and herniation of the temporal lobe and exophthalmos can be well appreciated. Volume-rendered CT image demonstrated sphenoid wing absence elegantly [Figure 3]. The presence of neurofibromas which may be related to the bony dysplasia can also be demonstrated.[12]

MR imaging is very important in NF-1 patients and is recommended as a screening tool in patients with NF because of the large number of asymptomatic lesions seen in these patients.[8] It has good soft tissue resolution and does not use ionising radiation though expensive and not readily available. It helps to demonstrate, characterise and define most of the soft tissue tumours seen in NF-1. However, MR imaging was not done for this patient as it is not available in our centre.

The management of NF-1 is a multidisciplinary approach involving the clinical geneticist, neurologist and surgeon.[17] The neurofibromas are surgically removed, but complete removal is rarely achieved. The use of drugs such as thalidomide, vinblastine, peginterferon alfa-2b and pirfenidone is being studied.[18]

CONCLUSION

Pulsating exophthalmos can result from dysplasia of the greater wing of the sphenoid in NF-1, and the role of radiological imaging has been highlighted.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Fortman BJ, Kuszyk BS, Urban BA, Fishman EK. Neurofibromatosis type 1: A diagnostic mimicker at CT. Radiographics 2001;21:601-12.
2. Sutton D, Stevens J, Miszkiel K. Intracranial lesions (1). In: Sutton D, editor. Textbook of Radiology and Imaging. 7th ed. Philadelphia: Elsevier, 2003; 1723-66.
3. Gunny RS, Kling Chong WK, Paediatric neuroradiology. In: Adam A, Grainger RG, Dixon AK, Allison DJ, editors. Grainger and Allison Diagnostic Radiology: A Textbook of Medical Imaging. 5th ed. Philadelphia: Elsevier, 2008; 1653-701.
4. Baskurt E. Cranial and spinal imaging. In: Gay SB, Woodcock RJ, editors. Radiology Recall. 2nd ed. Philadelphia: Lippincott Williams and Wilkins, 2008; 700-70.
5. Dahnert W. Radiology Review Manual. 6th ed. Philadelphia: Lippincott Williams and Wilkins, 2007; 316-9.
6. Levy AD, Patel N, Dow N, Abbott RM, Miettinen M, Sobin LH. From the archives of the AFIP: Abdominal neoplasms in patients with neurofibromatosis type 1: Radiologic-pathologic correlation. Radiographics 2005;25:455-80.
7. Patronas NJ, Courcoutsakis N, Bromley CM, Katzman GL, MacCollin M, Parry DM. Intramedullary and spinal canal tumors in patients with neurofibromatosis 2: MR imaging findings and correlation with genotype. Radiology 2001;218:434-42.
8. Bognanno JR, Edwards MK, Lee TA, Dunn DW, Roos KL, Klatte EC. Cranial MR imaging in neurofibromatosis. AJR Am J Roentgenol 1988;151:381-8.
9. Bunin GR, Needle M, Riccardi VM. Paternal age and sporadic neurofibromatosis 1: A case-control study and consideration of the methodologic issues. Genet Epidemiol 1997;14:507-16.
10. Jacquemin C, Bosley TM, Liu D, Svedberg H, Buhaliqa A. Reassessment of sphenoid dysplasia associated with neurofibromatosis type 1. AJNR Am J Neuroradiol 2002;23:644-8.
11. Jacquemin C, Bosley TM, Svedberg H. Orbit deformities in craniofacial neurofibromatosis type 1. AJNR Am J Neuroradiol 2003;24:1678-82.
12. Chung EM, Specht CS, Schroeder JW. From the archives of the AFIP: Pediatric orbit tumors and tumorlike lesions: Neuroepithelial lesions of the ocular globe and optic nerve. Radiographics 2007;27:1159-86.
13. Rogers LF, Auringer ST. The congential malformation syndromes: Osteochondrodysplasias, dysostoses and chromosomal disorders. In: Juhl JH, Crummy AB, Kuhlman JE, Paul LW, editors. Paul and Juhl's Essential of Radiologic Imaging. 7th ed. Philadelphia: J B Lippincott company, 1998.
14. Akadiri O, Jackson I. Craniofacial neurofibromatosis type 1: Clinical features, challenges of management, and a report of 2 Nigerian patients. Int J Head Neck Surg 2008;3:1-7.
15. Wakely SL. The posterior vertebral scalloping sign. Radiology 2006;239:607-9.
16. Chapman S, Nakielny R. Aids to Radiological Differential Diagnosis. 4th ed. Edinburg: Elsevier, 2003; 375-96.
17. Hope RA, Longmore JM, McManus SK, Wood-Allum CA. Oxford Handbook of Clinical Medicine. 4th ed. Oxford: Oxford University Press, 1998; 474-5.
18. Cai W, Kassarjian A, Bredella MA, Harris GJ, Yoshida H, Mautner VF, *et al.* Tumor burden in patients with neurofibromatosis types 1 and 2 and schwannomatosis: Determination on whole-body MR images. Radiology 2009;250:665-73.