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Case Report

Central nervous system manifestations of neurofibromatosis type 2: A case report ☆

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ARTICLE INFO

Article history:
Received 31 December 2022
Revised 29 April 2023
Accepted 4 May 2023

Keywords:
Neurofibromatosis type 2
Schwannoma
Meningioma
Ependymomas

ABSTRACT

Neurofibromatosis type 2 (phacomatosis) is a rare inherited autosomal dominant condition defined by the development of numerous central neuronal tumors. In addition to classic intracranial schwannomas, intracranial and spinal meningiomas, and intramedullary ependymomas, it can be associated with a few cutaneous abnormalities. In this report, we discuss the case of a 21-year-old female who was examined for persistent headache with cutaneous masses and bilateral hearing loss. Magnetic resonance imaging of the cranium and the whole spine detected multiple meningiomas, intracranial, and intramedullary tumors.

Introduction

NF2 is a rare genetic disorder, making it less prevalent than NF type 1 with an incidence of one in 25,000-40,000 individuals [1]. This entity has an autosomal dominant inheritance pattern and no preference for race or gender. It is believed that around half of the cases are inherited, with the other half being the outcome of new, de novo mutations [2]. There are 2 subgroups: NF2 type 1 (Gardner type): a late start with scwannoma of VII that is less evolutif and has fewer related tumors, and NF2 type 2 (Wishart-Lee-Abbot type): an early start with many tumors and a juvenile character like the case of our patient [3]. The expression and complications of NF2 disease are indeed very varied, necessitating a multidisciplinary approach to improve outcomes. The aim of this report is to present a case of NF2 in which diagnosis was established based on imaging.

Case report

A 21-year-old maghrebin female without a significant medical history presented with 1 year history of chronic headache, limb weakness, bilateral hearing loss, and skin lesions, with no family history of neoplasia. A general physical examination revealed an oriented and alert patient with normal cognitive function. She was afebrile with normal vital signs. There

☆ Competing Interests: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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https://doi.org/10.1016/j.radcr.2023.05.011

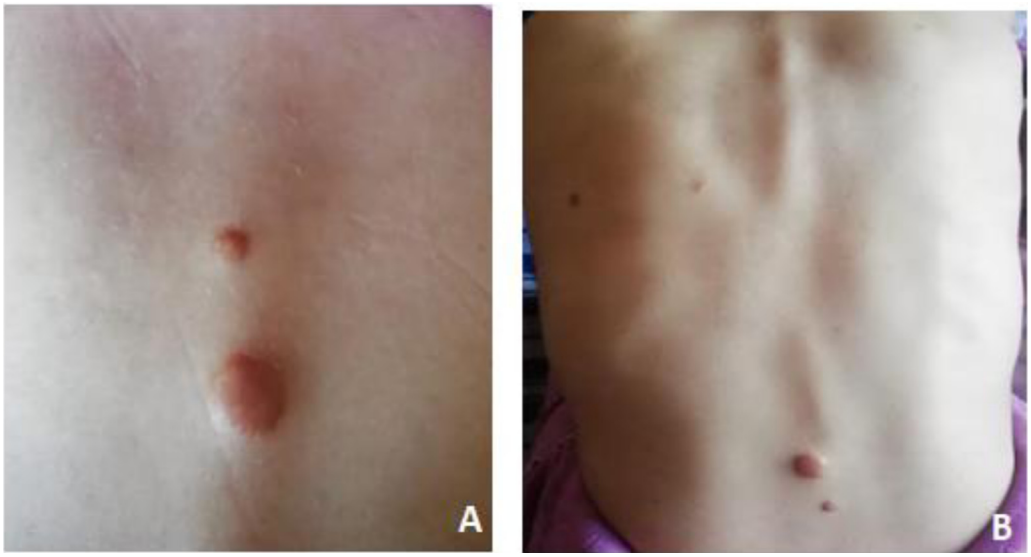

Fig. 1 – Images show cutaneous lesions: (A) 2 neurofibromas, (B) a discret cafe au lait lesions.

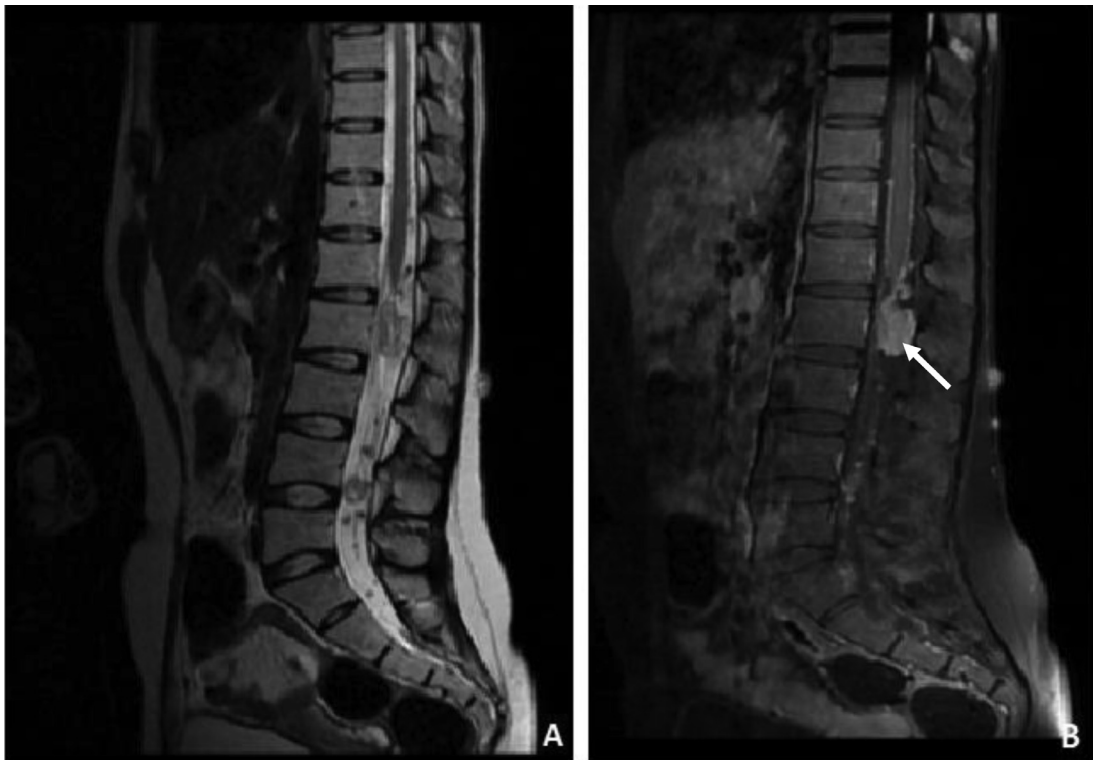

Fig. 2 – Sagittal MRI images in T2 (A) and T1 after injection of GADO (B) shows an enhancing intra medullary masses suggesting the diagnosis of multiple spinal schwannomas (white arrow).

was intracutaneous plaque-like lesion that, lightly raised, and more pigmented than the surrounding skin (Fig. 1).

Neurologic examination showed reduced visual acuity with bilateral exophtalmia, and 4-limb weakness. The otologic evaluation revealed a bilateral sensorineural hearing loss moderate on the right and minimal in the left. Blood laboratory testing was normal.

Spine MR imaging findings included multiple spinal schwannomas that develop within the intradural spinal canal and extramedullary (Fig. 2).

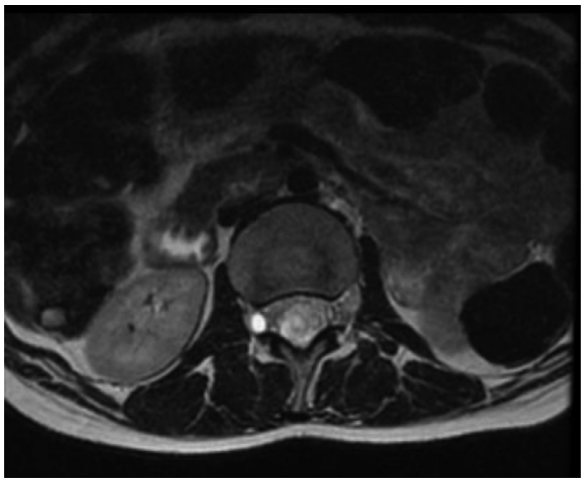

Fig. 3 – Axial MRI in T2-weighted image show arachnoidien cyst.

Brain MR imaging with contrast showed:

- Bilateral vestibular schwannomas bulging into cerebellopontine cisterns from the internal acoustic which are widened and cause the typical "ice cream cone" (Fig. 3),
- Multiple meningiomas, extra-axial tumors with typical features, isointense signal on T1-weighted images and isohyperintense signal on T2-weighted images with important enhancement along with a typical enhancing dural tail (Fig. 4),
- A tumoral mass occupying Meckel's cave on hypo-intense T2 weighed images with a heterogeneous enhancement after GADO injection (Fig. 5),
- And a mass in the left pterygoidien space (Fig. 6).

As a result, the diagnosis of NF2 was established based on clinical presentation and radiological imaging without histopathologic proof.

Discussion

NF2 is 10 times less common than NF1. It is a rare autosomal dominant disease caused by a mutation in the gene on chromosome 22, which normally encodes the tumor suppressor protein "Merlin."

The clinical diagnostic criteria have changed over time is based on the presence of any one of the following criteria [3] (Table 1).

The NF2 is often diagnosed in the second or third decade of life, with a peak in the 20s. The general age of death is 36 years, and the actuarial survival following diagnosis is 15 years.

Patients with NF2 might present with a diverse variety of clinical symptoms and most patients have ophthalmologic abnormalities, such as cataracts (70%-80%), retinal alterations (20%-44%), strabismus (12%-50%) like our case, and other optic pathway tumors (10%-27%), and extra-ocular movement abnormalities (10%) [4]. Cutaneous lesions are a common sign of NF2; however, they are considerably more prevalent in the NF1 subtype [4].

Hearing impairment, vertigo, scoliosis, numerous cranial neuropathies, and paraplegia are common and typical manifestations [5]. Our patient's symptoms were clinically related to the vestibular schwannomas causing the hearing loss, the tumoral mass occupying Meckel's causing the ophthalmologic abnormalities and intramedullary tumors causing limb weakness.

Radiologic evaluation plays a major role in the diagnosis of NF2, a contrast-enhanced MRI of the brain and the entire spine is indicated for assessing and characterizing schwan-

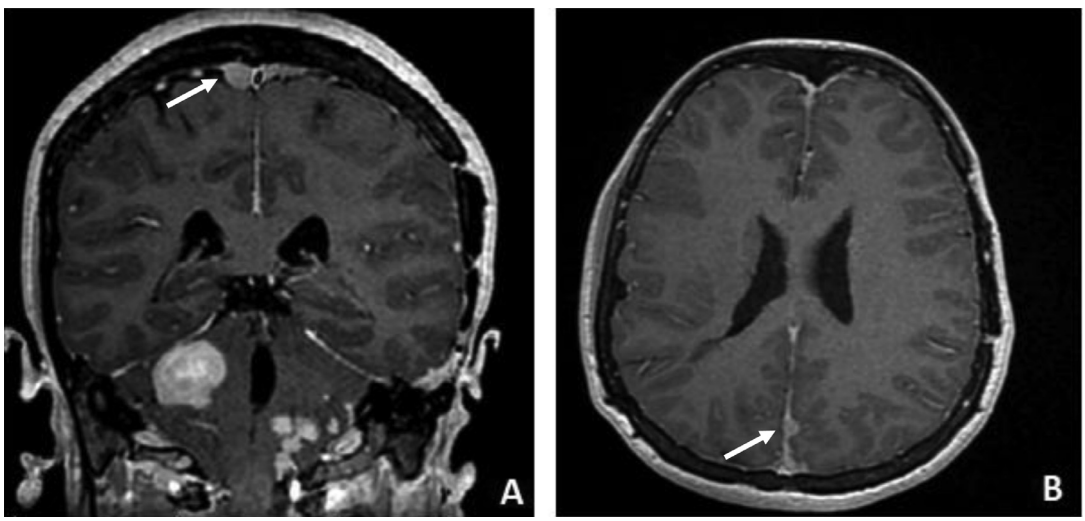

Fig. 4 – Coronal (A) and axial (B) T1-weighted contrast-enhanced MR images showing multiple dural-based homogeneous enhancing masses, suggesting the diagnosis hypothesis of multiple meningiomas (white arrows).

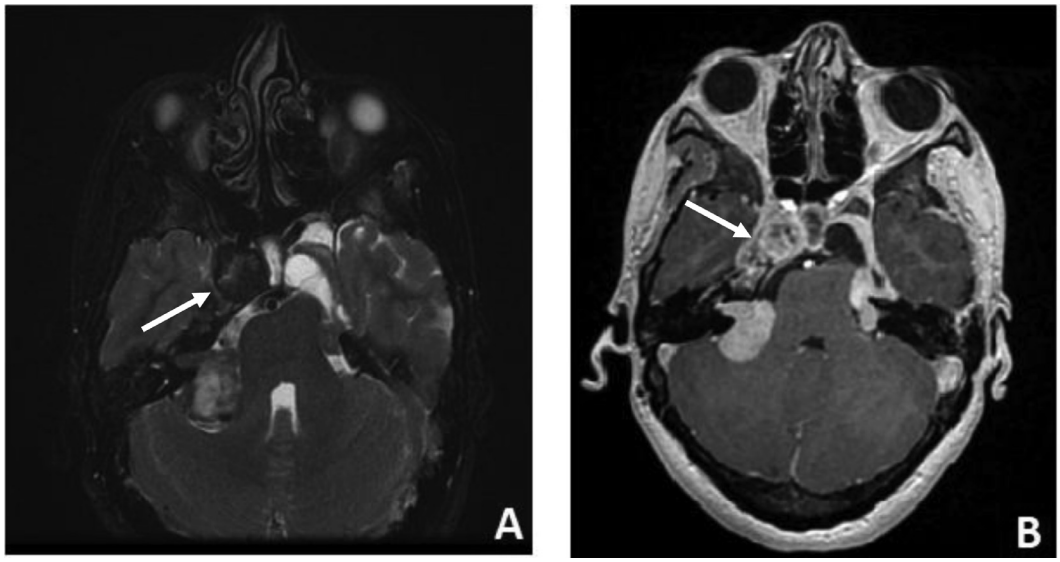

Fig. 5 – Axial T2 (A) and T1-weighted contrast-enhanced (B) MR images showing masses occupying the Meckel's cave (white arrows).

Table 1 – Criteria for neurofibromatosis 2.

Definite diagnoses of NF2
• Bilateral CN VIII schwannomas on MRI or CT scan (no biopsy necessary)
• First-degree relative with NF2 and either unilateral early-onset CN VIII schwannoma (age <30) or any 2 of the following:
• Meningioma
• Glioma
• Schwannoma
• Juvenile posterior subcapsular lenticular opacity (juvenile cortical cataract)
Presumptive diagnoses of NF2
• Early onset of unilateral CN VIII schwannomas on MRI or CT scan detected in patients younger than 30 years and one of the following:
• Meningioma
• Glioma
• Schwannoma
• Juvenile posterior subcapsular lenticular opacity
• Multiple meningiomas (>2) and unilateral CN VIII schwannoma or one of the following:
• Glioma
• Schwannoma
• Juvenile posterior subcapsular lenticular opacity

noma and meningioma. The diagnosis is simple when bilateral vestibular schwannomas bulge into the cerebellopontine cisterns from internal acoustic canals, which are frequently expanded and cause the classic and famous "ice cream cone" appearance. These tumors are hypointense on T1-weighted images and heterogeneously hyperintense on T2-weighted images with intense contrast enhancement [6]. Cystic changes can be seen in large tumor.

Meningiomas in patients with NF2 are developed in 50%-75% of the cases [7] at a younger age and often numerous; these extra-axial tumors present typical MRI features but no specific semiology isointense signal on T1-weighted images and iso-hyperintense signal on T2-weighted images with significant enhancement as well as an enhancing dural tail.

The distinction between schwannoma and meningioma could be difficult if they are situated in the pontocerebellar angles, although in T2-weighted imaging, the schwannoma exhibits a greater signal than the meningioma [8].

Spinal lesions are mostly represented by schwannomas and meningiomas that develop in 89% within the spinal canal in the intradural space [9]. As a result, it is critical to look for spinal localizations. These numerous tumors frequently reach

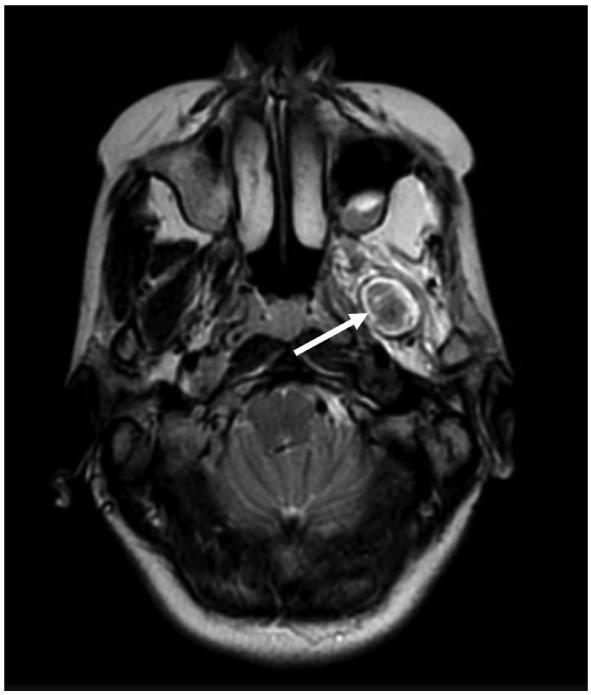

Fig. 6 – Axial T2-weighted MR images showing a mass of the left pterygoidien space.

10 in number and generally correspond to the concurrent development of schwannomas and meningiomas [8]. Meningiomas and spinal neuromas can be challenging to distinguish; meningiomas are more likely intradural with cervicothoracic topography and an iso or hypointense signal on a T2-weighted imaging, whereas schwannomas are more likely extradural at the lombosacral level like the case of our patient.

Ependymomas are intramedullary tumors that cause spinal cord swelling and enlargement with occasional bleeding, cystic alterations that can be described, and varied enhancement [10].

Choroid plexus, cerebellum, and cerebral cortical calcifications have been documented [11].

Conclusion

NF2 is characterized by the numerous and various of the intracranial and intraspinal tumors that occur in both symptomatic and asymptomatic patients. Imaging, particularly MRI, when combined with clinical and genetic data, has the ability to offer a valid diagnosis.

Author contributions

All authors contributed to this work. All authors have read and approved the final version of the manuscript.

Patient consent

Written informed consent for publication was obtained from patient.

REFERENCES

[1] Tiwari R, Singh AK. Neurofibromatosis type 2. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
[2] Antinheimo J, Sankila R, Carpen O, Pukkala E, Sainio M, Jaaskelainen J. Population-based analysis of sporadic and type 2 neurofibromatosis-associated meningiomas and schwannomas. Neurology 2000;54:71–6.
[3] Smith MJ, Bowers NL, Bulman M, Gokhale C, Wallace AJ, King AT, et al. Revisiting neurofibromatosis type 2 diagnostic criteria to exclude LZTR1-related schwannomatosis. Neurology 2017;88(1):87–92.
[4] Coy S, Rashid R, Stemmer-Rachamimov A, Santagata S. An update on the CNS manifestations of neurofibromatosis type 2. Acta Neuropathol 2020 Apr;139(4):643–65. doi:10.1007/s00401-019-02029-5.
[5] Gabriela S, Edson M, Emerson L G, Rafael Ferracini C, Tatiana Chinem T, Raquel Ribeiro B, et al. Magnetic resonance findings of neurofibromatosis type 2: a case report. Cases J 2009;2:6720.
[6] Akeson P, Holtås S. Radiological investigation of neurofibromatosis type 2. Neuroradiology 1994;36(2):107–10. doi:10.1007/BF00588071.
[7] Eckstein O, Stemmer-Rachamimov A, Nunes F, Hoch D, Ojemann R, MacCollin M. Multiple meningiomas in brain and lung due to acquired mutation of the NF2 gene. Neurology 2004;62(10):1904–5.
[8] Ahlawat S, Blakeley JO, Langmead S, Belzberg AJ, Fayad LM. Current status and recommendations for imaging in neurofibromatosis type 1, neurofibromatosis type 2, and schwannomatosis. Skeletal Radiol 2020 Feb;49(2):199–219. doi:10.1007/s00256-019-03290-1.
[9] Mautner VF, Tatagiba M, Lindenau M, et al. Spinal tumors in patients with neurofibromatosis type 2: MR imaging study of frequency, multiplicity, and variety. AJR Am J Roentgenol 1995;165(4):951–5.
[10] Kalamarides M, Essayed W, Lejeune JP, Aboukais R, Sterkers O, Bernardeschi D, et al. Spinal ependymomas in NF2: a surgical disease? J Neurooncol 2018;136(3):605–11.
[11] Anıl O, Yasemin K, Feramuz D, Meltem N. J Clin Imaging Sci 2013 May;3:21. doi:10.4103/2156-7514.112802.