Neurofibromatosis type two with associated spinal schwannomas

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Abstract: Neurofibromatosis (NF) is a rare genetic disorder characterized by the development of benign tumors in the nervous system. This pathology is classified into neurofibromatosis type one (NF1) and neurofibromatosis type two (NF2) [1]. Schwannomatosis is a newly recognized third form of NF. It is characterized by multiple schwannomas, without vestibular schwannomas which are diagnostic of NF2. This case report describes the role of imaging and the management of a patient diagnosed as NF2 who later developed multiple spinal schwannomas [1-3]. NF2 occurs as a result of genetic defects caused by a mutation on a gene located on chromosome number 22 [1]. It is characterized by multiple schwannomas, meningiomas, and ependymomas. Multiple cranial nerve schwannomas, as well as bilateral acoustic neuromas or bilateral vestibular schwannomas, are the hallmark of the disease. Tumors of the brain and spine eventually occur in most patients with NF2.
Keywords: genetic disorder, vestibular schwannomas.

Case report

A 37 year old female was diagnosed with neurofibromatosis type two (NF2) in 2004 when she presented with bilateral acoustic neuromas. The left acoustic neuroma was surgically removed and then treated with stereotactic radiotherapy. She also underwent stereotactic radiotherapy treatment for a right acoustic neuroma. She developed left cranial nerve VII palsy and bilateral cranial nerve VIII palsy causing loss of hearing. Due to loss of hearing the patient learned to lip read.

As this patient had been diagnosed as NF2 she underwent magnetic resonance imaging scans to monitor her condition. In 2007 she presented with pain and progressive weakness of her lower limbs, back pain and she was developing spasticity. She had multiple schwannomas related to almost every cranial nerve intracranially, as well as widespread spinal schwannomas. She had slight scoliosis to the right. She also had multiple tiny schwannomas involving her entire cauda equina. She experienced pain in the left eye with no left eyelid closure.

She was referred for a magnetic resonance imaging scan of the spine. This scan revealed a large T11/12 schwannoma dumbelling out through the neural foramina. Compared to her previous scans this schwannoma had substantially increased in size and was causing displacement of the spinal cord (Figure 1). A large cervical schwannoma at C1/2 level was also thought to be associated with significant spinal cord compression but did not appear to have changed in size since the previous scan (Figure 2).

The patient was referred to a neurosurgeon for surgical removal of the large thoracic schwannoma. Surgical resection of the cervical schwannoma was contraindicated due to the risks involved regarding the extensive nerve supply in that area and since no significant size increase had occurred.

The patient underwent a T10-12 laminectomy and tumor resection. The surgery was successful and the patient was then transferred to the intensive care unit and kept overnight so that rapid intervention would be available if postoperative complications occurred. She was mobilized following physiotherapy treatments and now uses a walking frame.

The patient was discharged on day four post-surgery. She was prescribed pain management medication. The patient was scheduled

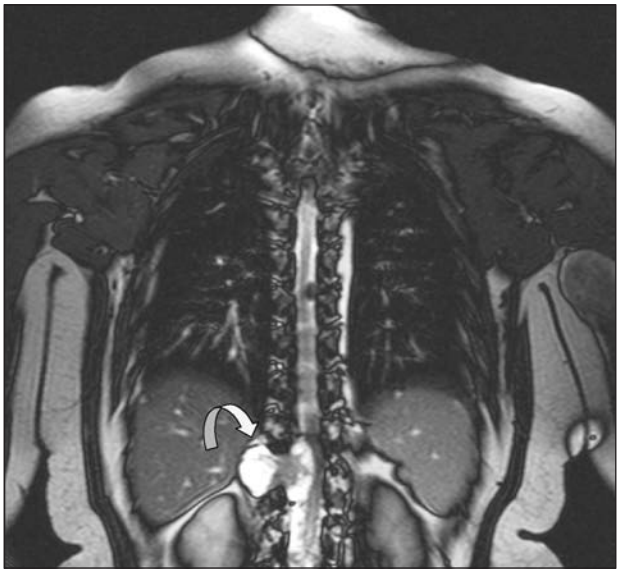

Figure 1: MRI post gadolinium FISP coronal chest image showing large dumbbell shape schwannoma at the T11-12 level (curved arrow).

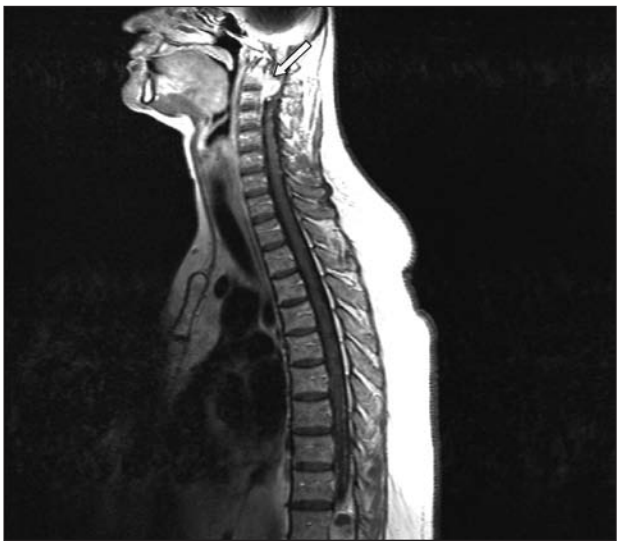

Figure 2: An MRI post Gadolinium T1 axial chest image depicting schwannoma at the C1-2 level in the spine causing compression of the spinal cord (arrow).

to return for a follow-up magnetic resonance imaging scan within 3-6 months to document the completeness of tumor removal and to serve as a baseline for further follow-up scans and also to monitor her progress.

Discussion

A schwannoma is a benign tumor of the nerve sheath from cells called Schwann cells. Schwann cells produce the insulating myelin sheath which covers peripheral nerves fibers. Multiple schwannomas is a feature of NF2. Schwannomas may develop on cranial, spinal, and peripheral nerves. These tumors can develop anywhere in the body but are most commonly visualized in the brain and spine[1].

NF2 is a rare autosomal dominant disorder which occurs in approximately 1:50 000 births. The defective gene producing NF2 can be inherited from a parent who has NF2 as there is a 50% chance of passing the gene to offspring [2]. In the case presented the patient did not have a family history of NF2 and was therefore the founder of a spontaneously mutated gene.

NF2 is commonly confused with schwannomatosis which is a newly recognized third form of neurofibromatosis. The distinguishing feature of schwannomatosis from NF2 is the development of multiple schwannomas everywhere in the body except on the vestibular nerve [3]. Classic features of NF2 are bilateral acoustic neuromas and multiple schwannomas. These schwannomas can occur anywhere in the body but most commonly develop in the brain and spine. In the presented case the patient had previously developed bilateral acoustic neuromas which resulted in hearing loss and currently she has multiple schwannomas in the spine [3, 4].

Spinal schwannomas account for approximately 29% of all spinal tumors. Schwannomas tend to occur in the 30-60 year age group but they may occur at any age. They have no gender predilection. They can occur at any level in the spine, typically from the posterior nerve roots. Schwannomas are benign and slow growing but can cause compression of the spinal cord giving rise to neurologic symptoms (Figure 3) [5].

Although symptoms reflect the function mediated by the involved nerve and surrounding structures, presentation is usually of a slowly advancing spastic paraparesis with an unilateral band of pain and sensory loss from the affected nerves. As the lesion progresses these initial symptoms may be followed by weakness and bladder and bowel dysfunction [5,6]. In the case presented the patient's symptoms included spasticity, weakness of lower limbs, back pain, pain experienced in the lower limbs and left eye pain.

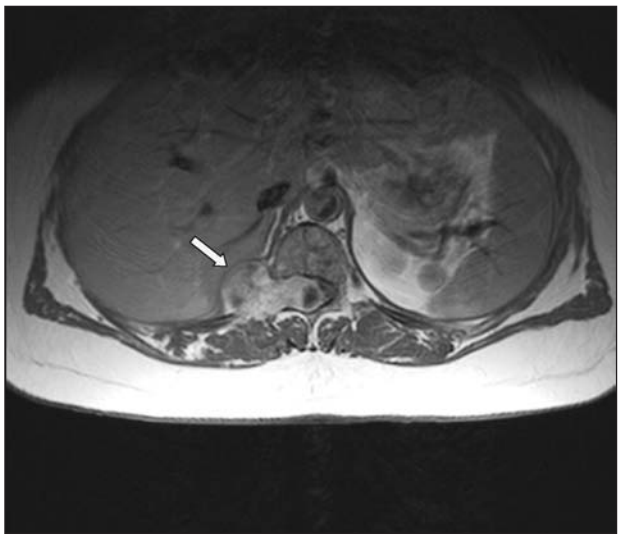

Figure 3: An MRI T1 post gadolinium axial chest image depicting T11-12 schwannoma dumbelling out of the neural foramen and causing spinal cord compression (arrow).

Magnetic resonance imaging with the use of gadolinium-based contrast medium is the technique of choice for diagnosing schwannomas; it provides the highest degree of soft tissue resolution. The images are in multiple planes and are not encumbered by bone artifacts from the skull base. Computed tomography is ideal for evaluating the secondary effects of spinal schwannomas on the neural foramen and to delineate extraspinal extension [6]. Since the emergence of magnetic resonance imaging other imaging methods, such as computed tomography including gas cisternography and myelography, have limited roles in diagnosing schwannomas but occasionally are used in patients where magnetic resonance imaging is contraindicated [6].

Treatment for spinal schwannomas includes surgical resection of the schwannoma, arresting schwannoma growth using radiation therapy or careful serial observation and monitoring. Each treatment modality has its own risks and benefits [7]. Genetic screening and testing of blood can reveal damaging mutations of the NF2 gene. Screening may be conducted during pregnancy to aid in early diagnosis of individuals with a family history of the disorder thereby allowing for early treatment [7].

Conclusion

NF2 is a rare genetic disorder characterised by multiple schwannomas of the nervous system, brain and spine. Due to the fact that NF2 is so rare, few studies have been done to observe the natural progression of this disorder. As there is no cure for NF2 the main aim of treatment is to alleviate symptoms, closely monitor its development and to intervene when necessary.

One concern that should not be overlooked is the risk of isolation, depression and loneliness in NF2 patients. Patients with NF2 are anxious about future complications of their condition and often deteriorate into a state of chronic depression brought on by progressive symptoms of this disorder. Geneticists are working hard to improve understanding of how mutations in these genes occur so that they can develop gene therapy to help prevent NF2.

References

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