Neurology and Neuroscience Research

Research Article

Acoustic neuroma: A case series

Abdulwahab F. Alahmari
Radiology Specialist, Radiology Department, Al-Namas General Hospital, Ministry of Health, Al-Namas City, Saudi Arabia

Corresponding author
*Abdulwahab F. Alahmari, *Radiology Specialist, Radiology Department, Al-Namas General Hospital, Ministry of Health, Al-Namas City, Saudi Arabia*

Email: Afaa99@hotmail.co.uk

Submitted: 14July 2020
Accepted: 18 July 2020
Published: 27July 2020

Abstract
Acoustic neuroma is one of the most common cerebellopontine angle masses. It's a benign tumor that can displace the brainstem or affect other cranial nerves or cerebellum leading to very serious consequences. The aim of this case series is to analyze the common and uncommon findings on MRI scans and clinical examination of a 31 schwannoma cases.

Keywords
Acoustic neuroma; vestibular schwannoma; MRI; cerebellopontine angle; benign tumors

Introduction

Acoustic neuroma, vestibular schwannoma, acoustic neurinoma, or acoustic neurilemoma is slow growing benign tumors that occupy the cerebellopontine angle and it affects the vestiblocochlear nerve which is responsible for hearing and balance. Schwann cells over production lead to forming a schwannoma which can affect any nerve covered by myelin sheath.

Methodology

A Radiopaedia cases search for the terms "acoustic neuroma" and "vestibular schwannoma" to find acoustic neuroma radiology cases. The cases were selected to be presented as case series to help in collecting the common and uncommon findings of acoustic neuromas. The selected cases must have all essential data available including the age, gender, presentations, findings, must be on an MRI scan, and at least almost diagnostic certainty. The collection started on April 5th 2020 and finished on April 7th 2020. Only the confirmed acoustic neuroma cases by a qualified neuroradiologist were selected for this case series. A 31 cases matched with this paper's requirements were collected

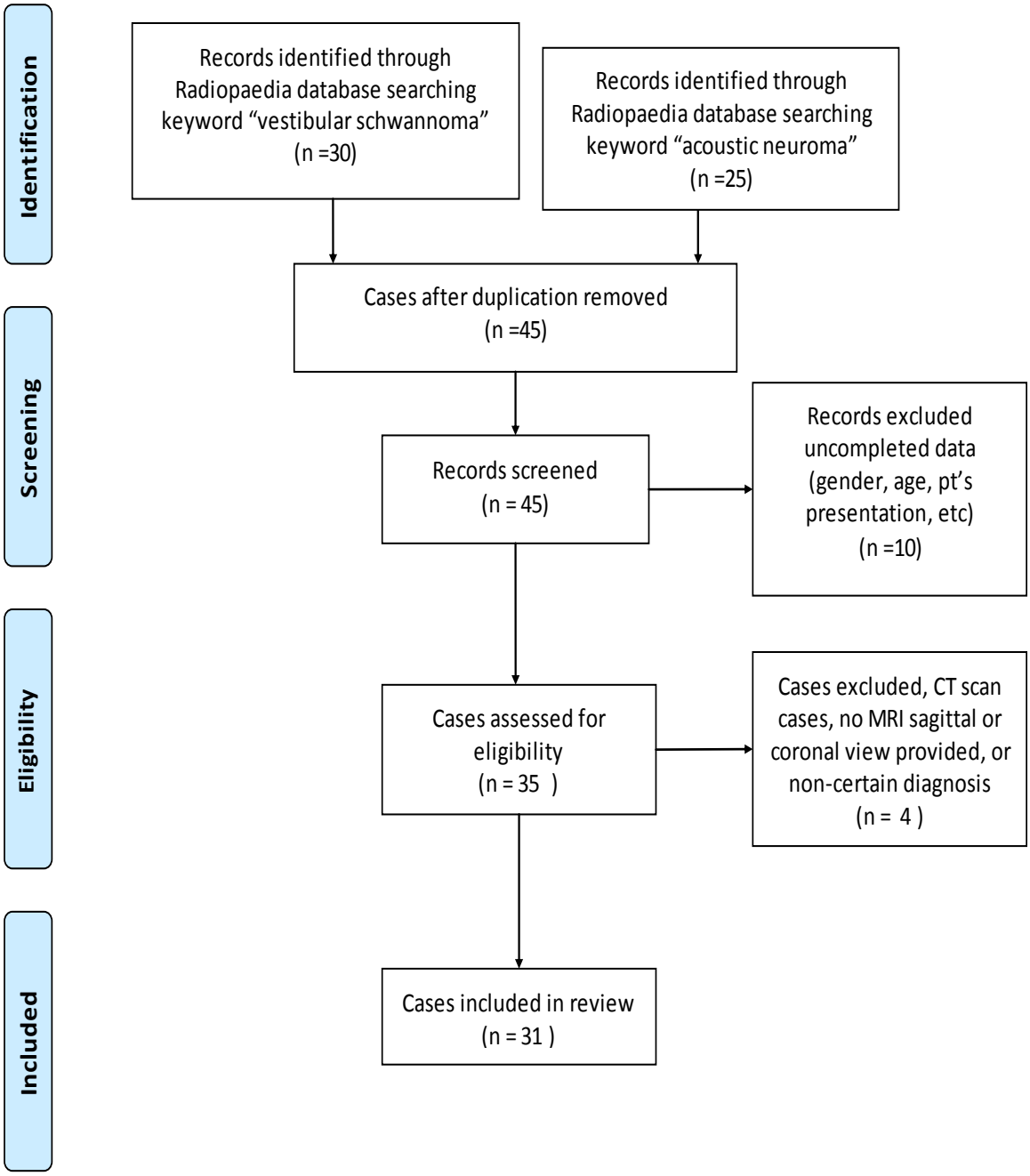

FIGURE 1: A PRISMA diagram is showing the process of collecting acoustic neuroma cases.

Each acoustic neuroma case was measured from the right side to the left side (Rt. to Lt.), the anterior side to the posterior side (A.P.), the cephalic side to the caudal side (C.C.). The greatest measurements was taken for each acoustic neuroma tumor. The measurements were analyzed by a simple Excel analysis of the mean in every category. Each acoustic neuroma case was given a Koos' score based on the MRI scan's measurements and findings see (Table 1 & Fig. 2).

Table 1. Koos grading system for acoustic neuroma.

Koos grade	Description
I	Intracanalicular tumor
II	Minimal tumor extension into the cerebellopontine angle, <2 cm
III	Tumor occupies the cerebello-pontine angle but does not dis-place the cerebellar trunk, <3 cm
IV	Large tumor with brainstem dis-placement, >3 cm

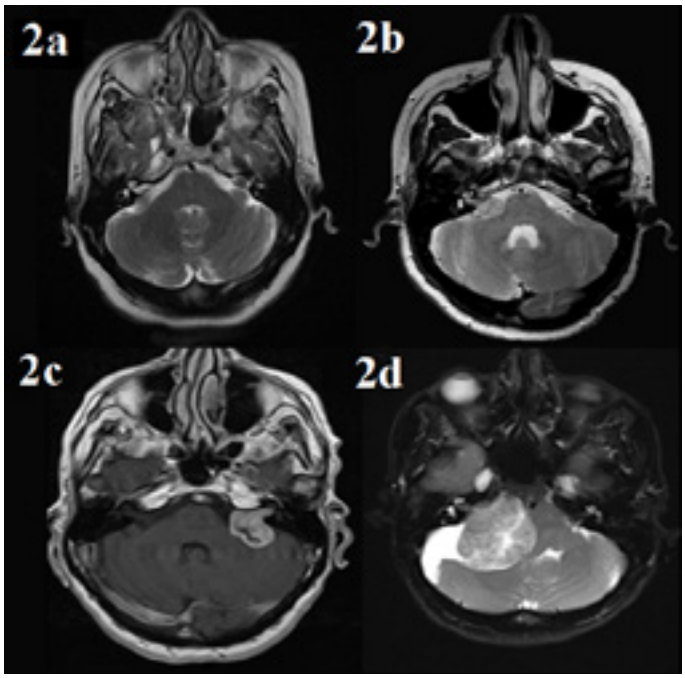

FIGURE 2: Koos' grading system for acoustic neuroma. The (1a) is grade 1 an intracanalicular tumor, (1b) is grade 2 a cerebellopontine angle tumor with minimal extension <2 cm, (1c) is grade 3 a cerebellopontine angle tumor with no cerebellar trunk displacement <3 cm, and (1d) is grade 4 a massive tumor that displace the brainstem >3 cm.

All cases of vestibular schwanomma combined with other disease were selected. Any schwanomma case that is not acoustic neuroma (vestibular schwanomma) like glossopharnageal nerve, cervical nerve, or any other cerebral schwanomma were excluded. Any case of vestibular schwanomma that is not provided with an MRI scan were excluded. As well, any case must have an axial, a sagittal, a coronal slices so the schwanomma can be evaluated accurately.

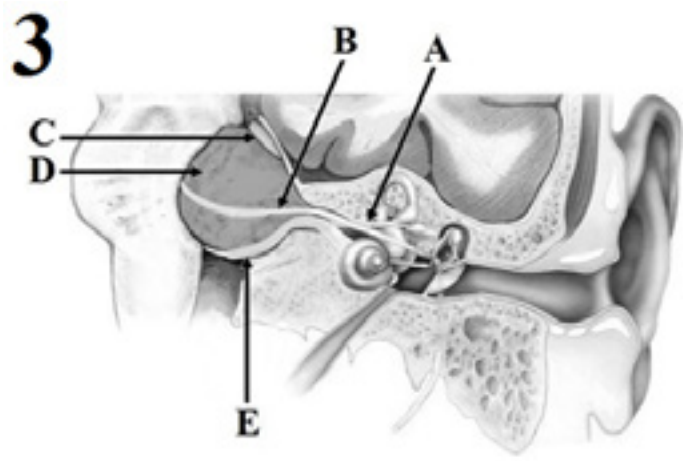

FIGURE 3: An illustration of the surrounding nerves to the acoustic neuroma. The arrow with the letter (A) is the vestibular nerve, (B) is the facial nerve, (C) is the trigeminal nerve, (D) is the acoustic neuroma, and (E) is the cochlear nerve.

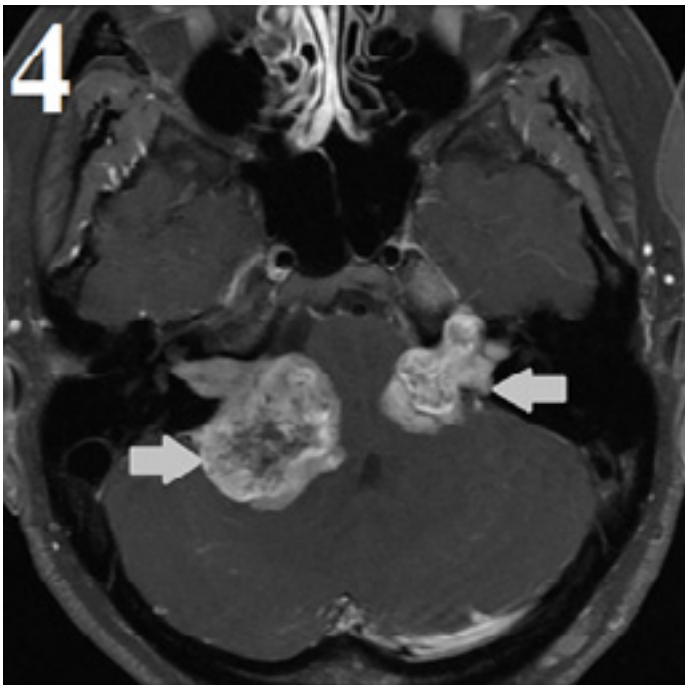

FIGURE 4: A bilateral acoustic neuroma in a neurofibromatosis type 2 patient

Result

The total number of acoustic neuroma cases is 31 patients. Only three cases out of the 31 cases are bilateral acoustic neuroma cases. The average age for the female patients is 42.5 years, the average age for the male patients is 50.15 years, and the total average age for both male and female is 45.7 years. The oldest patient in this case series is 75 years and the youngest patient is 20 years. The number of the female acoustic neuroma patients is higher than the male patients. Acoustic neuroma affect the right side (20 patients) more than the left side (14 patients) in both genders. The most common Koos grade is grade 4 see (Table 2).

Table 2. Distribution of cases by grade, gender, and affected side.

	Number of cases	Average age	Koos grade 1	Koos grade 2	Koos grade 3	Koos grade 4	Affected right side	Affected left side
Female	18	42.5	9	1	2	9	13	8
Male	13	50.15	3	2	1	7	7	6
Total	31	45.7	12	3	3	16	20	14

The average measurements of the tumors on the right side and left side in male patients is higher than the average size of the tumor on the right side and left side in female patients. The average right side's measurement in both genders is 3.03×2.51×2.42 cm and the average left side's measurement in both genders is 2.12×1.66×1.62 cm. The average both sides' measurements in both genders is 2.59×2.16×2.09 cm see (Table 3).

Table 3. Schwannomas' mean measurements in both genders.

	Mean right side measurements (cm)	Mean left side measurements (cm)	Mean for both sides (cm)
Female	2.78×2.13×1.98	1.92×1.65×1.54	2.45×1.94×1.81
Male	3.49×3.24×3.25	2.37×1.68×1.74	2.51×2.52×2.55
Total	3.03×2.51×2.42	2.12×1.66×1.62	2.59×2.16×2.09

The associated cranial nerves in acoustic neuroma cases that were found in this case series are: cochlear, vestibular, trigeminal, oculomotor, and abduecens nerves. The following table summarizes all the found clinical presentations and the affected nerves see (Table 4).

Table 4. Associated cranial nerves or affected subdivision of a cranial nerve.

Cranial nerve	Number of cases	Found symptoms summary in all patients.
Cochlear nerve	26	Hearing loss (sensorineural), tinnitus, and headache.
Vestibular nerve	11	Vertigo, headache, ataxia, dizziness, and unsteady gait (imbalance).
Trigeminal nerve	5	Trigeminal neuralgia, hemifacial numbness, and headache.
Facial nerve	3	Facial pain and mastoiditis.
Oculomotor nerve	2	Diminution of vision, ptosis, and dilatation of pupil.
Abducens nerves	1	Diplopia.

The common patients' presentations are headache, nausea, vomiting, tinnitus, facial pain, hearing loss, progressive sensorineural hearing loss, vertigo, ataxia, dizziness, and unsteady gait (imbalance).

The uncommon patients' presentations are vision dimunition, pupil dilatation, hemifacial numbness, diplopia, mastoiditis, trigeminal neuralgia, and bilateral hearing loss (deaf).

The common findings are hydrocephalus, ice cream cone sign (which is a common sign for acoustic schwannoma), neurofibromatosis type 2, bilateral acoustic neuroma, intercanalicular dilatation, widening of internal acoustic meatus, obstructive hydrocephalus, vasogenic edema, cystic changes, ipsilateral enlargement of porus acusticus, schwannoma with central necrosis, ventriculoperitoneal (VP) shunt, and intercanalicular component. As well, all the three bilateral schwannoma are associated with neurofibromatosis type 2.

The uncommon findings are encephalomalacia, intramural cyst, posterior fossa arachnoid cyst, partial empty sella, multiple meningiomas, incidental arachnoid granulation in the transverse sinus, cisternal calcifications, contralateral cervical schannoma, multiple cysts, colpocephaly, trigeminal nerve ganglion occupying schwannoma, labyrinthine schannoma (affecting the cochlea, vestibule, and madiolus), gliosis, and tonsillar herniation see (Table 5).

Table 5. All the patients information.

Pt.Age In yrs	Pt. Sex	Koos Grade	Measurements From Rt. to Lt., A.P., & C.C. diameters (cm)	Presentation	Findings	Associated Cranial Nerves	Affected Side
50	F	4	4.0×3.8×3.4	Tinnitus & Vertigo & Facial pain	Hydrocephalus	Trigeminal nerve Vestibular nerve	Rt.
50	F	4	3.0×3.0×3.0	Hearing loss	Encephalomalacia	Cochlear nerve	Lt.
75	M	2	2.6×2.4×2.1	Hearing loss	Intramural cyst	Cochlear nerve	Lt.
32	F	1	1.6×1.06×1.4	Tinnitus & Headache	Intercanalicular	Cochlear nerve	Rt.
50	M	4	2.6×2.17×2.43	Chronic headache	Hydrocephalus	Cochlear nerve	Rt.
50	M	4	4.7×4.0×4.0	Progressive headache & Sensorineural hearing loss	Posterior fossa arachnoid cyst	Cochlear nerve	Rt.
45	F	4	4.31×4.47×2.88	Progressive headache	Partial empty sella	Vestibular nerve	Rt.
20	F	4	4.21×3.12×3.44	Vision dimunition & Ptosis & Pupil dilatation & Sensorineural hearing loss	Ice cream cone sign	Oculomotor nerve	Rt.
40	F	1	Rt. 1.8×0.69×0.7 Lt. 1.9×0.85×1.27	Hearing loss	Neurofibromatosis type 2 & Bilateral acoustic neuroma	Cochlear nerve	Rt. & Lt.
40	F	4	4.2×3.78×3.2	Headache & Ataxia	Neurofibromatosis type 2	Vestibular nerve	Rt.
70	M	1	2.37×2.57×2.7	Hearing loss & Vertigo	Labyrinthine schannoma affecting the cochlea, vestibule, and madiolus	Vestibulocochlear nerve	Rt.
65	F	1	0.66×0.5×0.71	Tumor follow up	Neurofibromatosis type 2 & Multiple meningiomas	Facial nerve Vestibulocochlear nerve	Lt.
47	M	1	1.61×0.56×0.48	Sensorineural hearing loss & Tinnitus	Intercanalicular dilatation	Cochlear nerve	Lt.
20	F	2	1.75×1.46×1.72	Hearing loss & Dizziness	Incidental arachnoid granulation in the transverse sinus	Vestibulocochlear nerve	Rt.
40	M	4	3.57×3.39×3.94	Hearing loss & Tinnitus	Intercanalicular extension & Hydrocephalus	Cochlear nerve	Rt.
20	F	3	Rt. 4×3.73×3.28 Lt. 3.15×3.1×1.77	Bilateral hearing loss (deaf) & Gait imbalance & Hemi facial numbness & Diplopia	Intercanalicular extension & Cisternal calcifications & Neurofibromatosis type 2 & Bilateral acoustic neuroma	Rt. Facial nerve Rt. Vestibulo cochlear nerve Rt. Trigeminal nerve Lt. Oculomotor nerve Lt. Abducens nerve	Rt. & Lt.
65	F	1	0.7×0.8×0.45	Mastoiditis	Lt. cervical schannoma & Neurofibromatosis type 2	Facial nerve	Rt.
50	F	4	2.49×2.25×2.62	Hearing loss	Widening of internal acoustic meatus	Cochlear nerve	Rt.
65	M	4	3.12×2.57×3.33	Nausea & Vomiting & Unsteady gait	Hydrocephalus & Intracanalicular component	Vestibular nerve	Rt.
40	M	4	2.1×3.5×2.6	Sensorineural hearing loss	Multiple cysts & colpocephaly & Obstructive hydrocephalus	Cochlear nerve	Rt.
45	F	4	2.1×1.1×1.32	Follow up	Intracanalicular component & Ice cream cone sign	Vestibulocochlear nerve	Lt.
55	M	3	3.04×2.12×2.70	Hearing loss	Ice cream cone sign	Cochlear nerve	Lt.
55	M	4	2.5×2.2×2	Lt. Trigeminal neuralgia & Ipsilateral hearing loss	Meckel's cave (trigeminal nerve ganglion) occupying schwannoma	Trigeminal nerve Cochlear nerve	Lt.

35	M	1	1.58×1.24×1.8	Hearing loss	Intercanalicular portion	Cochlear nerve	Lt.
45	M	2	2.94×1.56×1.4	Hearing loss & Tinnitus	Extended internal auditory meatus	Cochlear nerve	Lt.
43	F	4	5×1.45×1.3	Headache	Cystic changes	Vestibulocochlear nerve	Rt.
50	F	1	0.5×0.6×0.7	Sensorineural hearing loss	Rt. Trigeminal schwannoma in Meckel's cave & another Rt. Side acoustic neuroma in the glossopharyngeal nerve & Gliosis & Cystic changes	Cochlear nerve Trigeminal nerve	Rt.
25	M	4	6×4.5×3.8	Hearing loss	Intracanalicular extension & Vasogenic edema & Hydrocephalus & Tonsillar herniation & VP shunt	Cochlear nerve	Rt.
55	F	4	2.8×2.4×2.2	Hearing loss & Chronic headache	Ipsilateral enlargement of porus acusticus & Schwannoma central necrosis & Obstructive hydrocephalus	Cochlear nerve Trigeminal nerve	Lt.
45	F	1	0.82×0.5×1.0	Sensorineural hearing loss	Intercanalicular & No extracanalicular extension	Vestibulocochlear nerve	Lt.
30	F	1	Rt. 1.64×0.48×0.64 Lt. 0.98×1.8×1.06	Hearing loss	Neurofibromatosis type 2 & Bilateral acoustic neuroma	Cochlear nerve	Rt. & Lt.

VP shunt: ventriculoperitoneal shunt.

Discussion

The bilateral acoustic neuroma is associated with neurofibromatosis type 2 which is similar to this case series finding [1]. The common findings according to the literature is a nodular mass occupying the cerebellopontine angle present with intracanalicular extension causing porus acusticus widening, cystic changes, high contrast enhancement, occasionally hemorrhage, and rarely calcification [1]. All the previous radiologic findings were found in all the cases including the rare one like the present of calcifications was found in one case of this case series.

Epidemiology

The acoustic neuroma is forming 80% of the cerebellopontine angle's mass and it forms 7.5 % of primary intracranial tumors [1-3]. Most of the solitary lesions 95% are sporadic lesions. The average age of acoustic neuroma is 50 years and its more common in the age range between 40 to 60 years [4]. The average age (in both male and female patients) in this case series is 45.7 years.

Association

Acoustic neuroma association with neurofibromatosis type 2 was proven in bilateral acoustic neuroma cases [1]. In this case series, a 25 acoustic neuroma patients out of the 31 patients (i.e. this case series entire sample) did not have neurofibromatosis type 2, while 6 cases only where associated with neurofibromatosis type 2 and three out of the 6 cases are bilateral acoustic neuroma cases.

The found schannomas that are not acoustic were three; right side labyrinthine schannoma in patient with right side acoustic neuroma, left cervical nerve schannoma in patient with right side acoustic neuroma (on the opposite side in a neurofibromatosis type 2 patient), and right side glossopharyngeal nerve schannoma in patient with right side acoustic neuroma (on the same side).

References

1. Dahnert WF. Radiology review manual. Lippincott Williams & Wilkins; 2017.
2. Mulkens TH, Parizel PM, Martin JJ et al.. Acoustic schwannoma: MR findings in 84 tumors. AJR. American journal of roentgenology. 1993; 160: 395-398.
3. Silk PS, Lane JI, Driscoll CL. Surgical approaches to vestibular schwannomas: what the radiologist needs to know. Radiographics. 2009; 29: 1955-1970.
4. Lin EP, Crane BT. The management and imaging of vestibular schwannomas. American Journal of Neuroradiology. 2017; 38: 2034-2043.