

**Hearing Loss and/or Vertigo
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Bagai A, Thavendiranathan P, Detsky AS. Does this patient have hearing impairment? <i>JAMA</i> 2006; 295(4):416-428.	Review/Other-Dx	24 studies (12,645 patients)	Systematic review to examine accuracy and precision of bedside clinical maneuvers for diagnosing hearing impairment.	Elderly individuals who acknowledge they have hearing impairment require audiometry. Those unable to perceive the whispered-voice test require audiometry.	4
2. Busaba NY, Rauch SD. Significance of auditory brain stem response and gadolinium-enhanced magnetic resonance imaging for idiopathic sudden sensorineural hearing loss. <i>Otolaryngol Head Neck Surg</i> 1995; 113(3):271-275.	Observational-Dx	96 consecutive patients	Retrospective study of patients with idiopathic SNHL evaluated with ABR and gadolinium-enhanced MRI. ABR and MRI were correlated with hearing outcome.	Gadolinium-enhanced MRI was obtained on all 14 patients with abnormal ABR but on none with normal ABR.	3
3. Hendrix RA, DeDio RM, Sclafani AP. The use of diagnostic testing in asymmetric sensorineural hearing loss. <i>Otolaryngol Head Neck Surg</i> 1990; 103(4):593-598.	Review/Other-Dx	225 consecutive cases	Retrospective review to examine the value of diagnostic tests in patients with asymmetric SNHL.	MRI offers greater specificity than CT in patients with asymmetric hearing loss.	4
4. Huang MH, Huang CC, Ryu SJ, Chu NS. Sudden bilateral hearing impairment in vertebrobasilar occlusive disease. <i>Stroke</i> 1993; 24(1):132-137.	Review/Other-Dx	7 patients	A report on 7 patients with sudden bilateral hearing impairment in vertebrobasilar occlusive disease seen between 1986 and 1991.	6/7 patients had CT evidence of posterior fossa infarcts. 7/503 patients with vertebrobasilar occlusive disease had sudden bilateral hearing impairment, giving an incidence of approximately 1.4%. Authors conclude that sudden bilateral hearing impairment in vertebrobasilar occlusive disease is common and may indicate a grave prognosis.	4
5. Kano K, Tono T, Ushisako Y, Morimitsu T, Suzuki Y, Kodama T. Magnetic resonance imaging in patients with sudden deafness. <i>Acta Otolaryngol Suppl</i> 1994; 514:32-36.	Observational-Dx	30 patients	MRI performed on patients with unilateral sudden deafness to study the relationship between MRI findings and response to treatments.	7/30 cases showed high signal in labyrinth. MRI would help to further classify the etiology of sudden deafness.	3
6. Reilly JS. Congenital perilymphatic fistula: a prospective study in infants and children. <i>Laryngoscope</i> 1989; 99(4):393-397.	Observational-Dx	244 patients	3-year prospective study of children (5 months to 17 years) with SNHL.	57 children (23%) had radiographic evidence of abnormalities of the temporal bone detected by CT, and/or progression of SNHL.	3
7. Saunders JE, Luxford WM, Devgan KK, Fetterman BL. Sudden hearing loss in acoustic neuroma patients. <i>Otolaryngol Head Neck Surg</i> 1995; 113(1):23-31.	Observational-Dx	92 patients	Retrospective study to: 1) to define the prevalence of acoustic neuroma in the sudden hearing loss population with the current diagnostic techniques ABR and gadolinium-enhanced MRI, 2) to identify the typical clinical findings in sudden hearing loss/acoustic neuroma patients and compare these features with those from other patients with sudden hearing loss, and 3) to evaluate the proposed theories of sudden hearing loss/acoustic neuroma pathophysiology.	Recommend either an evaluation with ABR or gadolinium-enhanced MRI for any patient with sudden hearing loss.	3

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8. Sauvaget E, Kici S, Kania R, Herman P, Tran Ba Huy P. Sudden sensorineural hearing loss as a revealing symptom of vestibular schwannoma. <i>Acta Otolaryngol</i> 2005; 125(6):592-595.	Observational-Dx	139 consecutive unilateral vestibular schwannoma	To examine sudden SNHL as a revealing symptom of vestibular schwannoma.	Sudden SNHL was observed in 20% of cases at some point in their vestibular schwannoma history.	3
9. Schick B, Brors D, Koch O, Schafers M, Kahle G. Magnetic resonance imaging in patients with sudden hearing loss, tinnitus and vertigo. <i>Otol Neurotol</i> 2001; 22(6):808-812.	Observational-Dx	354 patients	Retrospective study to evaluate the value of MRI in analysis of the complete audiovestibular pathway.	MRI abnormalities seen in 122/354 patients (34.5%). Contrast-enhanced MRI can be used to assess a significant number of different pathologic conditions in patients with audiovestibular disorders.	4
10. Weber PC, Zbar RI, Gantz BJ. Appropriateness of magnetic resonance imaging in sudden sensorineural hearing loss. <i>Otolaryngol Head Neck Surg</i> 1997; 116(2):153-156.	Review/Other-Dx	16 patients	Retrospective chart review to identify patients and demonstrate the appropriateness of MRI in SNHL.	Three (18.75%) of 16 patients found to have a cause for their SNHL on MRI with gadolinium contrast. Essential that all patients with idiopathic sudden SNHL be evaluated at some point during their treatment with a MRI with gadolinium contrast.	4
11. Davidson HC, Harnsberger HR, Lemmerling MM, et al. MR evaluation of vestibulocochlear anomalies associated with large endolymphatic duct and sac. <i>AJNR Am J Neuroradiol</i> 1999; 20(8):1435-1441.	Observational-Dx	63 patients with large endolymphatic duct and sac, 60 controls	Retrospective review. Use high-resolution T2-weighted FSE MRI to describe the features and prevalence of specific anomalies that occur in association with large endolymphatic duct and sac.	High-resolution FSE MRI provides a means of exquisite characterization of large endolymphatic duct and sac and a more sensitive detection of associated vestibulocochlear anomalies.	3
12. Mafee MF, Charletta D, Kumar A, Belmont H. Large vestibular aqueduct and congenital sensorineural hearing loss. <i>AJNR Am J Neuroradiol</i> 1992; 13(2):805-819.	Review/Other-Dx	22 patients	To examine the value of CT and MRI in patients with long-standing SNHL.	Large cochlear aqueduct may be seen in patients with “gusher” syndrome.	4
13. Okumura T, Takahashi H, Honjo I, Takagi A, Mitamura K. Sensorineural hearing loss in patients with large vestibular aqueduct. <i>Laryngoscope</i> 1995; 105(3 Pt 1):289-293; discussion 293-284.	Review/Other-Dx	181 patients (327 ears) with SNHL and 25 people (50 ears) with normal hearing	Examine patients with SNHL of unknown etiology and people with normal hearing by HRCT.	Minor head trauma or barometric pressure changes may trigger hearing loss in patients with large vestibular aqueducts.	4
14. Valvassori GE, Clemis JD. The large vestibular aqueduct syndrome. <i>Laryngoscope</i> 1978; 88(5):723-728.	Review/Other-Dx	50 patients	Analysis of the radiographic observation of patients, each having an enlarged (>1.5 mm diameter) vestibular aqueduct.	Large vestibular aqueduct may be associated with other inner abnormalities in 60% of cases.	4
15. Shah LM, Wiggins RH, 3rd. Imaging of hearing loss. <i>Neuroimaging Clin N Am</i> 2009; 19(3):287-306.	Review/Other-Dx	N/A	Review of the common entities causing hearing loss and divide these pathologies into conductive hearing loss, SNHL, and mixed hearing loss.	Reviewed the common pathologies and the imaging findings affecting the hearing pathways from outside to inside, starting at the external auditory canal and moving inward toward the midbrain.	4

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16. Dickins JR, Graham SS. Evaluation of the dizzy patient. <i>Ear Hear</i> 1986; 7(3):133-137.	Review/Other-Dx	N/A	Reviews value of various tests in patients with vertigo.	Different diagnosis of dizziness can be made with appropriate tests.	4
17. Phelps PD, Lloyd GA. Radiology of vertigo. In: Phelps PD, Lloyd GA, eds. <i>Radiology of the Ear</i> . St. Louis, Mo.: Blackwell Scientific Publications; 1983:137-141.	Review/Other-Dx	N/A	Book chapter.	N/A	4
18. Hegarty JL, Patel S, Fischbein N, Jackler RK, Lalwani AK. The value of enhanced magnetic resonance imaging in the evaluation of endocochlear disease. <i>Laryngoscope</i> 2002; 112(1):8-17.	Review/Other-Dx	5 patients	Retrospective review to determine value gadolinium-enhanced MRI in the evaluation and diagnosis of endocochlear disease.	Gadolinium-enhanced MRI plays an important role in the diagnosis of cochlear pathology associated with SNHL and may directly impact patient management.	4
19. Davidson HC. Imaging evaluation of sensorineural hearing loss. <i>Semin Ultrasound CT MR</i> 2001; 22(3):229-249.	Review/Other-Dx	N/A	Review roles of imaging modalities in patients with SNHL.	Conventional enhanced MRI is the most commonly used technique. High-resolution FSE T2 MRI is an adjunctive technique that provides exquisite evaluation of the CPA, IAC, cranial nerves, and membranous labyrinth, and plays a significant role in the diagnosis and surgical evaluation of SNHL.	4
20. Cueva RA. Auditory brainstem response versus magnetic resonance imaging for the evaluation of asymmetric sensorineural hearing loss. <i>Laryngoscope</i> 2004; 114(10):1686-1692.	Observational-Dx	312 patients	Multicenter, prospective, nonrandomized comparison of ABR and MRI for the evaluation of patients with asymmetric SNHL. ABR and MRI were interpreted independently in a blinded fashion.	31 (9.94%) of 312 were found on MRI to have lesions causing their SNHL. Sensitivity of ABR as a screening test was 71%, and specificity was 74%. Study recommends abandoning ABR as a screening test for asymmetric SNHL and adoption of a focused MRI protocol as the screening test of choice (within certain guidelines).	1
21. Selesnick SH, Jackler RK, Pitts LW. The changing clinical presentation of acoustic tumors in the MRI era. <i>Laryngoscope</i> 1993; 103(4 Pt 1):431-436.	Observational-Dx	126 patients	Retrospective review to examine of application of MRI in patients with acoustic tumors.	Symptoms vary with different size acoustic tumors. MRI essential to make diagnosis.	3
22. Gebarski SS, Tucci DL, Telian SA. The cochlear nuclear complex: MR location and abnormalities. <i>AJNR Am J Neuroradiol</i> 1993; 14(6):1311-1318.	Observational-Dx	175 patients	Retrospective study to determine the value of MRI in detecting central cochlear nuclei and their diseases.	175 patients provided 350 cochlear nuclear complex for study. 13/175 patients (7.4%) had focal cochlear nuclear complex MR abnormalities; 136 of these 175 patients had been referred for MR evaluation of unilateral SNHL. In 10 of these 136 patients (7.4%), the cochlear nuclear complex abnormalities shown on MR proved to be the cause of the SNHL. MRI delineates central cochlear nuclei and focal abnormalities reliably.	3

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23. Daniels RL, Swallow C, Shelton C, Davidson HC, Krejci CS, Harnsberger HR. Causes of unilateral sensorineural hearing loss screened by high-resolution fast spin echo magnetic resonance imaging: review of 1,070 consecutive cases. <i>Am J Otol</i> 2000; 21(2):173-180.	Review/Other-Dx	1,070 consecutive cases	Retrospective review to evaluate ability of screening high-resolution, nonenhanced, FSE T2-weighted MRI of the IAC and CPA to detect nonacoustic schwannoma causes of unilateral SNHL.	High-resolution FSE screening technique, used in conjunction with appropriate clinical prescreening and referral, can provide an equally sensitive method of evaluating unilateral SNHL compared to gadolinium-enhanced T1 MRI while reducing costs and providing distinct advantages in evaluating nonacoustic schwannoma causes of SNHL.	4
24. Kocaoglu M, Bulakbasi N, Ucoz T, et al. Comparison of contrast-enhanced T1-weighted and 3D constructive interference in steady state images for predicting outcome after hearing-preservation surgery for vestibular schwannoma. <i>Neuroradiology</i> 2003; 45(7):476-481.	Observational-Dx	22 patients	Prospective study to compare contrast-enhanced T1-weighted and 3D CISS sequences for demonstrating possible prognostic factors in hearing-preservation surgery.	All tumors were adequately demonstrated by both techniques. 3D-CISS sequence, which has high contrast resolution, was superior to T1-weighted images (P<0.05) for detection of the fundal involvement. Authors believe contrast-enhanced T1-weighted images are required for diagnosis.	3
25. Kwan TL, Tang KW, Pak KK, Cheung JY. Screening for vestibular schwannoma by magnetic resonance imaging: analysis of 1821 patients. <i>Hong Kong Med J</i> 2004; 10(1):38-43.	Observational-Dx	1,821 consecutive patients	Retrospective study to examine diseases that can be detected by MRI in patients suspected of having vestibular schwannoma (acoustic neuroma) and to assess the extent of the problem of hearing loss in a screened population.	MRI is an effective tool to screen for vestibular schwannoma in patients with sensorineural or mixed hearing loss.	3
26. Somers T, Casselman J, de Ceulaer G, Govaerts P, Offeciers E. Prognostic value of magnetic resonance imaging findings in hearing preservation surgery for vestibular schwannoma. <i>Otol Neurotol</i> 2001; 22(1):87-94.	Observational-Dx	26 patients	Retrospective blinded study to determine whether three MRI findings (tumor size, extension to the fundus, intralabyrinthine signal intensity) have a predictive value to hearing preservation in vestibular schwannoma surgery.	3DFT-CISS gradient-echo images are a valuable additional tool for determining candidacy for hearing preservation surgery.	2
27. Swartz JD. Lesions of the cerebellopontine angle and internal auditory canal: diagnosis and differential diagnosis. <i>Semin Ultrasound CT MR</i> 2004; 25(4):332-352.	Review/Other-Dx	N/A	Review diagnosis and differential diagnosis of lesions of the CPA and IAC.	A wide variety of differential diagnostic possibilities that must be considered when viewing images of patients with SNHL, vertigo, and dizziness.	4
28. Zealley IA, Cooper RC, Clifford KM, et al. MRI screening for acoustic neuroma: a comparison of fast spin echo and contrast enhanced imaging in 1233 patients. <i>Br J Radiol</i> 2000; 73(867):242-247.	Observational-Dx	1,233 consecutive patients	Prospectively study patients with suspected acoustic neuroma referred for MRI and compare the diagnosis based on thin section FSE with that of gadolinium enhanced MRI.	Screening examination should continue to include a gadolinium enhanced sequence in order to optimize the detection of small acoustic neuromas.	2
29. Parry DA, Booth T, Roland PS. Advantages of magnetic resonance imaging over computed tomography in preoperative evaluation of pediatric cochlear implant candidates. <i>Otol Neurotol</i> 2005; 26(5):976-982.	Observational-Dx	56 patients	Retrospective study to compare MRI to HRCT in the preoperative evaluation of pediatric cochlear implant candidates.	MRI is more sensitive and specific in diagnosing soft tissue abnormalities in the inner ear than HRCT in cochlear implant candidates and the abnormalities detected with MRI are more likely to influence the implantation process.	3

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30. Rauch SD. Clinical practice. Idiopathic sudden sensorineural hearing loss. <i>N Engl J Med</i> 2008; 359(8):833-840.	Review/Other-Dx	N/A	To review the diagnosis and management of SNHL.	If an audiogram reveals unilateral SNHL, then MRI with gadolinium is needed to rule out a retrocochlear abnormality. In the absence of these findings, sudden SNHL is the presumed diagnosis.	4
31. Swartz JD. Temporal bone trauma. <i>Semin Ultrasound CT MR</i> 2001; 22(3):219-228.	Review/Other-Dx	N/A	Review temporal bone trauma - fractures and pseudofractures, fistulous communication, hearing loss, and facial nerve involvement.	The many manifestations of temporal bone trauma are detectable by current imaging techniques.	4
32. Bamiou DE, Phelps P, Sirimanna T. Temporal bone computed tomography findings in bilateral sensorineural hearing loss. <i>Arch Dis Child</i> 2000; 82(3):257-260.	Observational-Dx	116 patients	Retrospective analysis of children to examine the yield of CT of the temporal bones when investigating SNHL.	33 (28.4%) CT scans were identified as abnormal. Performing a CT or MRI will depend on scanner availability, expertise, and management considerations, but cochlear implant candidates will require both.	3
33. Glastonbury CM, Davidson HC, Harnsberger HR, Butler J, Kertesz TR, Shelton C. Imaging findings of cochlear nerve deficiency. <i>AJNR Am J Neuroradiol</i> 2002; 23(4):635-643.	Review/Other-Dx	22 patients	Retrospectively review high-resolution T2-weighted FSE MRI of patients examined for SNHL who had deficiency of the cochlear nerve.	Deficiency of the cochlear nerve was seen in 12 patients with congenital SNHL and in 10 patients with acquired SNHL. Deficiency of the cochlear nerve can be shown by high-resolution T2-weighted FSE MRI.	4
34. Mafee MF. Congenital sensorineural hearing loss and enlarged endolymphatic sac and duct: role of magnetic resonance imaging and computed tomography. <i>Top Magn Reson Imaging</i> 2000; 11(1):10-24.	Review/Other-Dx	N/A	To review the anatomy and embryology of the inner ear, the pathological changes associated with congenital SNHL, the spectrum of imaging findings in patients with SNHL.	MRI and CT are useful for preoperative evaluation of cochlear implant patients. CT is the study of choice for evaluating anomalies of otic labyrinth including large vestibular aqueduct. MRI is recommended to confirm the presence or absence of cochlear nerve when a cochlear implant is indicated. Both MRI and CT cannot provide any information on physiological condition and electrical excitability of the cochlear sensory end organ and cochlear nerve.	4
35. McClay JE, Tandy R, Grundfast K, et al. Major and minor temporal bone abnormalities in children with and without congenital sensorineural hearing loss. <i>Arch Otolaryngol Head Neck Surg</i> 2002; 128(6):664-671.	Observational-Dx	247 children (494 ears)	Retrospective blinded review of CT scans to determine the extent of correlation between SNHL and abnormal temporal bone anatomy in children.	A narrow IAC is found more often in children with vs without SNHL. More IAC abnormalities were seen, regardless of the presence of SNHL. With SNHL, the presence of a congenital syndrome increases the likelihood of a cochlear or vestibular abnormality.	2
36. Morzaria S, Westerberg BD, Kozak FK. Evidence-based algorithm for the evaluation of a child with bilateral sensorineural hearing loss. <i>J Otolaryngol</i> 2005; 34(5):297-303.	Review/Other-Dx	N/A	To develop an evidence-based algorithm for determining the etiology of bilateral SNHL in a child.	CT scanning of the temporal bones is frequently valuable in detecting inner ear malformations.	4

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37. Robson CD. Congenital hearing impairment. <i>Pediatr Radiol</i> 2006; 36(4):309-324.	Review/Other-Dx	N/A	Review some of the common forms of congenital hearing loss and illustrate their imaging features.	HRCT and MRI have contributed to the evaluation and management of hearing impairment.	4
38. Simons JP, Mandell DL, Arjmand EM. Computed tomography and magnetic resonance imaging in pediatric unilateral and asymmetric sensorineural hearing loss. <i>Arch Otolaryngol Head Neck Surg</i> 2006; 132(2):186-192.	Observational-Dx	131 children	Retrospective chart study to compare temporal bone CT with temporal bone and central nervous system MRI in children with unilateral or asymmetric SNHL.	When both CT and MRI were obtained (n=42), results were concordant in 69% of cases, and one imaging modality detected clinically significant abnormalities not identified by the other in 31% of cases.	3
39. Tan TY, Goh JP. Imaging of congenital middle ear deafness. <i>Ann Acad Med Singapore</i> 2003; 32(4):495-499.	Review/Other-Dx	8 patients	Examine imaging of congenital middle ear deafness. Cases of congenital middle ear deafness are illustrated.	HRCT of the middle ear is the technique of choice. With appropriate imaging technique and a systemic analysis of the images, the abnormalities that result in congenital middle ear deafness can usually be demonstrated on most occasions.	4
40. Westerhof JP, Rademaker J, Weber BP, Becker H. Congenital malformations of the inner ear and the vestibulocochlear nerve in children with sensorineural hearing loss: evaluation with CT and MRI. <i>J Comput Assist Tomogr</i> 2001; 25(5):719-726.	Observational-Dx	42 inner ears in 21 children	To examine the diagnostic value of CT and MRI in children with SNHL and to analyze anatomic abnormalities of the inner ear and the vestibulocochlear nerve.	CT and MRI allowed accurate identification of malformations of the inner ear. 99 malformations identified, with most patients showing multiple abnormalities. MRI with an extremely small field of view should be used to study possible abnormalities of the vestibulocochlear nerves.	3
41. Yuen HY, Ahuja AT, Wong KT, Yue V, van Hasselt AC. Computed tomography of common congenital lesions of the temporal bone. <i>Clin Radiol</i> 2003; 58(9):687-693.	Review/Other-Dx	N/A	Describe application of HRCT to the investigation and preoperative workup of the common lesions of congenital hearing loss.	HRCT is the basis for the pre-operative investigation of patients with congenital aural dysplasia.	4
42. Kutz JW, Jr. The dizzy patient. <i>Med Clin North Am</i> 2010; 94(5):989-1002.	Review/Other-Dx	N/A	To discuss causes and treatment of dizziness in patients.	Central causes include migraine-associated dizziness, postconcussion syndromes, cerebrovascular disease, and multiple sclerosis. Treatment depends on the cause of the dizziness and may include dietary modifications, diuretics, vestibular suppressants, vestibular rehabilitation, or surgical intervention.	4
43. McGee SR. Dizzy patients. Diagnosis and treatment. <i>West J Med</i> 1995; 162(1):37-42.	Review/Other-Dx	N/A	Review causes of dizziness and provide a scientific approach to diagnosis and treatment	Cause of dizziness can be determined in 75% of cases by interview.	4
44. Macleod D, McAuley D. Vertigo: clinical assessment and diagnosis. <i>Br J Hosp Med (Lond)</i> 2008; 69(6):330-334.	Review/Other-Dx	N/A	To review the diagnosis and assessment of vertigo.	Outline of current workup and treatment algorithms.	4

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45. Albers FW, Van Weissenbruch R, Casselman JW. 3DFT-magnetic resonance imaging of the inner ear in Ménière's disease. <i>Acta Otolaryngol</i> 1994; 114(6):595-600.	Observational-Dx	20 patients: 23 affected ears, 17 non-affected, 50 ears as controls	Randomized MRI images to examine endolymphatic duct and sac in patients with Ménière's disease using 3DFT-CISS MRI.	3DFT-CISS MRI allows a detailed visualization of the membranous labyrinth of the inner ear.	2
46. Kraus EM, Dubois PJ. Tomography of the vestibular aqueduct in ear disease. <i>Arch Otolaryngol</i> 1979; 105(2):91-98.	Review/Other-Dx	190 ears	To determine whether roentgenographic narrowing or nonvisualization of the vestibular aqueduct is a sign for Ménière's disease.	Narrowing or nonvisualization of vestibular aqueduct is not a sign of Ménière's disease.	4
47. Lorenzi MC, Bento RF, Daniel MM, Leite CC. Magnetic resonance imaging of the temporal bone in patients with Meniere's disease. <i>Acta Otolaryngol</i> 2000; 120(5):615-619.	Review/Other-Dx	21- Ménière's disease, 30-normal	To study the endolymphatic duct, MRI studies of the temporal bone were performed in patients with unilateral and bilateral cases of Ménière's disease. Results were compared with images from 30 normal ears.	Demonstration of endolymphatic hydrops "in vivo" is not yet possible by MRI; some features can be observed that can support a clinical hypothesis of Ménière's disease.	4
48. Sajjadi H, Paparella MM. Meniere's disease. <i>Lancet</i> 2008; 372(9636):406-414.	Review/Other-Dx	N/A	To review epidemiology, pathophysiology, diagnosis, and clinical management of Ménière's disease.	Although there is still no cure, more than 85% of patients are helped by either changes in lifestyle and medical treatment, or minimally invasive surgical procedures such as intratympanic steroid therapy, intratympanic gentamicin therapy, and endolymphatic sac surgery. Vestibular neurectomy has a very high rate of vertigo control and is available for patients with good hearing who have failed all other treatments. Labyrinthectomy is undertaken as a last resort and is best reserved for patients with unilateral disease and deafness.	4
49. Mateijsen DJ, Van Hengel PW, Krikke AP, Van Huffelen WM, Wit HP, Albers FW. Three-dimensional Fourier transformation constructive interference in steady state magnetic resonance imaging of the inner ear in patients with unilateral and bilateral Ménière's disease. <i>Otol Neurotol</i> 2002; 23(2):208-213.	Observational-Dx	111 patients with Ménière's disease, 62 ears in patients without Ménière's disease as controls	Retrospective clinical study. 3DFT-CISS MRI was used to quantify the distance between the vertical part of the posterior SSC and the posterior fossa as a measure of the endolymphatic sac and duct in patients with Ménière's disease.	90 patients had 3DFT-CISS MRI. 86 of these patients were analyzed in study. MRI visualized distance between the vertical part of the posterior SSC and the posterior fossa does not have any relationship to the duration of the disease.	3

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50. Nakashima T, Naganawa S, Sugiura M, et al. Visualization of endolymphatic hydrops in patients with Ménière's disease. <i>Laryngoscope</i> 2007; 117(3):415-420.	Review/Other-Dx	9 patients	To visualize how intratympanically administered drug enters the inner ear in patients with Ménière's disease.	3D-FLAIR MRI revealed that the gadolinium entered the perilymphatic space and delineated the perilymphatic and endolymphatic spaces of the inner ear. In patients with endolymphatic hydrops, the perilymphatic space surrounding the endolymph was small or had disappeared. Gadolinium appeared first in the scala tympani of the basal turn of the cochlea and the perilymphatic space of the vestibule. One day after the intratympanic injection of gadolinium, the gadolinium was observed in almost all parts of the perilymph. Six days after the intratympanic injection, the gadolinium had almost disappeared from the inner ear.	4
51. Xenellis J, Vlahos L, Papadopoulos A, Nomicos P, Papafragos K, Adamopoulos G. Role of the new imaging modalities in the investigation of Meniere's disease. <i>Otolaryngol Head Neck Surg</i> 2000; 123(1 Pt 1):114-119.	Observational-Dx	23 with Ménière's disease, 50 control	Analysis of findings after examination of the vestibular aqueduct, endolymphatic duct and endolymphatic sac complex, and periaqueductal pneumatization with HRCT and MRI of 23 temporal bones from patients with Ménière's disease.	MRI is a sensitive examination of the membranous labyrinth and may contribute to better understanding of the pathophysiology of the different stages and phases of Ménière's disease. HRCT and MRI may be used as confirmatory techniques when the diagnosis of Ménière's disease is questioned.	2
52. Goebel JA. Management options for acute versus chronic vertigo. <i>Otolaryngol Clin North Am</i> 2000; 33(3):483-493.	Review/Other-Dx	N/A	Review the rationale for treating acute and chronic vertigo with different therapeutic options.	Acute vertigo may represent labyrinthine dysfunction treated with medication or a more serious central nervous system process requiring prompt intervention to avoid long-term disability. Chronic vertigo, however, may require surgical or rehabilitative measures for lasting relief.	4
53. Hasso AN, Ledington JA. Imaging modalities for the study of the temporal bone. <i>Otolaryngol Clin North Am</i> 1988; 21(2):219-244.	Review/Other-Dx	N/A	Review roles of imaging modalities for the evaluation of the temporal bone.	Progress has been made in diagnostic imaging of the petrous temporal bone, especially in the techniques of complex motion (pluridirectional) tomography, CT, and MRI.	4
54. Mark AS, Seltzer S, Nelson-Drake J, Chapman JC, Fitzgerald DC, Gulya AJ. Labyrinthine enhancement on gadolinium-enhanced magnetic resonance imaging in sudden deafness and vertigo: correlation with audiologic and electronystagmographic studies. <i>Ann Otol Rhinol Laryngol</i> 1992; 101(6):459-464.	Review/Other-Dx	12 patients	To describe patients with enhancement of the cochlea and/or vestibule on gadolinium-diethylenetriamine pentaacetic acid-enhanced MRI, correlating the enhancement with the auditory and vestibular function.	Cochlear enhancement on the side of hearing loss was found in all patients. No labyrinthine enhancement was seen in a series of 30 control patients studied with the same MRI protocol. Labyrinthine enhancement is indicative of labyrinthine disease. Enhanced MRI may separate patients with retrocochlear lesions, such as acoustic neuromas, from those in whom the abnormal process is in the labyrinth or the brain.	4

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55. Seltzer S, Mark AS. Contrast enhancement of the labyrinth on MR scans in patients with sudden hearing loss and vertigo: evidence of labyrinthine disease. <i>AJNR Am J Neuroradiol</i> 1991; 12(1):13-16.	Review/Other-Dx	5 patients	Case report to determine the value of gadopentetate dimeglumine-enhanced MRI in patients with sudden hearing loss and vertigo.	Cochlear enhancement, on the side of hearing loss only, was found in all patients. No labyrinthine enhancement was seen in a series of 30 control subjects studied with gadopentetate dimeglumine-enhanced MR using the same protocol. Labyrinthine enhancement in patients is indicative of labyrinthine disease.	4
56. Weissman JL, Curtin HD, Hirsch BE, Hirsch WL, Jr. High signal from the otic labyrinth on unenhanced magnetic resonance imaging. <i>AJNR Am J Neuroradiol</i> 1992; 13(4):1183-1187.	Review/Other-Dx	2 patients	Case report in which high signal from the otic labyrinth was observed on precontrast MRI of patients who presented with sudden hearing loss and vertigo.	High signal may be due to hemorrhage. Further studies recommended.	4
57. Belden CJ, Weg N, Minor LB, Zinreich SJ. CT evaluation of bone dehiscence of the superior semicircular canal as a cause of sound- and/or pressure-induced vertigo. <i>Radiology</i> 2003; 226(2):337-343.	Observational-Dx	50 patients, 50 controls having CT at 1.0-mm and 57 controls having CT at 0.5-mm	To describe the CT findings at different collimation widths associated with superior SSC dehiscence syndrome and to determine the frequency of these findings in a control population.	The PPV of CT in identification of SSC dehiscence syndrome improves with 0.5-mm-collimated helical CT (93%) and reformation in the SSC plane.	2
58. Curtin HD. Superior semicircular canal dehiscence syndrome and multi-detector row CT. <i>Radiology</i> 2003; 226(2):312-314.	Review/Other-Dx	N/A	Comment on diagnosis of SSC dehiscence syndrome and MDCT.	SSC dehiscence syndrome is now an accepted cause of substantial patient symptoms. Evaluation of patients with SSC dehiscence syndrome pushes the resolution limits of modern CT scanner technology.	4
59. Mong A, Loevner LA, Solomon D, Bigelow DC. Sound- and pressure-induced vertigo associated with dehiscence of the roof of the superior semicircular canal. <i>AJNR Am J Neuroradiol</i> 1999; 20(10):1973-1975.	Review/Other-Dx	1 patient	Present a patient with sound- and pressure-induced vertigo associated with bony dehiscence of the roof of the superior SSC.	CT should be performed early in the diagnostic workup of patient.	4
60. Branstetter BfT, Harrigal C, Escott EJ, Hirsch BE. Superior semicircular canal dehiscence: oblique reformatted CT images for diagnosis. <i>Radiology</i> 2006; 238(3):938-942.	Observational-Dx	27 patients; 27 control patients; 108 total temporal bones	To retrospectively determine, by using thin-section MDCT, whether additional reformations in the planes of Stenver and Poschl change the diagnostic interpretation for SSC dehiscence when compared with the diagnostic interpretation of standard coronal reformations for SSC dehiscence.	Observer 1 diagnosed SSC dehiscence in 25/108 (23%) temporal bones and had no discordances between the two reviews. Observer 2 diagnosed SSC dehiscence in 21/108 (19%) temporal bones and had one intraobserver discordance. After a post hoc consensus review of this one discordance, the radiologic diagnosis remained equivocal. The discordance involved the right temporal bone of a patient suspected of having SSC dehiscence in the left temporal bone, so no clinical follow-up was available.	4

Hearing Loss and/or Vertigo
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
61. Kikuchi S, Kaga K, Yamasoba T, Higo R, O'Uchi T, Tokumaru A. Slow blood flow of the vertebrobasilar system in patients with dizziness and vertigo. <i>Acta Otolaryngol</i> 1993; 113(3):257-260.	Observational-Dx	102 patients	To determine value of MRI to detect vertebrobasilar insufficiency in patients over 50.	Slow blood flow in the vertebrobasilar system was detected in 36 patients (35%). MRI is recommended for evaluation of vascular disorders in older patients with vestibular symptoms.	3
62. Norrving B, Magnusson M, Holtas S. Isolated acute vertigo in the elderly; vestibular or vascular disease? <i>Acta Neurol Scand</i> 1995; 91(1):43-48.	Observational-Dx	24 patients	Prospectively study patients (50-75 years) with the acute onset of isolated vertigo lasting >48 hours and no abnormality on neurological examination other than nystagmus. Study protocol included neuro-imaging (MRI 22 patients, CT 2 patients), Doppler US, and electro-oculography.	MRI/CT showed the presence of an infarction of the caudal cerebellum in 6 patients (25%). MRI of the posterior fossa was normal in 18 patients. On electro-oculography, ataxic pursuit eye movements were a characteristic finding in patients with cerebellar infarction, whereas caloric test findings were not discriminative.	3
63. American College of Radiology. <i>Manual on Contrast Media</i> . Available at: http://www.acr.org/~link.aspx?_id=29C40D1FE0EC4E5EAB6861BD213793E5&amp;_z=z .	Review/Other-Dx	N/A	Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media.	N/A	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
 - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
 - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
 - c) the study is an expert opinion or consensus document.

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

3DFT = 3D Fourier transformation

ABR = Auditory brainstem response

CPA = Cerebellopontine angle

CISS = Constructive interference in steady state

CT = Computed tomography

FLAIR = Fluid-attenuated inversion-recovery

FSE = Fast spin-echo

HRCT = High-resolution computed tomography

IAC = Internal auditory canal

MRI = Magnetic resonance imaging

PPV = Positive predictive value

SNHL = Sensorineural hearing loss

SSC = Superior semicircular canal

US = Ultrasound