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CASE REPORT

Auditory evoked potentials (AEP) – an important help in early diagnosis of Schwannoma originating from vestibular nerve

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Abstract: Early diagnosis of expansive formations enables efficient therapy and maximal reduction of remaining neurological damage. Schwannoma situated entirely within the inner auditory canal with free pontocerebellar angle is a rather rare event. Of significant diagnostical help are auditory evoked potentials (AEP), computerised tomography (CT) of the temporal bone pyramid with measuring the inner auditory canal diameter, and magnetic resonance (MRI). In this paper we present a case of a 56-year-old woman with gradually advancing noise in the right ear, weakening of hearing and occasional instability while walking. AEP register no evoked response at the right side, whereas at the left side the latencies and amplitudes of evoked acoustic responses are adequate. CT of the temporal bone pyramid shows a difference in the inner auditory canal diameters of 0.04 cm. MRI shows a Schwannoma tumorous formation in the inner auditory canal, situated entirely within the canal with free pontocerebellar angle *(Fig. 3, Ref. 16)*. Full Text (Free, PDF) *www.bmj.sk.*
Key words: Schwannoma, n. VIII, AEP, CT, MRI.

The neurophysiological method of registering the auditory evoked potentials (AEP) represents a great advancement in the diagnosis of neuro-otological diseases. AEP is a diagnostic method that enables sensitive detection of the progression of potentials through the acoustic nerve. The pathological process can be located depending on changes of latency and amplitude of each evoked response wave (1, 2).

AEP enables early diagnoss of diffuse and focal lesions of the brain stem and other parts of the acoustic canal. Utilised is a dynamic diagnostic procedure that registers the evoked potentials. Applied are all neurophysiological and technical skills using unilateral, contralateral and bilateral stimulations aimed at obtaining the most precise response possible and an exact diagnosis of the waves I, III and V. Wave I depends on the synchronous reaction of high-frequency fibrils of the distal part of wave VIII situated in the superficial part of the nerve. Wave III depends on activities of the superior olivary complex and the crossing of auditory canals. Waves IV and V correspond to the more rostral brain-stem structures. Wave IV depends on lateral lemniscus activities and on bilateral canals. Wave V results from the inferior colliculus activity (3–6). The latency of I–III is an indirect measure of conductibility in the pontocerebellar segment of the auditory canal, which is important for diagnosing tumours of nerve VIII and other lesions in this region, whereas the latency of III–V shows conductibility in the rostral pontine and mesencephalic segments of the auditory canal (5, 6).

Standard CT of posterior cranial cavity is insufficient in cases of clinical suspicion of neurinoma of the acoustic nerve. Such cases often require CT with contrast agent, as it shows the contrast imbibed formation more clearly. MRI of brain is a method of choice in showing the cerebellopontine angle tumour. This fact is confirmed by other authors as well (7, 8).

Our goal is to diagnose the tumorous process as early as possible in order to select the most beneficial medical treatment before any severe neurological damage occurs.

Case report

This 56-year-old woman is occasionally instable while walking, swerving to the right side. In the last three or four months she complained of noise in her right ear. Save the hypacusia and a discrete instability in the tandem-Romberg test, neurological tests are perfectly normal. Otoscopic findings are normal. Audiogram shows perceptively more significant hearing reduction at the 65–50 dB threshold at the right side, whereas hearing at the left side is normal. AEP was performed by a Medelec Synergy – Oxford Instruments. Both ears were stimulated by acoustic click stimuli of up to 80 dB intensity. Responses were detected above a Cz electrode. Stimulation of both acoustic canals registers normal evoked responses at all levels at the left side, whereas the right side waves III and V fail to be registered (Fig. 1).

Performed is computerised tomography (CT) of the temporal bone pyramid by a spiral CT apparatus, Siemens Somatom EMOTION 2000. The right-sided inner auditory canal was shown

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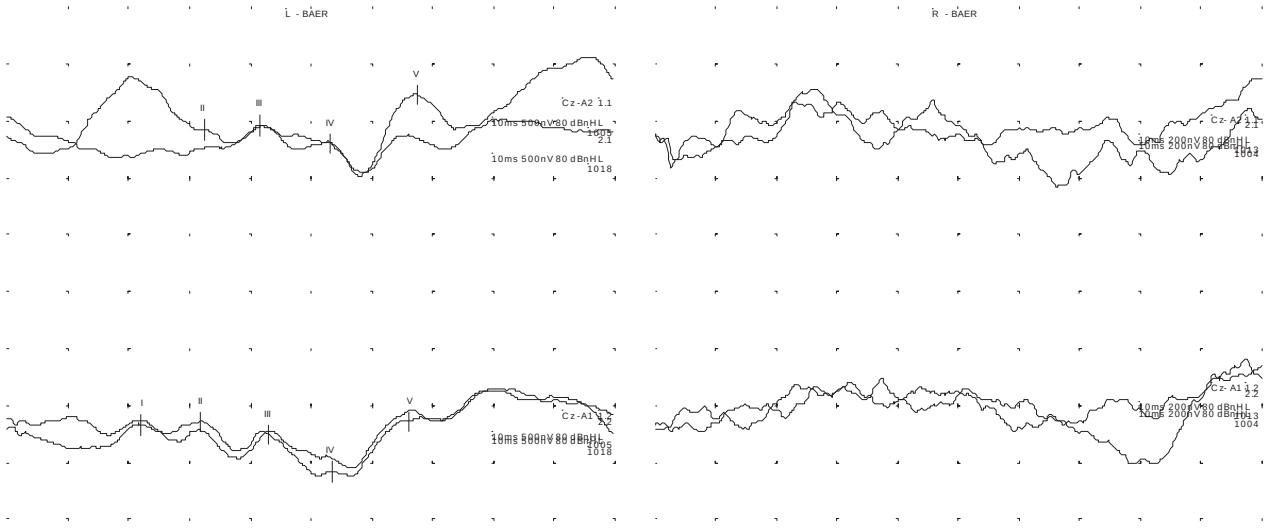

Fig. 1. Auditory evoked potentials (AEP) – auditory stimulus conductivity disturbances at the right side.

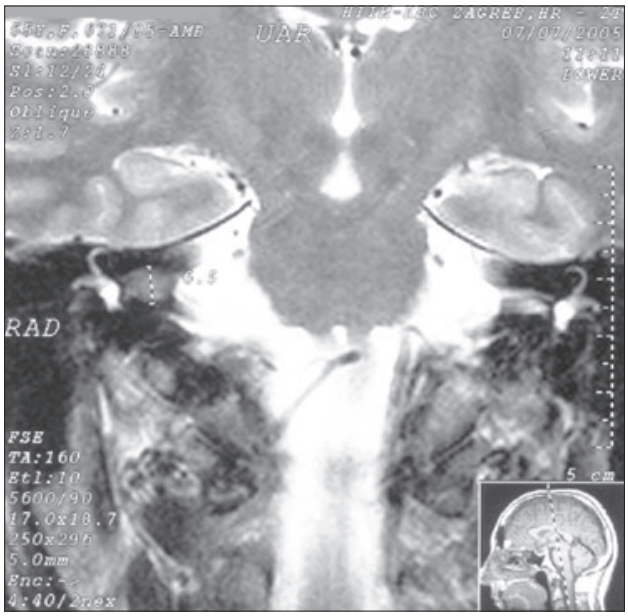

Fig. 2. MRI of the brain – expansive formation in the right side inner auditory canal, coronary cross-section.

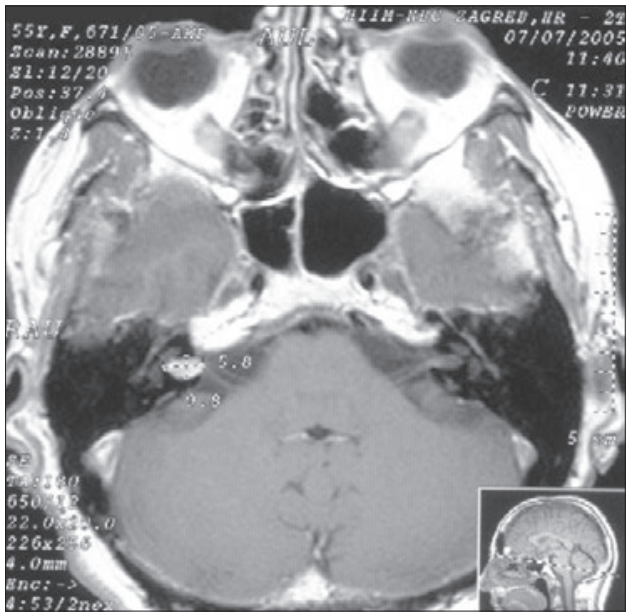

Fig. 3. MRI of the brain – expansive formation in the right side inner auditory canal, transversal cross-section.

up to 0.64 cm in width, and the left one up to 0.60 cm. Intravenous application of contrast agent showed no pathological contrast imbibition. Both pontocerebellar angles are free. MRI was made by Siemens Symphony 2002 apparatus of 1.5 T. MRI shows an expansive formation entirely situated within the right inner auditory canal, with the pontocerebellar angle being free. The expansive formation is isointensive in T1 and T2-weighted images, being primarily consistent with the nervus vestibularis Schwannoma. The right-sided auditory canal is widened up to 6.5 mm in diameter (Fig. 2 a 3).

Radiosurgery methods indicate that the tumour is consistent with a Schwannoma, 166.2 mm in size. The radiosurgery procedure was performed by a 4-mm APS collimator. Applied was gamma-knife radiosurgery, the dose being of 13 Gy with isodose concentration of 65 %. The maximum tumour dose was of 20 Gy. No complications occurred in the treatment. There remains right-sided facial hypestesia and rare hemifacial spasms.

Discussion

Early diagnosis of tumorous processes situated in the inner auditory canal and causing minimum neurological damage re-

quire a sensitive neurosurgical approach. Discrete initial signs, such as hearing difficulties, noise, and instability, require diagnostic treatment. Incidence of Schwannoma in tumours located in the pontocerebellar angle is deemed significant in as much as 50 %. The sensoneural hearing impairment testing and treatment protocol is neither uniform nor consistent strategy in the world (9). Growth of tumour in the inner auditory canal causes an increase in the intracanalicular pressure, which results in hearing impairment with Schwannoma of the vestibular nerve. AEP is an examination that tests the damage of the auditory canal by detecting the biopotential flow. The AEP sensitivity in assessing a possible tumour process in pontocerebellar angle tumours is relative (10–12).

Schwannoma is a benign neoplasm of nerve sheath and the most common neoplasm of the internal auditory canal and cerebellopontine angle. AEP is used extensively in the detection of pontine angle tumours and brain-stem abnormalities (13, 14). The short-latency AEP is a useful noninvasive test to screen for lesions affecting the eighth cranial nerve. AEP is superior to conventional audiometry, electrocochleography, tomograms of the internal auditory canals, and CT with intravenous contrast (15).

Pathological changes in latencies and amplitudes of particular AEP responses require further treatment, i.e., CT of the temporal bone pyramid with measuring the inner auditory canal diameter. Diameters of the healthy and the changed auditory canals are compared, and requirements of further diagnosis are assessed. However, based upon pathological AEP results, CT with contrast and/or MRI of the brain may be done. MRI of brain of larger resolution is the method of choice in the final diagnosis of Schwannoma n. VIII (7, 13, 16).

Yet, it can be concluded that AEP is the method of choice when the diagnosis of Schwannoma originating from nerve VIII is suspected. The latter method can indicate that sensitive neuroradiological diagnostic treatment is required.

References

1. Aminoff MJ. Electrodiagnosis in clinical neurology. New York, Churchill Livingstone 1999; 451—484.

2. Chiappa KH. Evoked potentials in clinical medicine. Philadelphia—New York, Lippincott-Raven publishers 1997; 157—198.

3. Josey AF, Jackson CG, Glasscock ME. Brain stem evoked response audiometry in confirmed eighth nerve tumors. Amer J Otolaryngol 1980; 1 (4): 285—290..

4. Stockard JJ, Stockard EJ, Sharbrough FW. Brain-stem auditory-evoked responses. Arch Neurol 1979; 36 (9): 597—598.

5. Robinson K, Rudge P. Centrally Generated Auditory Potentials. In: Halliday M (Ed). Evoked potentials in clinical testing. Edinburgh, Churchill Livingstone 1982; 345—372.

6. Haralampiev K, Kitanoski B. Auditivni evocirani potencijali moždanog stabla, normalne vrijednosti i dijagnostičke mogu•nosti. Vojnosanitet Pregl 1986; 43 (4): 273—277.

7. Zanetti M, Weishaupt D. MR imaging of the forefoot: Morton neuroma and differential diagnoses. Semin Musculoscelet Radiol 2005; 9 (3): 175—186.

8. Lapsiwala SB, Pyle GM, Kaemmerle AW, Sasse FJ, Badie B. Correlation between auditory function and internal auditory canal pressure in patients with vestibular schwannomas. J Neurosurg 2002; 96 (5): 872—876.

9. Ahmed I, Fenton JE, Manning K, Koegh P. Management of sudden sensorineural hearing los — a national survey. Ir Med J 2004; 97 (5): 146—147.

10. Lapsiwala SB, Pyle GM, Kaemmerle AW, Sasse FJ, Badie B. Correlation between auditory function and internal auditory canal pressure in patients with vestibular schwannomas. J Neurosurg 2002; 96 (5): 872—876.

11. Frohne C, Matthies C, Lesinski-Schiedat A, Battmer RD, Samii M, Lenarz T. Extensive monitoring during auditory brain stem implant surgery. J Laryngol Otol Suppl 2000; (27): 11—14.

12. Gilain L, Bouccara D, Jacquier I, Achouche J, Casteran JM, Freyss G, Tran Ba Huy P. Diagnostic strategy of acoustic neuroma. Evaluation of efficacy of auditory evoked potentials. Apropos of a series of 50 neuroma cases. Ann Otolaryngol Chir Cervicofac 1991; 108 (5): 257—260.

13. Salzman KL, Davidson C, Harnsberger R, Glastonbury CM, Wiggins RH, Ellul S, Shelto C. Dumbbell Schwannomas of the Internal Auditory Canal. Amer J Neurol Radiol 2001; 22: 1368—1376.

14. Eggermont JJ, Don M. Mechanisms of central conduction time prolongation in Brain-stem auditory evoked potentials. Arch Neurol 1986; 43: 116—120.

15. Legatt AD, Pedley TA, Emerson RG, Stein BM, Abramso M. Normal Brain- stem auditory evoked potentials with abnormal latency-intensity studies in patients with acoustic neuromas. Arch Neurol 1988; 45: 1326—1330.

16. Inamasu J, Shiobara R, Kagami H, Sato S, Kawase T, Kanzaki J. Medial (intra-cisternal) acoustic neuromas. Acta Orolaryngol 2000; 120: 623—626.

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