



ORIGINAL ARTICLE

Extra-Tympanic Electrocochleography in a Normal Population. A Descriptive Study[☆]



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KEYWORDS

Electrocochleography;
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Abstract

Introduction and objectives: Extra-tympanic electrocochleography is an electrophysiological register obtained after stimulating the cochlea with an audible stimulus. This stimulus is applied using an earphone over the external auditory canal, while the electrical activity is registered by surface electrodes. There are few studies that analyse normal electrocochleography in our environment. Thus, the main objective of our study was to regularise the values obtained with electrocochleography in ears without any otoneurological diseases. We explain in detail the process of obtaining the register.

Methods: Sixty healthy ears were studied by extratympanic electrocochleography. Statistical results were analysed. While 30 ears were studied with a stimulus at 90 dB, another 30 ears were studied with a stimulus at 80 dB.

Results: Summating potential and action potential latencies and amplitudes were measured. Summating potential/action potential ratios were calculated. Wave I and wave II latencies were also determined. These results were analysed in function of stimulus intensity, patient gender, patient age group and ear side studied.

Conclusions: This study collected extra-tympanic electrocochleography data in a normal population and the results were in the range of other international studies obtained in other countries. These data can be used as a reference to evaluate illnesses that affect cochlear structure or functions.

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PALABRAS CLAVE

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Electrococleografía extratimpánica en una población normal. Estudio descriptivo**Resumen**

Introducción y objetivos: La electrococleografía extratimpánica es un registro electrofisiológico que refleja la actividad eléctrica acontecida en la cóclea tras un estímulo sonoro. Se obtiene mediante la aplicación del estímulo en el conducto auditivo externo y el registro de la actividad eléctrica mediante electrodos de superficie. Dada la escasa literatura existente acerca de la exploración electrococleográfica normal en nuestro medio, este estudio busca regularizar los valores obtenidos mediante esta exploración en sujetos sin enfermedad otoneurológica y explicar detalladamente el proceso mediante el cual se obtiene el registro.

Métodos: Exploración mediante electrococleografía extratimpánica de 60 oídos sin enfermedad otoneurológica y análisis estadístico de los resultados obtenidos. De ellos, 30 oídos fueron explorados a 90 dB mientras que otros 30 oídos fueron estimulados a 80 dB.

Resultados: Se muestran los valores medios de amplitud y latencia del potencial de sumación y del potencial de acción, así como las latencias medias de la onda I y la onda II. Asimismo, se presenta el cálculo del cociente potencial de sumación/potencial de acción. Obtenidos estos resultados se comparan en función de la intensidad del estímulo, del sexo del paciente, del oído estudiado y del grupo etario.

Conclusiones: Este estudio recopila datos sobre la electrococleografía en una población normal. Los valores obtenidos están en el rango de los valores normales de otros países, expuestos en la literatura internacional. Estos datos pueden ser muy útiles como referencia a la hora de valorar exploraciones en pacientes con dolencias que afectan la estructura o la función coclear.

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Introduction

Electrocochleography is an electrophysiological test covering the short latency auditory evoked potentials which occur in the first 10–15 ms after sound stimulation.¹ It records the electrical activity occurring in the cochlea and the auditory nerve after sound stimulation, which can be emitted in various ways, as clicks or tone burst.

Electrocochleography can be classified as transtympanic or extratympanic depending on the location of the electrodes. Given that the placement of electrodes on the promontory, necessary to achieve an intratympanic electrocochleography, is an invasive procedure, this study was undertaken using the extratympanic technique, which is considered a non-invasive test. This is why although the transtympanic technique can be more precise, have lower noise levels and achieve potentials of greater magnitude,^{2–7} the extratympanic technique was used because it is easy to perform, due to the speed in achieving the recording and because it is not aggressive.^{7,8}

The recorded wave comprises different potentials^{8–12}: cochlear microphones, summing potential (SP) and action potential (AP). Cochlear microphonic potentials are an alternating electrical current produced by the hair cells of the organs of Corti in which the contribution of the external cells is 10 times greater than that of the internal cells. It is a potential that is recorded after low or moderate stimuli, the phase and duration of which relate linearly with the intensity of the stimulus. The SP is continuous electrical activity which reaches its greatest amplitude in the area where the effect is recorded of the summation of potentials of a wider portion of the displacement of the basilar

membrane. In practice it appears mixed with the AP. Finally, the AP corresponds to the summed response of the synchronous firing of the acoustic nerve fibres. It corresponds with the end of electromechanical transduction and with the start of the electrical activity of the auditory nerve. The SP/AP ratio can be calculated from these potentials.

The most established and best known clinical application of electrocochleography is in diagnosing and monitoring Menière's disease.^{4,10,11,13–18} It can also be useful for intraoperatively monitoring the auditory structures during surgical procedures where there is a risk of injury.¹⁹ Furthermore, the study of cochlear microphonic potentials has been reported to enable a diagnosis of auditory neuropathy.^{20,21} It is possible that electrocochleography is also useful in some demyelinating and autoimmune diseases such as sudden hearing loss.²²

Although many authors agree that an SP/AP ratio greater than 0.5 is pathological and indicates the presence of endolymphatic hydrops,^{4,10,11,14,15,23–27} there is little literature on the normal values of electrocochleography that sets a clear normal limit.^{8,12,16,28} The parameters depend on many factors that can change the latency and amplitude of the potentials. As a consequence, the SP/AP ratio can also be variable, which makes it difficult to set a numerical limit that indicates endolymphatic hydrops. This is why many authors suggest that each centre should create their own control group to determine the normality values of electrocochleography under the working conditions used in that particular centre.^{14,27} On the one hand, the aim is to describe in detail the process for obtaining an electrocochleographical recording so that the results shown are useful for other testers in confirming reproducibility in

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