ECoG as a Monitoring Tool for Meniere's Disease

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Introduction

Meniere's Disease is a complex disorder affecting the inner ear, affecting both balance and hearing. This systematic review investigates the use of Electrocochleography (ECoG) as a monitoring tool for Meniere's Disease.

ECoG is commonly used as a diagnostic tool for Meniere's Disease. Is there evidence in the literature to also support its use to monitor the disease through treatment or progression of the disease?

Questions

Can ECoG results be used to track the progression of Meniere's Disease?

What is its current use in monitoring Meniere's?

This question is addressed by investigating the factors and outcomes in a systematic review of the literature.

Search Criteria

Literature Review:
-Keywords extracted from systematic review question.
-Inclusion/exclusion criteria
-Appraisal of literature
-Evaluation of literature

Search Terms:
-Meniere's Disease
-Electrocochleography (and acronyms)
-Monitoring

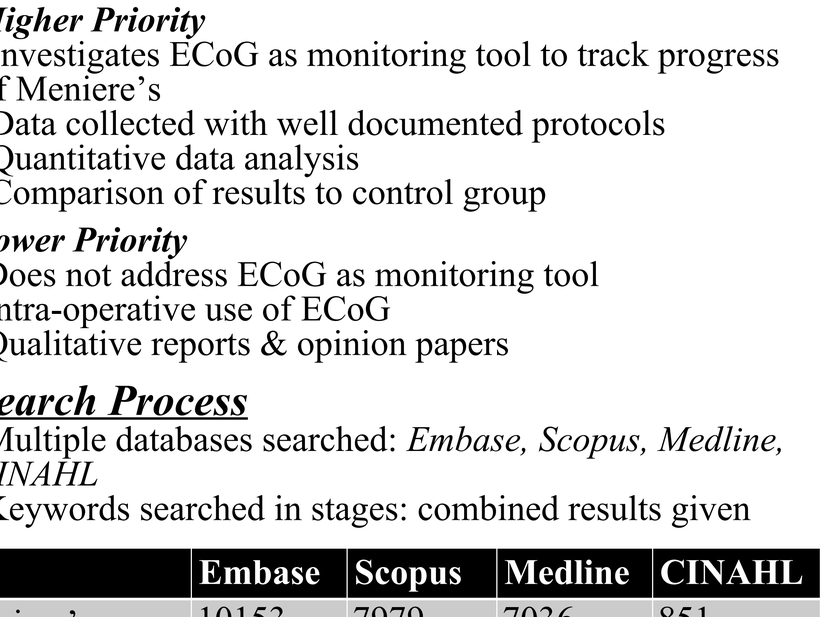
Inclusion / Exclusion Criteria

Higher Priority
-Investigates ECoG as monitoring tool to track progress of Meniere's
-Data collected with well documented protocols
-Quantitative data analysis
-Comparison of results to control group

Lower Priority
-Does not address ECoG as monitoring tool
-Intra-operative use of ECoG
-Qualitative reports & opinion papers

Search Process
-Multiple databases searched: *Embase, Scopus, Medline, CINAHL*
-Keywords searched in stages: combined results given

	Embase	Scopus	Medline	CINAHL
Meniere's Disease	10153	7979	7036	851
ECoG	1598	1597	2766	775
Monitoring	635086	1137015	444598	71960
Combined	25	26	33	4



Results

The literature search included 8 articles that were appraised for their quality using the Crowe Critical Appraisal Tool (CCAT) Version 1.4 and the CCAT form. A data extraction tool was used to gather key pieces of information from each article including: authors, year, research objectives, sample size, interventions, ECoG techniques, research methods, findings & conclusions, and a CCAT quality score. The table below displays the results of the literature search and summarizes the findings.

#	Reference	Research Objective	Sample Size	Description of Intervention	ECoG Technique	Findings/Conclusions	CCAT Score
1	Adamonis et al. 2000	Comparison of ECoG before and 1 month after intratympanic gentamicin	*n=48* normal control, MD control, treated group	Gentamicin: transtympanic ECoG before & 1mo after	100-µs clicks 2000 repetitions 8.3/s rate 90dBnHL Tymp electrode	Significant reduction in SP/AP ratio of treatment group. Evidence supports reduction in hydrops via ECoG measurement.	83% or (33/40)
2	Büki et al. 2012	Comparison of before/after measurements following gentamicin therapy	*n=62* *40 before & after*	Intratympanic gentamicin (1-6 injections) ECoG 1mo, 2mo, & after last injection Ratio > 0.4 abnormal	Alternating clicks 2000 repetitions 20/s rate 80-95dBnHL Tymp electrode	Intratympanic gentamicin showed a significant decrease in SP/AP ratio of MD patients. AP latency values compared between involved/non-involved ears were significant.	75% or (30/40)
3	Martin-Sanz et al. 2014	Changes in ECoG after intratympanic steroid injections and long term effects	*n=62*	Dexamethasone: 3 weekly, 4mg/ml treatments ECoG 1mo before, 1mo after, 12mo after treatment Ratio > 0.5 abnormal	Alternating clicks 1000 repetitions 8.1/s rate 99dBnHL Tymp electrode	Significant SP/AP ratio differences between 1 month pre- & post-treatment. Ratios returned to initial values following 1 year post-.	88% or (35/40)
4	Martin-Sanz et al. 2013	Use of ECoG to monitor response of MD patients to intratympanic steroids	*n=53*	Dexamethasone: 3 weekly, 4mg/ml treatments ECoG 1mo before & after treatment Ratio > 0.5 abnormal	Alternating clicks 1000 repetitions 8.1/s rate 99dBnHL Tymp electrode	Significant SP/AP ratio between 1 month before and after treatment. Short term benefit of treatment through ECoG monitoring.	83% or (33/40)
5	Miller & Agrawal 2014	Review of recent intratympanic therapies for MD	N/A	Various 1 study with ECoG: Martin-Sanz et al. 2013	See Martin-Sanz et al. 2013	Limited evidence of ECoG use for monitoring MD. Only recent study completed by Martin-Sanz et al. 2013	65% or (26/30)
6	Moon et al. 2012	Predictive value of ECoG at initial visit on hearing outcomes	*n=90*	ECoG SP/AP ratio obtained at initial visit. Ratio > 0.34 abnormal	Alternating clicks 1000 repetitions 8.1/s rate 90dBnHL TIPtrode	High SP/AP ratios at initial visit may be used as a predictors for hearing outcomes for MD patients—especially MD Stages 1 & 2.	80% or (32/40)
7	Nguyen et al. 2010	Survey on clinical use of ECoG in diagnosis/treatment of Meniere's Disease	*n=143*	N/A	Little consensus amongst survey respondents	Low clinical use of ECoG as a tool for diagnostics/monitoring. Used routinely in only 1 of 6 respondents (half reported no use of Ecog)	53% or (21/40)
8	Orchik et al. 1998	Comparison of SP/AP ratio in MD patients before & after medical/surgical interventions	*n=84* (88 ears)	Various medical/surgical treatments (shunt, medical, dexamethasone…) ECoG before & after (mean 13.5mo) Ratio > 0.4 abnormal	100-µs square pulses 128 repetitions 11.1/s rate 90 & 100 dBnHL Needle electrode	Enlarged SP/AP ratios found before & after treatment. Despite the treatment effects on vertiginous symptoms, enlarged SP/AP ratios persisted.	68% or (27/40)

Conclusions

Data extracted from the 8 retrieved articles suggest that the evidence is varied for the use of ECoG as a monitoring tool for Meniere's Disease. There were multiple articles that show significant results following therapy, however longitudinal ECoG data is still lacking—only 1 study reported a 1 year follow up. One study found no significant results between SP/AP ratios before and after treatment. Additionally, the survey results, although lacking in statistical evidence, provided a snapshot of current ECoG use as a monitoring tool. ECoG is not used as a standard of practice, and it is not standardized in its protocols (there is some consensus). The use of ECoG as a monitoring tool is not fully supported in the literature; however, more research is needed to provide a well supported evidence-based conclusion.

References

Adamonis, J. d., Stanton, S., Cashman, M., Mattan, K., Nedzelski, J., and Chen, J. (2000). Electrocochleography and gentamicin therapy for meniere's disease: A preliminary report. American Journal of Otology, 21(4):534–542.

Büki, B., Junger, H., and Avan, P. (2012). Cochlear function in ménière's disease. Inter- national journal of audiology, 51(5):373–378.

Martin-Sanz, E., Esteban-Sanchez, J., Rodrigañez-Riesco, L., and Sanz- Fernández, R. (2014). Transitory effect on endolymphatic hydrops of the intratympanic steroids for meniere's disease. The Laryngoscope.

Martin-Sanz, E., Luzardo, C. Z., Riesco, L. R., Patino, T. M., and Sanz, R. (2013). The use of electrocochleography to monitor the response of meniere's disease patients to intratympanic steroids. Acta oto-laryngologica, 133(11):1158–1164.

Miller, M. W. and Agrawal, Y. (2014). Intratympanic therapies for meniere's disease. Current otorhinolaryngology reports, 2(3):137–143.

Moon, I. J., Park, G. Y., Choi, J., Cho, Y.-S., Hong, S. H., and Chung, W.-H. (2012). Predictive value of electrocochleography for determining hearing outcomes in meniere's disease. Otology & Neurotology, 33(2):204–210.

Nguyen, L. T., Harris, J. P., and Nguyen, Q. T. (2010). Clinical utility of electro- cochleography in the diagnosis and management of meniere's disease: Aos and ans membership survey data. Otology & neurotology: official publication of the American Otological Society, American Neurotology Society [and] European Academy of Otology and Neurotology, 31(3):455.

Orchik, D. J., Shea Jr, J. J., and Norman, N. G. (1998). Summating potential and action potential ratio in meniere's disease before and after treatment. Otology & Neurotology, 19(4):478–483.