Does Intratympanic steroid injection improves hearing in idiopathic sudden sensorineural hearing loss

Meta-Analysis study

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Abbreviations

ABR	Auditory Brain Stem Evoked Response
ATP	Adenosine Tri-Phosphate
CBC	Complete Blood Picture
CO2	Carbon Dioxide
CT	Computed Tomography
CSF	Cerebro-Spinal Fluid
CMV	Cytomegalovirus
DNA	Deoxyribonucleic Acid
G	Gauge
HIV	Human Immunodeficiency Virus
HL	Hearing Loss
ISSNHL	Idiopathic Sudden Sensorineural Hearing Loss
IL1	Interleukin 1
IT	Intratympanic
IV	Intravenous
K	Potassium
kHz	Kilo-Hertz
meq	Milliequivalant
mg	Milligram
mm	Millimeter
ml	Milliliter

mV	Millivolt
MRI	Magnetic Resonance Imaging
Na	Sodium
NFkB	Nuclear Factor Kappa B
l	Liter
LAM	LASER Assisted Myringotomy
LFSHL	Low Frequency Sensorineural Hearing Loss
PTA	Pure Tone Average
RWM	Round Window Membrane
RW	Round Window
SHL	Sudden Hearing Loss
SDS	Speech Discrimination Score
TNF	Tumor Necrosis Factor
ug	Microgram
um	Micrometer
ul	Microlitre

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Introduction

Introduction

Idiopathic Sudden sensorineural hearing loss (ISSNHL) is considered an otologic emergency requiring immediate and careful clinical intervention, followed by appropriate and specific treatment **(Ahn et al., 2007).**

ISSNHL is defined as the rapid decline in hearing in less than 3days >20 db in >3contiguous audiometric frequencies without any identifiable cause **(Byle, 1984).**

ISSNHL occurs over a short period of time and may vary from a mild to profound hearing impairment in otherwise normal hearing individuals. The disorder has an estimated incidence of 5-20 cases per 100,000 populations **(Mattox et al., 1977).**

In some cases the patient feels a pop or senses the sudden onset of tinnitus and the hearing drops precipitously, in other cases the hearing drops over a few minutes or few hours, other patients awakens in the morning with hearing loss. This condition, however constitute a medical emergency because the window of opportunity for treatment is narrow and early administration of steroids is more efficacious than watchful waiting **(Rauch, 2004).**

No single treatment exists leading to complete recovery to pre-hearing loss levels. Proposed treatments have included vasodilators, steroids (Intratympanic or systemic), antiviral agents, hyperbaric oxygen and plasmapherisis **(Slattery et al., 2005).**

Meta-analysis will be the statistical method used in this study to determine the efficacy of Intratympanic steroid therapy in the treatment of ISSNHL.

Meta-analysis is a quantitative statistical procedure that synthesizes findings across many studies, overcoming the problems of small samples and diverse outcomes and programs. According to **Tobler, 1986,** the computation of the effect size is dependent on statistically significant results. Instead of discounting the studies whose results do not reach statistical significance, as would be the case in a literature review, the quantitative results of each study are converted into a common metric (effect size). There by allowing comparison of results across studies**.**

Etiology, pathology and Pathophysiology of ISSNHL

Possible Causes of ISSNHL

In the vast majority of patients with ISSNHL, no specific cause can be identified, therefore, the disease is called “Idiopathic” an exclusion diagnosis**.** A review of 837 patients with sudden hearing loss between 1989 and 1993 found that 88% were ultimately deemed idiopathic **(Fetterman et al., 1996).**

The most popular theories as to cause ISSNHL include viral infection, vascular insufficiency, immune mediated reaction, and intra-labyrinthine membrane rupture. 60% of patients with ISSNHL have an elevation in serum viral titers compared with 40% of control **(Wilson et al., 1983).** Cytomegalovirus (CMV), mumps, and rubella have been identified in the inner ear of patients with ISSNHL **(Cole, 1988).**

There are 4 types of direct and indirect evidence for the viral theory of ISSNHL: 1-Temporal association of ISSNHL with active viral upper respiratory illness. 2-Serologic evidence of active virus infection. 3-Histopathologic examination of post mortem human temporal bones. 4-Animal experiments demonstrating virus penetration of inner ear **(Mattox et al., 1977).**

There are 3 types of circumstantial evidence to support the vascular theory of ISSNHL: 1-Sudden onset. 2-Case reports of

sudden deafness with known systemic vascular disease. 3-Histopathologic demonstration of cochlear changes caused by vascular occlusion **(Rauch, 2004).** Certain prothrombotic risk factors and genes have been associated with ISSNHL **(O'Malley and Haynes, 2008).**

Studies have shown that there are alteration in the blood and red cell filterability. And an association between ISSNHL and slow blood flow in the vertebrobasilar system, it has been reported that reduction in cochlear blood flow results in cochlear hypoxia due to edema of the capillary cells. Spontaneous perilymphatic fistulae have also been implicated in ISSNHL **(Banerjee and Parnes 2005).**

ISSNHL is classified with some of these inner ear disorders as immune mediated. **McCabe, 1979** first introduced the concept of autoimmune inner ear disease. There may be other immune mediated but not autoimmune causes of ISSNHL **(Freedman et al, 1996).** Also it was found that there is association of ISSNHL with known inner ear diseases as Wegner's disease, Cogan's syndrome (main target organs cornea and inner ear) and temporal arteritis **(O'Malley and Haynes, 2008).**

Cochlear membrane rupture is a cause of sudden hearing loss (SHL), either spontaneous in cases of ISSNHL or occur in a patient

with a history of temporal bone trauma and stapedectomy that damage the internal membranes of the cochlea and results in hearing loss. The concept of spontaneous cochlear membrane rupture is different, so there seems to be little objective evidence to support the idea that a substantial percentage of ISSNHL is caused by spontaneous cochlear membrane rupture **(O'Malley and Haynes, 2008).**

Other diseases that can result in SHL must be excluded to diagnose ISSNHL as: Acoustic neuroma, Meniere's disease, syphilis, diabetes mellitus, multiple sclerosis, Lyme disease, mumps, polyarthritis nodosa, Cogan's syndrome and migraines **(Fetterman et al., 1996).**

Pathology and Pathophysiology of ISSNHL

Some studies have described the postmortem pathologic findings in the temporal bone of patients with sudden deafness. The temporal bones were prepared in the standard manner for light microscopic study including fixation in 10% formalin, decalcification with ethylene diamine tetra-acetate, embedment in celloidin, serial sectioning at a thickness of 20 um and staining of every tenth section with haematoxylin and eosin **(Schuknecht, 1993).**