Sudden Sensorineural Hearing Loss
State-of-the-art

Milan Profant
Dept ORL HNS
Medical School, Comenius University, Bratislava, Slovakia

IFOS
Otology, Audiology course, Lima, Nov. 11-13, 2018
Sudden Sensorineural Hearing Loss
SSNHL

• Incidence: 5-20/100,000

• Definition („3x3“):
  – Sudden onset (in 72h) – 3 days
  – Hearing threshold 30dB and more
  – At least 3 neighboring frequencies

• If there is no audiogram before the SSNHL onset the other side threshold is accepted as referential threshold

• In everyday clinical practice we accept for treatment also SSNHL that does not reach 30dB in 3 frequencies
In 2/3 of patients tinnitus, in 1/3 vertigo

Unilateral >95 %,

Bilateral <5 %

Bilateral is always more serious condition!
  - More severe HL, less chance for recovery, higher morbidity (mortality?)
  - Vestibular symptoms less frequent
    - Associated with toxic, genetic, autoimunne, neoplastic and vascular ethio-pathology
    - Requires complex diagnostic approach
## Table I

<table>
<thead>
<tr>
<th>Category</th>
<th>Condition or cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic</td>
<td>Alcohol</td>
</tr>
<tr>
<td></td>
<td>Cocaine, heroin, ecstasy</td>
</tr>
<tr>
<td></td>
<td>Opioid</td>
</tr>
<tr>
<td></td>
<td>Benzodiazepine</td>
</tr>
<tr>
<td></td>
<td>Pegylated interferon</td>
</tr>
<tr>
<td></td>
<td>Antiviral agents</td>
</tr>
<tr>
<td></td>
<td>Alkalising agents</td>
</tr>
<tr>
<td></td>
<td>Synthetic prostacyclin PGI2 analogue</td>
</tr>
<tr>
<td></td>
<td>Retinoid</td>
</tr>
<tr>
<td></td>
<td>Chemotherapeutic agents</td>
</tr>
<tr>
<td></td>
<td>NSAIDs</td>
</tr>
<tr>
<td></td>
<td>Immunosuppressive drugs</td>
</tr>
<tr>
<td></td>
<td>Bisphosphonates</td>
</tr>
<tr>
<td></td>
<td>Skeletal muscle relaxants</td>
</tr>
<tr>
<td></td>
<td>Insecticides</td>
</tr>
<tr>
<td>Neoplastic</td>
<td>Gentamycin</td>
</tr>
<tr>
<td></td>
<td>CPA or petrous meningioma</td>
</tr>
<tr>
<td></td>
<td>CPA or petrous apex metastasis</td>
</tr>
<tr>
<td>Vascular</td>
<td>Neurolymphatosis</td>
</tr>
<tr>
<td></td>
<td>Leptomeningial carcinoma</td>
</tr>
<tr>
<td></td>
<td>MDS-associated hypercoagulability</td>
</tr>
<tr>
<td></td>
<td>Vestibular schwannoma</td>
</tr>
<tr>
<td></td>
<td>Acoustic neurofibroma</td>
</tr>
<tr>
<td></td>
<td>Meningeal carcinoma</td>
</tr>
<tr>
<td>Autoimmune</td>
<td>Cerebrovascular accident</td>
</tr>
<tr>
<td></td>
<td>Migraine-associated vasospasm</td>
</tr>
<tr>
<td></td>
<td>Sickle cell disease</td>
</tr>
<tr>
<td>Infectious</td>
<td>Autoimmune inner ear disease</td>
</tr>
<tr>
<td></td>
<td>Cogan’s disease</td>
</tr>
<tr>
<td></td>
<td>Kawasaki disease</td>
</tr>
<tr>
<td></td>
<td>Guillain–Barre syndrome</td>
</tr>
<tr>
<td></td>
<td>Sclerodema</td>
</tr>
<tr>
<td></td>
<td>Anti-phospholipid syndrome</td>
</tr>
<tr>
<td></td>
<td>Crohn’s disease</td>
</tr>
<tr>
<td></td>
<td>Polyochondritis</td>
</tr>
<tr>
<td>Iatrogenic</td>
<td>Mumps</td>
</tr>
<tr>
<td></td>
<td>HIV</td>
</tr>
<tr>
<td></td>
<td>HSV</td>
</tr>
<tr>
<td></td>
<td>Cryptococcal meningitis</td>
</tr>
<tr>
<td></td>
<td>Bacterial meningitis</td>
</tr>
<tr>
<td></td>
<td>Viral URTI</td>
</tr>
<tr>
<td></td>
<td>Micro-embolic surgical complications</td>
</tr>
<tr>
<td></td>
<td>GA haemodynamic complication</td>
</tr>
<tr>
<td></td>
<td>GA ototoxicity</td>
</tr>
</tbody>
</table>

## Table IV

<table>
<thead>
<tr>
<th>Age</th>
<th>Likely aetiology</th>
<th>Assessment tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Younger*</td>
<td>Infective</td>
<td>Sx on presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ix: WCC, CRP, viral serology</td>
</tr>
<tr>
<td></td>
<td>Toxic</td>
<td>Sx on presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hx: exposure to drugs shown in Table I</td>
</tr>
<tr>
<td>Older†</td>
<td>Vascular</td>
<td>Sx on presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ix: autoimmune blood panel</td>
</tr>
<tr>
<td>Neoplastic</td>
<td>Constitutional Sx</td>
<td>Sx on presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ix: CT or MRI</td>
</tr>
<tr>
<td></td>
<td>Iatrogenic</td>
<td>Hx of recent surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hx of exposure to anaesthetic agents</td>
</tr>
</tbody>
</table>

*30–50 years; †>50 years. SNHL = sensorineural hearing loss; Sx = symptoms, Ix = investigations; WCC = white cell count; CRP = C-reactive protein; Hx = history; FMHx = family history; CT = computed tomography; MRI = magnetic resonance imaging.
SSNHL Etiopathogenesis

• In 90% of cases unclear (ISSNHL),
• Exceptions:
  – Acutrauma
  – PCA tumor
  – Labyrinthitis from concurrent otitis
• Hypothesis:
  – Vascular
  – Infectious (parainfectious)
  – Autoimmune
  – Mechanical inner ear damage (membrane rupture
Vascular hypothesis

• Pros
  – A. labyrinthi – terminal artery
  – Coincidence with cardiovascular diseases and risk factors
  – Clinical development similar to heart attack or stroke

• Cons
  – Young healthy generation involved frequently
  – Absence of vestibular symptomatology
  – Questionable effect of vasoactive treatment
  – Missing histopathologic proof
  – Freequent reversibility
Viral hypothesis

• Pros
  – Common cold prior to SSNHL in many patients (but common cold is very frequent condition)

• Cons
  – Missing the proof of virus to complete Robert Koch postulates
  – Majority of patients suffer from unilateral SSNHL
  – Vaccination did not reduce incidence of ISSNHL
Autoimmune hypothesis

• Pros
  – Rapidly developing condition
  – Respond to corticosteroid treatment

• Cons
  – Unknown specific antigenes or lab markers
Hypothesis of inner ear membranes rupture

• Pros:
  – Clinical development
  – Unilaterality

• Cons:
  – Problematic proof (beta-2 transferín, kochlín-tomoproteín),
  – Absence of additional ear pathology
Diagnosis

- Pure Tone Audiometry
- HRCT (brain, TB, PCA)?
- MRI PCU?
- USG of carotid arteries?
- RTG C-spine?
- Lab tests?
- Serology?
- ???
Treatment

- Corticosteroids?
- Virostatics?
- Vasoactive drugs (what kind?),
- Antiagregance/thrombolytics?
- Vitamíny?
- Minerals?
- Nutrition supplements?

- Local injection?
- Infusions?
- Hyperbaric oxygenation chamber (HBOC)?
- Surgery?
- Laser? Magnet?
- Acupuncture?
- ???
Dept ORL HNS Bratislava (coverage of territory 500.000)

- 50-70 patients/y with SSNHL
- Previous management:
  - No guidelines
  - Different approach of different colleagues
  - Patients always in-ward treatment, infusions of vasoactive drugs and corticosteroids for 7-14days
  - In case of treatment failure long term Cavinton, Agapurin, Ginkgo biloba,...
**Inward patients**

<table>
<thead>
<tr>
<th>MD</th>
<th>Prednison 20mg: 3dni 3x2, následne 2-2-1 až po 0,5-0-0, ex, Quamatel 2x1, Cavinton 3x1, p.p. Betaserc 24 3x1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Prednison 20 mg : 5 dni 3x2, 5 dni 3x1, 5 dni 2x1, 5 dni 1x1, 5 dni 1/2 tbl, Cavinton 3x2 alebo Betaserc 3x2 tbl</td>
</tr>
<tr>
<td>3</td>
<td>Prednison 20mg 2-2-1, 2-2-0, 2-1-0, 1-1-0, 1-0-0 dobrat’ (+gastroprotekt.), with Cavinton/Trental/Betahistín or their combination</td>
</tr>
<tr>
<td>4</td>
<td>After discharge Agapurin + Cavinton, follow up after 1 month, if no improvement no additional treatment</td>
</tr>
<tr>
<td></td>
<td>No treatment if infusion therapy improved hearing</td>
</tr>
<tr>
<td>5</td>
<td>„99%“ inward.; „1%“ oral vasoactibe, Betahistín, Vinpocetin, EGB</td>
</tr>
<tr>
<td>6</td>
<td>Infusions, hospitalization</td>
</tr>
<tr>
<td>7</td>
<td>Prednison 2-2-2, 2-2-1, 2-2-0, 2-1-0, 2-0-0 3d, 1-0-0 3d, 1/2-0-0 3d, Quamatel 2x1, Cavinton 3x1, Tanakan 3x1, susp. Menier + Betaserc 24 mg 2x1</td>
</tr>
<tr>
<td>9</td>
<td>5 days Prednison 20 mg tbl. /+ Helicid /: 2-2-2, 2-2-1,5, 2-2-1, 2-2-0,5, 2-2-0. Followed by audiometry, continues Cavinton + Agapurin, resp. Cavinton + Tanakan 2-3 mes., audiometry</td>
</tr>
</tbody>
</table>
Die aktuell gefasste Leitlinie „Hörsturz“ (Akuter idiopathischer sensorineuraler Hörverlust) *

The Revised Version of the German Guidelines “Sudden Idiopathic Sensorineural Hearing Loss”

Michel et al. 2011, Laryngorhinootologie

Corticosteroids (Prednisolon 250 mg in 3 days) + rheologic treatment
Otolaryngology-Head and Neck Surgery, 146 (Suppl. 1): 1-35.

- Guideline for adults (18+y)
- Based on evidence (EBM)
- Criteria of NIDCD (National Institute on Deafness and other Communication Disorders)
- 13 recommendations
Level of recommendations in relation to EBM

<table>
<thead>
<tr>
<th>Code</th>
<th>Quality of Evidence</th>
<th>Definition</th>
</tr>
</thead>
</table>
| A    | High                | • Clinicians should follow recommendations  
                     • *Strong recommendation (SR)* |
| B    | Moderate            | • Clinicians should follow recommendations  
                     • *Recommendation (R)* |
| C    | Low                 | • One or more studies with severe limitations  
                     • Clinitions should be flexible in decisions, requirements of patients are important  
                     • *Option (Op)* |
| D    | Very Low            | Any estimate of effect is very uncertain.  
                     • Expert opinion  
                     • No direct research evidence  
                     • *No recommendation (NoR)* |
1. Exclusion of conductive hearing loss in SHL

1. Strong recommendation (SR)

- The most frequent reason for HL
  - Cerumen
  - Tubal dysfunction in common cold

- History
- Otoscopy
- Tuning forks
- Audiometry
- Tympanometry
2. Special attention to:
   - Bilateral SSNHL
   - Recurrent SSNHL
   - Focal neurologic symptoms

Recommendation (R)

- Significant possibility of other reasons for SSNHL
  - Autoimmune
  - Metabolic
  - M. Ménière
  - Stroke

- Detailed history
- General medical investigation
- Neurologic investigation
3. CT imaging

- Strong recommendation (SR) against!

- CT has no sense in initial diagnosis of SSNHL (low information, irradiation, price)

- Exceptions – clinical suspicion for stroke, head trauma, otitis
4. Audiometry to confirm ISSNHL (R)

- HL ≥ 30 dB na 3 neighboring frequencies
- Onset in 72h
- Unknown reason for HL according to history and investigations

- If audiometry is not available diagnosis is based on tuning fork tests
- Speech audiometry is also recommended
5. Lab tests

• SR – against!

• No recommendations for routine lab tests in patients with SSNHL

• Reasons:
  – False positivity/negativity
  – Low value
  – No influence on treatment outcome
  – Price
6. Exclusion of retrocochlear pathology (SR)

- **1. MRI** (gold standard) - every patient with idiopathic SSNHL should have MRI !!!
- **2. BERA**

- **Pathologic finding in MRI in SSNHL is 7-14%** - *The most effective method to identify etiopathology in SSNHL*
7. Patient education (SR)

- Type of diagnosis
- Benefits and risks of medical interventions
- Limits of medical proofs and their effectivity
8. Initial Corticosteroid treatment (Op)

- **Oral CS:**
  - Supression of hypothalamo-pituitar-adrenal axis
  - Risk of Cushing like sy
  - Treatment duration 10-14 days
  - Low price

- **Intratympanic CS:**
  - Minimal general effect
  - Local reaction
    - Pain
    - Ear drum perforation
    - Dizziness
  - High price
  - Frequent visits
• Oral corticosteroids:
Best chance to improve hearing during first 2 weeks, low chance after 4-6 weeks

Doses:
• Maximal effect in **Prednisone** 1mg/kg/d,
• Usually the daily doses not more than 60mg
• Single shot doses
• 7-14 days of treatment followed by reducing the doses in the same time period
  - 200-300 mg HCT ~ Prednison 60mg ~ Dexametazon 10 mg
  (Prednison is 4x, Methylprednisolon 5x, Dexamethason 25x more effective than HCT)

Contraindications: insulin dependent DM (or decomp DM), Hypertension, TBC, peptic ulcus, some psychiatric dg
9. Hyperbaric Oxygenotherapy (Op)

- To be applied before 3 months of SSNHL
- Statistically the effect of treatment does not differ from CS
- Price?
- Availability?
- Eustachian tube function (barotrauma)
- Repeated sessions (5-10X)
10. Other pharmacologic treatment

• **R – against!**

• Antiviral drugs, thrombolytics, vasodilators, vasoactive drugs should not be routinely administered

• **Reasons:**
  – Nonsignificant results against placebo or corticotherapy,
  – Price,
  – Risk of sideeffect is overweighting benefit (overtreatment)

• Individual needs may indicate such a treatment
11. (Salvage therapy) (R) (paralel with primary CS?)

- After unsuccessful primary treatment salvage therapy should be recommended
  - **intratympanic** corticosteroids

- Higher concentration in the target organ can be reached than in genera CS administration

- **Method:**
  - 5 days - 3 months after primary unsuccessful treatment
  - 3-5 sessions during 1-2 weeks or every 2 days
• Hearing improvement can be expected in 50% of patients
• Intratympanic corticotherapy:

• Different schemes: at least 3-4 administrations during 1-2 weeks

• Myringotomy or tube

• 15-30 min. in otologic position

• Audiometry before each administration, after treatments and during follow ups
12. Evaluation of treatment results (R)

- 97% pac. have stabilized hearing 3 months after treatment
- No additional improvement can be expected
- Minimal follow up should be 6 months after treatment completion
- Follow up includes PTA a Speech Audiometry
IT corticotherapy

• Outpatient procedure
• Spinal needle, 2 ml syringe,
• Dexamethason or Methylprednisolone (for i.v. administration)
• Local anesthesia
• IT administration of cca 0,5 ml corticoid through posterior inferior quadrant
• 15-20 min. otologic position, avoid swallowing
• Audiogram before each administration
Complications

• Caloric vertigo (2-3 min.) – (solution should have a body temperature)
• Leak into pharynx aftertaste in mouth (avoid swallowing)
• Pain
• Permanent perforation (10-15%)

→ Patient counselling!
Audiogram after IT corticotherapy (N=20)
Salvage IT corticotherapy - results

**Hearing recovery (n=20)**
- Total: 10%
- Parcial: 50%
- No follow up: 15%
- No: 25%
- 25%

**Tinnitus (n=18)**
- Reduced: 38%
- Disappeared: 17%
- Worse: 6%
- Not changed: 22%
- N/A: 17%
Literature 2012-2017

• Too many papers
• Small series
• Non-univocal outcomes
• Metaanalysis – problems with heterogeneity of methodology
• Nowadays simultaneous administration of general and IT treatment
El Sabbagh et al. 2016, Laryngoscope
Contemporary algorithm

• **Primary th:**
  – Prednison 60 mg 7-14 dní (equivalent HCT 300 mg i.v. inf.),
  – Reducing the dosage during the same period (+gastroprotectives)

• **Salvage therapy:**
  – IT corticotherapy
  – +/- HBOT

• **Simultaneous general and local (IT) corticotherapy**
New possibilities

How long should patients stay in position after intratympanic steroid injection?

Soon Hyung Park, Jin Young Seo, In Seok Moon
Keimyung University School of Medicine
Yonsei University School of Medicine
New possibilities

• Inhibitor of gamma secretase
  – Influencing of Notch signal pathway that in mammals switches of possibility of hair cells regeneration (Phase II study)

• IGF-1 – influencing supporting cells of organ of Corti to inhibit hair cells apoptosis (Yamahara et al. 2015, Hear Res).
Tinnitus

• Tinnitus: The perception of sound when there is no external source of the sound
• Primary tinnitus: Tinnitus that is idiopathic and may or may not be associated with SNHL
• Secondary tinnitus: Tinnitus that is associated with specific underlying cause (other than SNHL) or an identifiable condition
• Acute tinnitus less than 6 months
• Chronic tinnitus more than 6 months

- To deal mostly with chronic tinnitus
- Acute tinnitus associated with SSNHL to be managed the same way as SSNHL
- *G. biloba* medication or any other medical treatment is not recommended
Take home message in SSNHL

• **Diagnosis:**
  – Typical history
  – Otoscopy normal
  – Tuning fork tests, tympanometry, audiometry
  – MRI PCU

• **Treatment**
  – As soon as possible oral and/or intratympanic corticosteroids in sufficient dosis on outpatient basis

• Other drugs and HBOT unclear effect, not recommended
• Delayed treatment (after 3 months) non-legitimate
• Audioprosthetic rehab when treatment fails
Thank you