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Learning Objectives:

Introduction: The study aimed on evaluating the benefit of a preoperative three-dimensional (3D) planning tool for surgically placement of the bone conduction floating mass transducer (BC-FMT) of the Bonebridge (BB) bone conduction hearing implant. As the BB should be implanted in the mastoid without compromising the dura or the sigmoid sinus, placement may be challenging especially in children with small mastoids, in malformations and after multiple ear surgery.

Method: Since 2012, the Bonebridge was implanted in 22 Patients, including 7 children <16 y old (mean = 34.2 y ± 23.4 SD; min 5, max 76 y). Audiological testing was performed preoperatively, and 1 month and 3 months postoperatively. A preoperative planning tool was developed based on high resolution CT-scans of the temporal bone: AMIRA-software based 3D models of the Bonebridge implant and of the skull were freely adjusted and fusioned, allowing to detect the optimal implant position ("virtual surgery"). Transfer to the intraoperative situation was performed based on anatomical landmarks.

Results: The BB could be accurately placed in the selected locations. Simultaneous planning and implantation oft the BB and bone anchors for ear prosthesis was performed in 2 cases.In some cases, preoperative planning revealed insufficient bone thickness of the mastoid, preventing BB-implantation.Audiological data showed a significant benefit 3 months after implantation in speech recognition, hearing in noise, in directional hearing and sound localization.

Conclusions: Audiological results were comparable to those reported in other studies about bone anchored hearing systems. Preoperative 3D planning is recommended especially in primarily small, poorly pneumatized mastoids, hypoplastic mastoids in malformations, reduced bone volume after canal wall down mastoidectomy, small mastoids in children, and for planning of simultaneous implantation of bone anchors for ear prostheses.

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Cholesteatoma and the mastoid (N843)

ID: 843.1

Secondary obliteration of discharging mastoid cavities

Presenting Author: **Lars Vendelbo Johansen**

Lars Vendelbo Johansen

Aarhus University Hospital

Learning Objectives: I will demonstrate how I now manage old discharging radical cavities. Over the years I have been using several techniques and with varying success. Now I most frequently use BonAlive as obliteration material, some times in combination with the temporal periosteal flap (described by M Yung and P Smith). I will present videos and pictures from the operations and updated figures of my material.

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Cholesteatoma and the mastoid (N843)

ID: 843.2

Incidence of mastoidectomy among cholesteatoma patients in Denmark

Presenting Author: **Bjarki Djurhuus**

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Objective:

1) To describe the incidence rate of first-time surgically treated middle ear cholesteatoma (STMEC1) in Denmark 1977–2015 and to estimate the proportion undergoing mastoidectomy.
2) To describe the recurrence rate after STMEC1 on Funen 1982–2015 taking surgical approach into consideration.

Methods: Cases of STMEC1 were identified by the use of the Danish National Hospital Register which also provided data on mastoidectomy. A change in incidence rate over time was examined using Poisson regression analysis.

For STMEC1s on Funen, the medical records were reviewed. The rate of recurrence was analyzed by the Kaplan Meier method and Cox regression analysis.

Results: A total of 16,475 STMEC1s were identified. Of these 4,416 (27%) were children (<16 years of age) and 12,059 (73%) were adults.

The incidence rate of STEM1 in adults was stable at 6–7 per 100,000 person years for the last couple of decades.

In children the incidence rate fell from 15 per 100,000 person years in 2002 to 7 per 100,000 person years in 2015.

The proportion undergoing mastoidectomy was stable (53% in children and 58% in adults).

The medical records from 1,003 patients with cholesteatoma (1,056 ears) were reviewed. The overall proportion of ears with recurrence was 38% in children and 14% in adults 5 years after primary surgery. Individuals without the need of mastoidectomy were at lowest risk of recurrence while individuals undergoing canal wall up (CWU) without

obliteration had the highest risk of recurrence (58% in children and 20% in adults after 5 years). In children, CWU without obliteration was associated with a hazard ratio for recurrence of 1.9 (95% 1.2–3.0) when compared with CWU with obliteration.

Conclusion: The incidence rate of STMEC1 in children halved from 2002 to 2015. Compared with adults, children were at an increased risk of recurrence. In children treated with CWU, obliteration was associated with a significantly lower risk of recurrence compared with no obliteration.

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Cholesteatoma and the mastoid (N843)

ID: 843.3

Rationale for obliteration of the mastoid cavity

Presenting Author: **Michael Gaihede**

Michael Gaihede

Aalborg University Hospital

Learning Objectives: Basic knowledge about the anatomy and function of the mastoid provides a rationale for obliteration of the cavity in cholesteatoma surgery.

"Danish Otology Society symposium"

Mastoidectomy is often included in cholesteatoma surgery in order to eradicate the disease. In such cases the subsequent reconstruction of the middle ear may include obliteration of the mastoid. This has become increasingly popular, because studies have demonstrated less recurrent cholesteatomas. While this may speak for itself, the basic reasons for obliteration have not been documented.

The rationale for mastoid obliteration should be based on its function in normal and diseased ears, but our understanding of the mastoid function is rather limited despite its unique structure compared with the tympanum. Thus, the mastoid has been regarded to have only a passive role, where it may enhance the area for gas exchange as well as be a pressure buffer by virtue of its volume.

Recent clinical physiological experiments have demonstrated how pressure regulation of the middle ear cleft consists of both stepwise pressure changes by Eustachian tube openings as well as gradual pressure changes explained by changes in the thickness or congestion of the mastoid mucosa. More studies have confirmed this idea, which may point to a role of the mastoid in the overall pressure regulation.

The histological structure of the mastoid mucosa favors such a function by a loose connective tissue and abundant blood vessels. However, the mucosa does not display cilia and goblet cells as found in the tympanum, which makes it more susceptible to inflammatory changes. Chronic or recurrent infections may easily cause a relative fibrosis, which inevitably limits its capability for thickness changes based on its congestion, whereas its capability for gas absorption may remain unaffected.

In this scenario, the mastoid mucosa may have lost its functional properties because of chronic or recurrent inflammations, and obliteration can eliminate the contribution of a diseased mucosa, which may contribute only to gas absorption and development of middle ear underpressure.

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Cholesteatoma and the mastoid (N843)

ID: 843.4

Primary obliteration of the mastoid cavity in cholesteatoma surgery

Presenting Author: **Peter Schousboe**

Peter Schousboe

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Learning Objectives: Handling of Canal wall up and Canal wall down mastoidal cavities in cholesteatoma surgery.

Danish Otology Society symposium

Mastoidectomy is often necessary in cholesteatoma surgery. If the posterior ear canal wall can be preserved, the mastoidal cavity remains in contact with the middle ear air space, even though it is often filled with scar tissue. The pressure-regulating role of the mastoid mucosa is presumably destroyed or severely diminished due to removal of the trabecular structure. Should the canal wall-up cavity be obliterated in order to prevent recurrence of a cholesteatoma? Or should it be left open allowing subsequent re-aeration? The latter includes a risk of renewed negative pressure in the middle ear and mastoid and the development of recurrent cholesteatoma.

If the posterior ear canal wall has to be removed producing a modified radical cavity, the ear canal is substantially enlarged. This implies regular cleaning (often by an ENT specialist), and moist and infections in the cavity can be troublesome. Should the cavity be obliterated in order to restore the ear canal to its normal size? Or should it be left open for optimal disease control? We have developed a strategy with partial obliteration and enlargement of the ear canal opening. Bone dust, cartilage, fascia and on rare occasions artificial material can be used for obliteration. We find that a partial obliteration diminishes the need for postoperative ear care.

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Endoscopic Ear Surgery 2 (R844)

ID: 844.1

Beyond the middle ear

Presenting Author: **Presutti Livio**

Presutti Livio

University Hospital of Modena

The lateral skull base constitutes an anatomic boundary between the fields of neurosurgery and otolaryngology.