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Abstract book

Orals in plenary programme

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S1.1 Cortical plasticity in children with short durations of single sided deafness (SSD)

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Objective: To assess impacts of cochlear implantation on cortical development in children with single sided deafness (SSD).

Methods: Our study cohort is now 63 children with short durations of single sided deafness (SSD) (mean(SD)=2.1(1.64) years) who have received cochlear implants (CIs). Age at CI reflected early onset SSD(n=44, 2.5(1.7) years or late onset of SSD (n=19, 11.6(3.8) years). Multi-channel electroencephalography measured cortical responses evoked by trains of acoustic pulses from the normal hearing (NH) ear and trains of electrical pulses from the CI. Datalogging measured consistency of daily CI use. Repeated measures were collected regularly with CI use in each participant. Voxels in left and right auditory cortices were identified in 22 participants using the ER-TRACS beamformer and maximum dipole moments were selected for analyses of effects including duration and consistency of CI use.

Results: Both groups demonstrated cortical preference for the NH ear at initial CI use. Over time, this preference reduced in the early-onset SSD group but persisted in the late-onset SSD group. In the early-onset SSD group, expected responses from the CI in the contralateral auditory cortex increased, particularly when daily CI use exceeded 6.5 hours. By contrast, responses from the deaf implanted ear in the late-onset SSDgroup showed a tendency to deteriorate (reduced lateralization to contralateral cortex). Consistent daily CI use could not halt this negative change in deafened ear activity but did support the NH ear by reducing abnormal responses (decreased strength of response in ipsilateral cortex).

Conclusion: Cortical reorganization driven by unilateral hearing can occur throughout childhood and adolescence. Consistent daily CI use helped reduced cortical reliance on the NH ear in both groups. CI use promoted auditory development of the deaf ear in the young early-onset SSD group but was not sufficient to halt deterioration of pathways from the deafened ear in the older late-onset SSD group.

S1.2 CI or ABI? Utility of an auditory nerve test system in children

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Objectives

At Sant Joan de Déu Barcelona Hospital, the use of auditory brainstem implants (ABI) is increasingly common. But given the limited performance obtained with an ABI, a test electrode has been used for assessing the functionality of the auditory nerve and thus helping in decision making between the CI and ABI.

Methods

Five paediatric cases are presented. Three were unilaterally implanted with a MED-EL Mi1200 SYNCHRONY ABI. The remaining two were implanted with a MED-EL CI (Mi1200 SYNCHRONY Compressed and Mi1250 SYNCHRONY 2 FORM19). In four cases, a test electrode (MED-EL Auditory Nerve Test System - ANTS) was first inserted into the patient's cochlea trying to find an auditory response.

Results

The first case, with congenital cleft palate and bilateral cochlear agenesia, was implanted with an ABI (6 currently active electrodes). From that moment on, the ANTS system was used with complicated cases. In the third and fourth cases (with aplasia of cochlea, labyrinth, atresia of IAC, agenesia CN VII on the right side, cystic cochlear vestibular malformation type I, presence of CN VII and IAC on the left, and a old patient on the DoI with Goldenhar syndrome, bilateral severe cochlear malformation CN VIII hipo/aplasia and bilateral CAI stenosis , the result with the ANTS was negative, and were implanted with an ABI (8 and 5 active electrodes respectively). In the second (with bilateral IAC stenosis) and fifth cases (with bilateral cochlear vestibular malformation type I with auditory nerve hipoplasia, auditory response was obtained with the ANTS, so the patients received a CI (10 and 12 active electrodes respectively).

Conclusion

Without the availability of this test electrode, maybe all 5 cases would have been implanted with an ABI. Or, 4 of them would have received a CI, but only two would have worked, With the ANTS system we were able to make a straightforward decision based on the evidence of neural response also in severe cochlear and auditory nerve malformation.

S1.3 The Exoscope in Pediatric Cochlear Implantation: is it feasible?

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Objectives

Operational microscopes (OM) have become the golden standard in otological surgery since the introduction at operating room (OR) in 1954. Modern OMs provide generally good magnification and visibility in to the small and delicate operating field of ear surgery. The main drawbacks of the OMs are related to problem of accessibility and poor ergonomics, which fatigue the surgeon and potentially lead to suboptimal performance. Three-dimensional (3D) exoscopes have been developed to overcome these limitations. The high-definition 3D image provides clear view with depth perception for the surgeon and assisting staff in the operation room. The exoscopes have currently been utilized mainly in the neurosurgery, although the use in otologic surgery has gradually gain some ground in OR. Here we present our experience of the exoscope in pediatric cochlear implantation.

Methods

We found two bilateral child patients (12 month and 3-year) and two unilateral child patients (4- and 5-years) with normal temporal bone anatomy operated with the exoscope (Aesculap Aeos, Braun, Kronberg im Taunus, Germany) between November 2021 and June 2022. We collected data of the operative time, the overall occupation time in the OR and possible complications during the surgery per ear (6 cases). Control group (two bilateral, 11 and 12 month and two unilateral 3- and 7-year) were gathered from patient files retrospectively operated with OM.

Results

All of the operations were carried out successfully without complications in the both groups. Mean operative time and overall time for the cases with exoscope was 125 min (190;91) and 207 min (238;181), respectively. For the OM control group operative time and overall time were 148 (185;95) and 264 min (393;185), respectively. Difference between operation time between exoscope and OM were statistically significant (p=0.04) but not in overall time (p=0.08).

Conclusion

The exoscope is feasible and safe to use in pediatric cochlear implantation in patients with normal temporal bone anatomy and comparable to OM. Due to small and heterogenic group of patients in this study, more research regarding the effectiveness and use of the exoscope in ear surgery is needed.

S2.1 Looking for a biomarker of neuroplasticity in congenital deafness treatment by cochlear implantation – is plasma level of MMP-9 a one?

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Treatment of congenital deafness with cochlear implantation allows for effective rehabilitation of speech and language, however considerable inter-individual differences among implantees do exist. To date very little or nothing is known about determinants of linguistic proficiency development, other than age of implantation, in children without comorbidities. Genetic biomarker of neuroplasticity in prelingualy deaf children qualified for cochlear implantation could facilitate their clinical management, especially rehabilitation, giving higher chances for development of robust proficiency of spoken language. We investigated whether plasma levels of matrix metaloproteinase MMP-9 and BDNF and proBDNF/BDNF ratio measured at cochlear implantation and at 8 and 18 months follow-up is a prognostic marker of auditory skills acquisition outcome.
Method: We performed a prospective observational study analysis of serum activities of MMP-9 at CI activation, 8, and 18 months after CI activation in the cohort of 61 children, diagnosed with bilateral profound sensory- neural non-syndromic hearing loss, aged below 2, treated with unilateral cochlear implantation. Language acquisition was assessed with Little Ears Questionnaire (LEAQ). We studied associations between serum activities of MMP-9 and BDNF in the aforementioned intervals and LEAQ scores over follow-up intervals of the implanted children.
Findings: Correlation analysis shows that there is a significant relation between plasma level of MMP-9 and LEAQ score in 18 month follow up (rho= - 0.69, p= 0.060).
Conclusion: MMP-9 plasma level measured at cochlear implantation below 150 ng/ml predisposes deaf children to good response to cochlear implantation after 18 months follow-up.
Funding: National Centre of Science grant NCN UMO 2013/14/D/NZ5/03337

S2.2 Auditory memory and narrative skills of children with congenital single-sided deafness with and without a cochlear implant

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OBJECTIVES: Pediatric single-sided deafness (SSD) affects children's spatial hearing abilities and increases their risk for other developmental difficulties, like speech-language delays. Even at a young age, children with SSD may have worse language scores compared to their normal hearing peers. While early cochlear implantation supports improved hearing-related outcomes, its impact on language development has received less attention. In our ongoing longitudinal study, we investigate the language skills of our group of young children with prelingual SSD. Half of them have received a cochlear implant (CI) before the age of 2.5 years. The aim of our current study is to explore the auditory memory capacity and narrative abilities of these children.

METHODS: We assessed the children's auditory memory span using word lists of increasing length. We also administered a story-retelling task, during which children hear a story first before retelling it in their own words. We have collected longitudinal data from 61 children aged 2.8 to 6.8 years, across three participant groups: children with prelingual SSD with a CI (SSD+CI, n = 18) or without a CI (SSD, n = 15), as well as controls with bilateral normal hearing (NH, n = 33).

RESULTS: Children in the SSD group achieved lower auditory memory scores than the SSD+CI group ($p = 0.04$) and the NH group ($p = 0.04$). Similarly, they performed worse on the narrative task compared to both the SSD+CI group ($p = 0.03$) and the NH group ($p = 0.05$). Across groups, we found a positive correlation between auditory memory span and narrative skills ($r = 0.35$, $p < 0.001$).

CONCLUSION: Our results suggest that early cochlear implantation not only supports grammar development, but also more complex language skills like auditory memory and narrative abilities. These findings affirm that cochlear implantation is a useful intervention to support the language development of children with prelingual SSD.

FUNDING: The current work is funded through a Baekeland mandate (grant number HBC.2020.2308) by VLAIO, in collaboration with Cochlear Technology Center.

S2.3 Audiologists' Views And Perceptions Of Multidisciplinary Team Factors Influencing Cochlear Implantation In A Developing Country, South Africa.

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Objectives: Multidisciplinary teamwork is accepted as the "gold standard" for various health conditions. One of the key responsibilities of the multidisciplinary team (MDT) is decision-making about candidacy for cochlear implant candidates. Bottlenecks or delays within this process may increase the patients waiting time and delay the patient's referral to treatment time or time to cochlear implantation. Influencing factors that affect referral to treatment time or cochlear implantation by multidisciplinary team members are not well understood. To determine audiologist's views and perceptions of multidisciplinary team factors influencing cochlear implantation in South Africa.

Methods: A qualitative research design was used comprising of Zoom interviews with 14 MaPping audiologists or STA's registered with the South African Cochlear Implant group (SACIG) through snowball sampling. Participants were from four provinces namely Gauteng, Free-State, Eastern Cape and Western Cape. Both private and public cochlear implant programmes were represented. The NVivo software revealed 783 codes, which were further broken down into 1420 sub-codes. Data was analyzed using the thematic analysis.

Results: Nine key themes emerged that focused on technical factors which included resources and guidelines as well as non-technical factors such as team composition, public health issues, culture; timeous decision making influenced cochlear implantation services in South Africa. Lack of universal newborn hearing screening programs; limited funding, economic issues, access to technology, infrastructure, and attitudinal barriers delayed CI decision making and implantation. Conversely, well-functioning, cohesive and coordinated team decision making and practices expedited processes facilitating optimal services for CI.

Conclusion: Understanding the bottlenecks or delays in the cochlear implantation process allows for multidisciplinary members to rectify influencing factors that affect service provision and sustainability of the program. Furthermore, understanding the urgency, importance, and timing of cochlear implantation for optimal hearing and potential developmental opportunities, needs to be understood by all team members. Referral to treatment time in the cochlear implantation process should consider these factors and how the sustainability of the program is affected.