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Social science

Case Report

Youngest age implanted in Kuwait

Post meningitis hearing loss

Dr Mariam Alkandari, consultant Audiovestibular physician

Dr Mutlaq Alsihan consultant Otorhinolaryngology, head and neck surgeon

Dr Ahmed Ashour, senior practitioner ENT

Aud Fahad Almethen , chief Audiologis

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Abstract

Meningitis, particularly bacterial meningitis, is a severe disease with serious complications, one of the most significant being complete hearing loss, often affecting both ears. Therefore, early diagnosis and treatment are of utmost importance to prevent such complications. Additionally, the early detection of hearing impairment resulting from meningitis is crucial, as it can have severe effects on the cochlea. Meningitis may lead to cochlear inflammation, followed by rapid ossification, ultimately rendering the patient unable to benefit from any hearing devices, including the most powerful and efficient hearing aids or even cochlear implants of any type.

Cochlear implantation for cases of severe to profound hearing loss due to meningitis is considered an emergency procedure that must be performed immediately after diagnosis to ensure the best possible outcomes. Delayed intervention may result in the inability to benefit from the implant due to cochlear ossification, which complicates electrode insertion, regardless of the child's age.

The presented case is the youngest recorded patient to undergo cochlear implantation following bacterial meningitis, which resulted in profound sensorineural hearing loss in both ears. CT scans revealed the early stages of cochlear ossification. The procedure was performed within a few weeks of the onset of meningitis and hearing loss diagnosis. The child, an Egyptian national, was fully sponsored by charitable organizations in Kuwait.

Keywords: Meningitis, hearing loss, cochlear implant.

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الملخص

تعتبر التهابات السحايا بالأخص الالتهابات البكتيرية , من الأمراض الخطيرة ذات مضاعفات خطيرة , منها فقدان كلي للسمع غالبا لكلا الأذنين. لذا الحرص علي تشخيصه وعلاجه لتدارك المضاعفات ذات أهمية قصوي, كما أن من الأهمية القصوي اكتشاف مضاعفات ضعف السمع الذي قد يتبع التهاب السحايا مبكرا, لما له من أثار خطيرة علي الأذن, حيث أنه قد يتسبب بالتهابات القوقعة يتبعها تكلس سريع بالقوقعة مما بدوره يجعل المريض ليس له قابلية للاستفادة من أي جهاز سمعي إن كان سماعات طبية ذات أقوي درجة وكفاءة أو حتي زرع جهاز القوقعة بأي نوع.

عملية زراعة القوقعة لحالات ضعف السمع الشديد إلي شديد جدا تبعا للالتهابات السحايا هي من العمليات الطارئة والتي يجب أن تتم فور التشخيص وذلك لتدارك عدم الاستفادة بعد ذلك بالإضافة إلي صعوبة زرع الشريط الالكتروني بالقوقعة بسبب التكلس بغض النظر عن عمر الطفل. والحالة التي تم عرضها هي أصغر عمر تم زرع جهاز القوقعة لها وذلك بعد إصابته بالتهاب السحايا البكتيرى تبعه ضعف سمع حسي عصبي شديد جدا كلا الأذنين وكان من خلال الأشعات المقطعية تبين البدء بالتكلس. تم إجراء العملية له خلال أسابيع قليلة من بدء الالتهاب وتشخيص ضعف السمع. علما بأن الطفل مصري الجنسية وتكفلت به اللجان الخيرية بالكويت.

الكلمات المفتاحية: التهاب السحايا، فقدان السمع، زراعة القوقعة.

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Case study background:

7 month old Egyptian infant, a product of full term pregnancy, twin pregnancy, C.S, birth weight 2300 gm, has no family history of hearing loss, no history of consanguinity and not incubated. There was no history of pre-natal, peri-natal, or post-natal factors. Hearing screening before discharging the mother with her babies from maternity hospital were normal, that is pass both AABR & TEOAE.

At the age of 4months, The infant received vaccination (3rd October 2024). 3 weeks later he developed fever for 3 days, 38°c followed by improvement after receiving antipyretic drug. One month after he had recurrent attack of fever with vomiting, due to which he had been referred from polyclinic to the hospital paediatric department. On examination, he was found to have neck stiffness and he started to get an attack of convulsion. Lumbar puncture done which confirmed to be positive for streptococcal bacterial meningitis.

One month later he developed hearing loss bilateral, due to which, he had been referred immediately to ENT & Audiovestibular Departments.

Clinical audiological assessment showed no response to the environmental sound. Behavioural test showed bilateral profound hearing SNHL, Diagnostic ABR chirp stimulus at 4KHz, broadband no response, tone burst at 500 Hz showed no response, TEOAE diagnostic frequency specific showed no response. Therefore, he had been diagnosed as bilateral profound SNHL, as a complication following meningitis.

Preoperative Audi-logical test results:

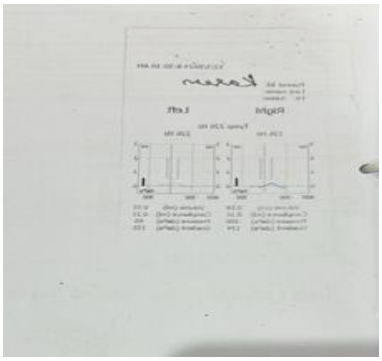


FIGURE 1 TYMPANOGRAM

FIGURE 2ABR

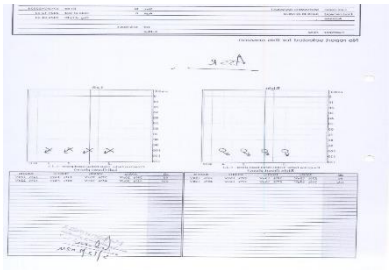


FIGURE 3 ASSR

Radiological results:

Urgent CT scan and MRI temporal bone done showed the following:

1. Brain images suggesting meningitis and bilateral cerebral sequelae of old insults as well as moderate to marked communicating hydrocephalus.
2. MRI features are suggestive of labyrinthitis with evidence of labyrinthitis ossificans.
3. Evidence of right sided labyrinthine fistula noted between the lateral semicircular canal and right middle ear cleft.
4. Evidence of dehiscence of the right sided superior semicircular canal and bilateral posterior semicircular canals.
5. Partial erosion of the right sided tympanic portion of the facial canal bony boundaries.
6. Abnormal increased postcontrast enhancement of the right superior, lateral and posterior semicircular canals on right side and basal turn of cochlea bilaterally
7. MRI and CT features could suggest right ear inflammatory changes with blunting of the right sided scutum and partial erosion of the ossicular chain and right tegmen tympani noted yet no definite MRI evidence of cholesteatoma.
8. Partial erosion of the right sided tegmen tympani, abnormal hyper enhancement of the right vestibulocochlear nerve and left cochlear nerve denoting extension of the inflammatory changes.

FIGURE 4 INFLAMMATORY PROCESS OF RIGHT MIDDLE EAR CLEFT AND MASTOID

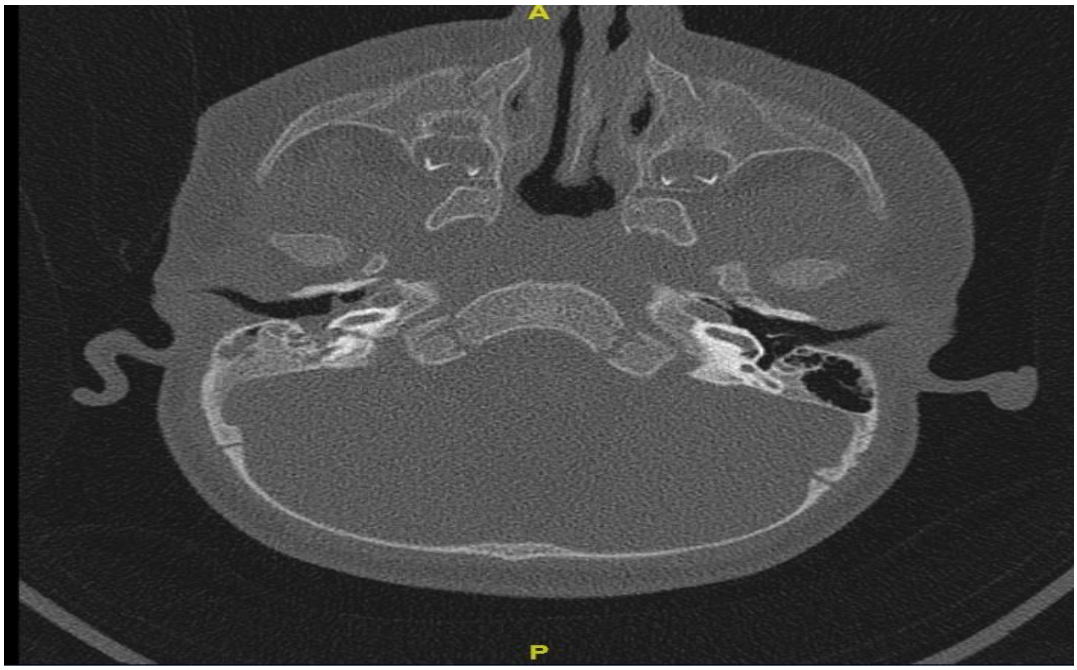


FIGURE 5 OSSIFIED RIGHT OVAL WINDOW NICHE.

FIGURE 6 PARTIAL OSSIFICATION OF LEFT OVAL WINDOW.

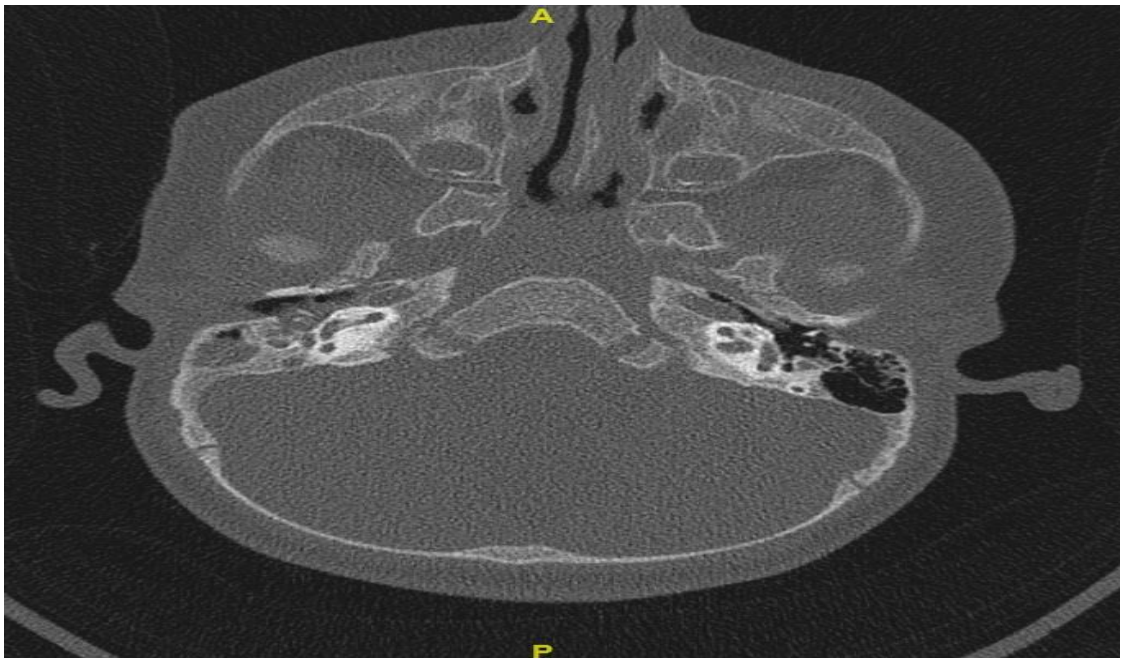


FIGURE 7PARTIAL OSSIFICATION OF BASAL TURN OF RIGHT COCHLEA

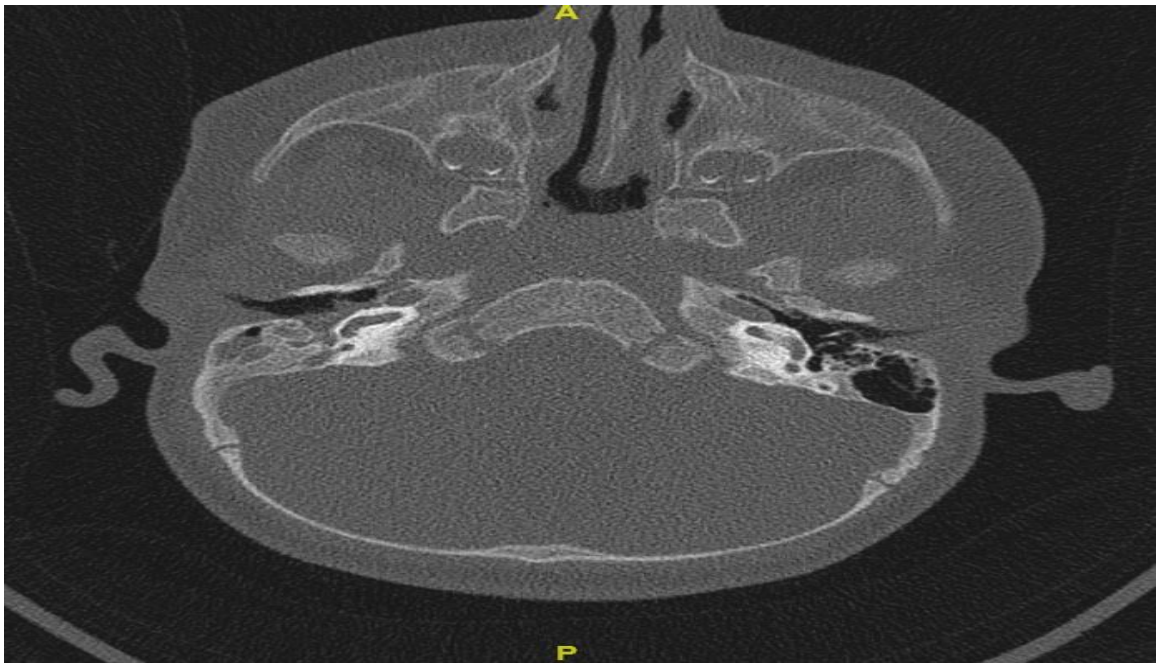


FIGURE 8PARTIAL OSSIFICATION OF BASAL TURN OF LEFT COCHLEA

Bilateral Cochlear Implantation Using MED-EL SONATA:

An immediate cochlear implant both sides were done after 5 days from the beginning of diagnosis using MED-EL device, SONATA, + FLEX 28.

Operative steps: right postauricular incision, dissection of subcutaneous layer, elevation of periosteum. Cortical mastoidectomy was done, congested oedematous mucosa and glue from middle ear during cortical mastoidectomy was noted. Significant ossification was noted in right round window niche. Modified round window technique and round window opened by drilling, insertion of electrode was done. At mid turn of cochlea, there was mild resistance that was overcome by minimal forcible insertion. Electrode was fully inserted.

Left side was slightly better, not congested mucosa and left round window niche ossification was also noted. Same steps were done.

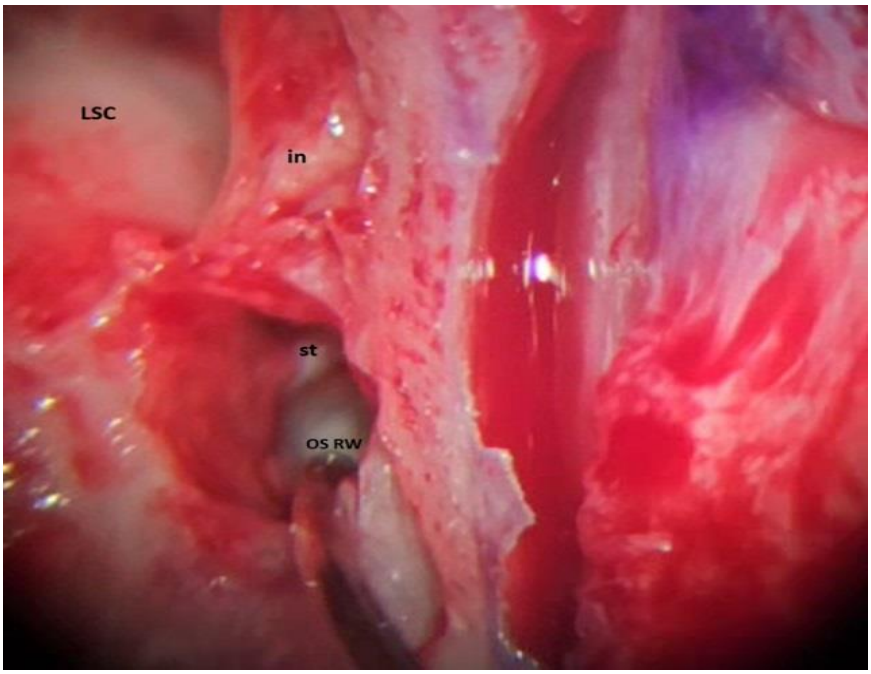


FIGURE 9RIGHT INTRAOPERATIVE OSSIFIED ROUND WINDOW

(LSC: lateral semicircular canal, in: incus, st: stapedial tendon, os RW: ossified round window)

FIGURE 10RIGHT ROUND WINDOW AFTER OPENING FOR ELECTRODE INSERTION

Intraoperative tests result, impedance and ART:

Detailed operation notes showed that full insertion of the electrodes has been done and all contacts were in the cochlea, drilled implant bed, single skin flap with 2.5mm, with hearing preservation technique.

Intraoperative impedance test results showed to be good through all channels.

AutoART recording has been done, which showed accepted results as a meningitis complication.

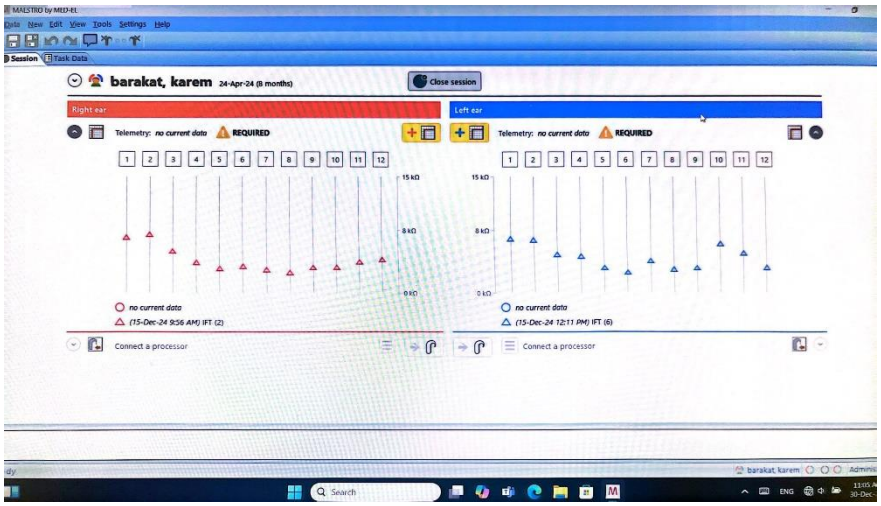
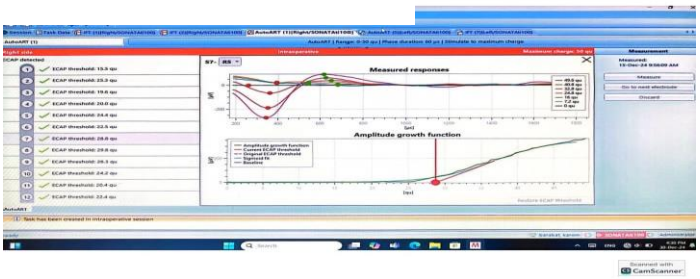
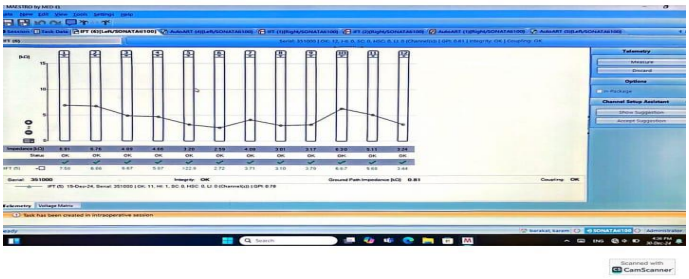
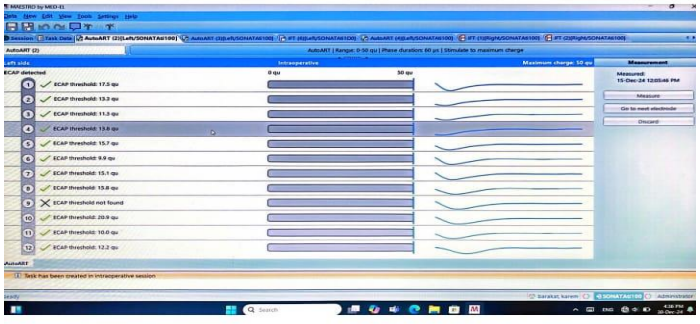


FIGURE 11IMPEDANCE







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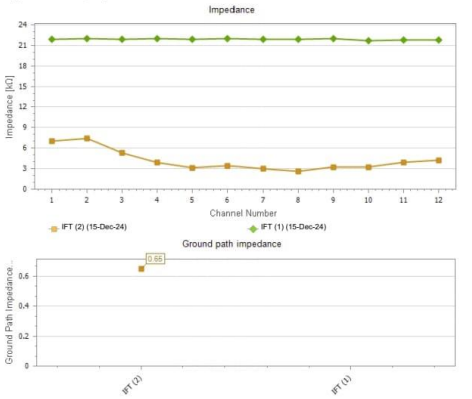
Telemetry History Report

MED EL

First Name:	**karem**	Birth Date:	24-Apr-24
Last Name:	**barakat**	Gender:	Male
Comment:	---		
Side:	**Right**	Surgical Date:	15-Dec-24
Implant:	SONATAti100	Serial Number:	351204
Electrode:	FLEX28		
Processors:			
No processors configured			

Empty markers indicate globally disabled channels.



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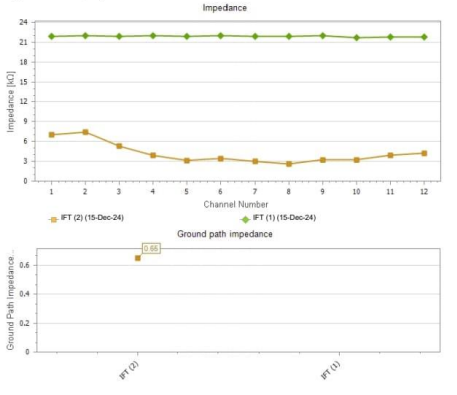
Telemetry History Report

MED EL

First Name:	**karem**	Birth Date:	24-Apr-24
Last Name:	**barakat**	Gender:	Male
Comment:	---		
Side:	**Right**	Surgical Date:	15-Dec-24
Implant:	SONATAti100	Serial Number:	351204
Electrode:	FLEX28		
Processors:			
No processors configured			

Empty markers indicate globally disabled channels.



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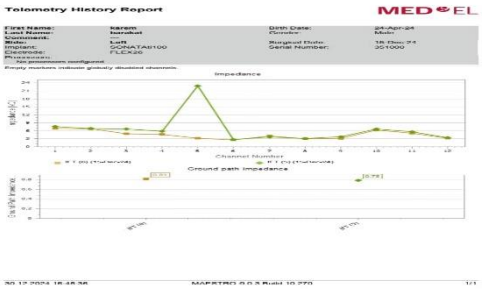

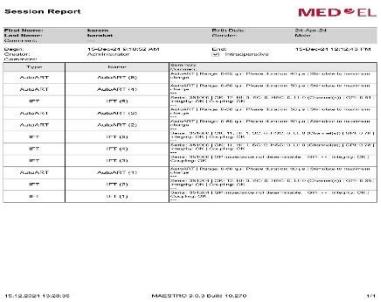

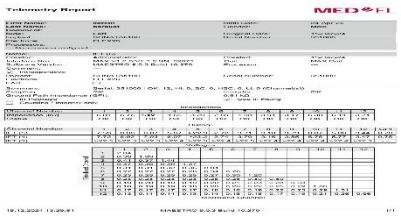

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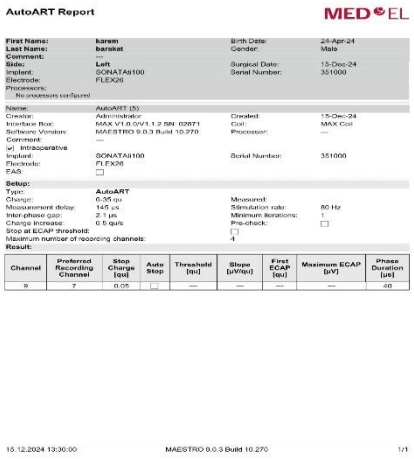


AutoART Report

MED EL

First Name:	**karem**	Birth Date:	24-Apr-24
Last Name:	**barakat**	Gender:	Male
Comment:			
Side:	**Left**	Surgical Date:	15-Dec-24
Implant:	SONATA8100	Serial Number:	351000
Electrode:	FLEX26		
Processors:			
No processors configured			

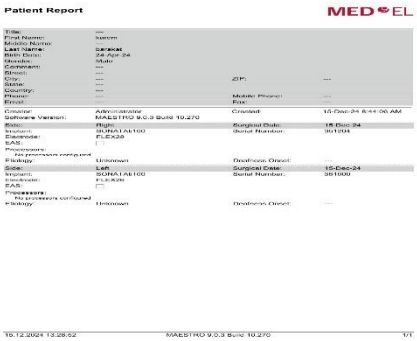
Name:	AutoART (5)		
Create:	Administrator	Created:	15-Dec-24
Interface Box:	MAX V1.6.0/V1.1.2 SN: 02871	Coil:	MAX Coil
Software Version:	MAESTRO 9.0.3 Build 10.270	Processor:	---
Comment:	---		
☑ Intraoperative			
Implant:	SONATA8100	Serial Number:	351000
Electrode:	FLEX26		
EAS:	☐		

Setup:

Type:	**AutoART**		
Charge:	0.35 qu	Measured:	
Measurement delay:	145 µs	Stimulation rate:	80 Hz
Inter-phase gap:	2.1 µs	Minimum iterations:	1
Charge increase:	0.5 qu/s	Pre-check:	☐
Stop at ECAP threshold:		☐	
Maximum number of recording channels:		4	

Result:

Channel	Preferred Recording Channel	Stop Charge [qu]	Auto Stop	Threshold [qu]	Slope [uV/qu]	First ECAP [qu]	Maximum ECAP [uV]	Phase Duration [us]
9	7	0.05	☐	---	---	---	---	40



Patient Report

MED EL

Title:	---		
First Name:	karem		
Middle Name:	---		
Last Name:	barakat		
Birth Date:	24-Apr-24		
Gender:	Male		
Comment:	---		
Street:	---		
City:	---	ZIP:	---
State:	---		
Country:	---		
Phone:	---	Mobile Phone:	---
Email:	---	Fax:	
Creator:	Administrator	Created:	15-Dec-24 8:44:06 AM
Software Version:	MAESTRO 9.0.3 Build 10.270		
Side:	Right	Surgical Date:	15-Dec-24
Implant:	SONATA8100	Serial Number:	351204
Electrode:	FLEX26		
EAS:	[ ]		
Processors:			
No processors configured			
Etiology:	Unknown	Deafness Onset:	---
Side:	Left	Surgical Date:	15-Dec-24
Implant:	SONATA8100	Serial Number:	351000
Electrode:	FLEX26		
EAS:	[ ]		
Processors:			
No processors configured			
Etiology:	Unknown	Deafness Onset:	---

Patient Report

MED EL

Title:	---		
First Name:	karem		
Middle Name:	---		
Last Name:	barakat		
Birth Date:	24-Apr-24		
Gender:	Male		
Comment:	---		
Street:	---		
City:	---	ZIP:	---
State:	---		
Country:	---		
Phone:	---	Mobile Phone:	---
Email:	---	Fax:	---
Creator:	Administrator	Created:	15-Dec-24 8:44:06 AM
Software Version:	MAESTRO 9.0.3 Build 10.270		
Side:	Right	Surgical Date:	15-Dec-24
Implant:	SONATA8100	Serial Number:	351204
Electrode:	FLEX26		
EAS:	[ ]		
Processors:			
No processors configured			
Etiology:	Unknown	Deafness Onset:	---
Side:	Left	Surgical Date:	15-Dec-24
Implant:	SONATA8100	Serial Number:	351000
Electrode:	FLEX26		
EAS:	[ ]		
Processors:			
No processors configured			
Etiology:	Unknown	Deafness Onset:	---

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Initial Activation and Hearing Progress:

Switch on the devices was done 2weeks later, the impedance test was accepted both sides (left higher than the right). ART test showed right better than left, which was more elevated thresholds in most of the channels.

Four programs had been done of different levels, starting from low level increasing slowly in steps for both sides.

Clinically, the infant started to respond to the high environmental sound with the first program and kept under regular follow up every 3 weeks to check the response, which showed improvement during regular follow up. First hearing threshold free field test showed to be in the range of moderately severe for the right side, while severe level on the left side.

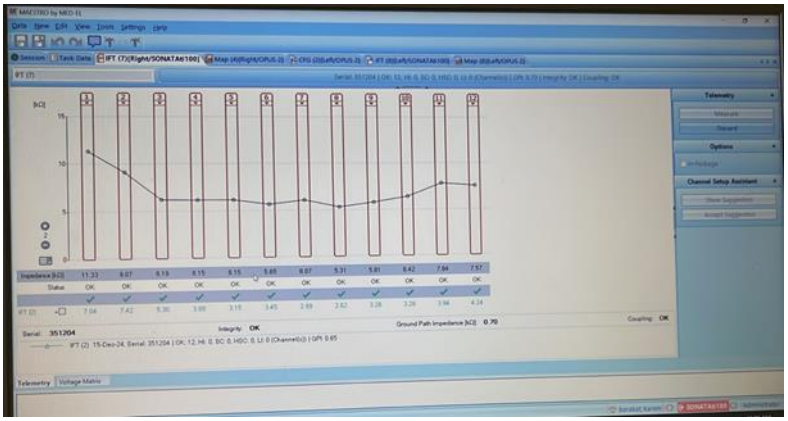
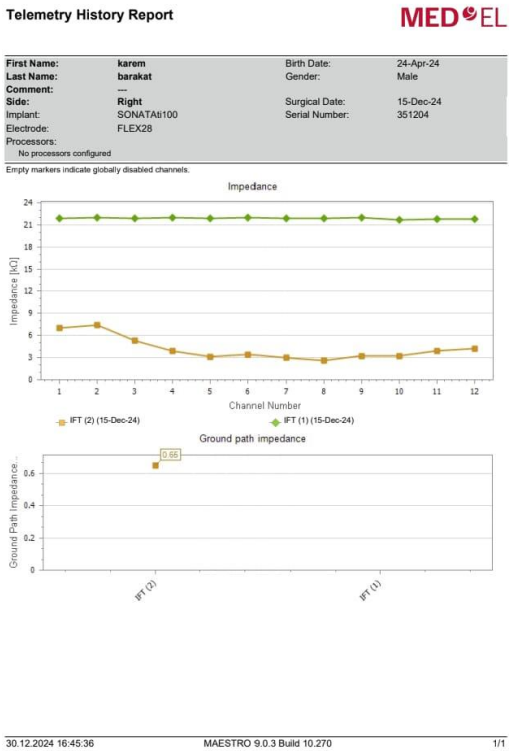


FIGURE 12 FOLLOW UP IMPEDANCE AND ART RESULTS



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MED EL

First Name:	**karem**	Birth Date:	24-Apr-24
Last Name:	**barakat**	Gender:	Male
Comment:	---		
Side:	**Right**	Surgical Date:	15-Dec-24
Implant:	SONATAti100	Serial Number:	351204
Electrode:	FLEX28		
Processors:			
No processors configured			

Empty markers indicate globally disabled channels.

Impedance

Impedance [kΩ]

Channel Number

IFT (2) (15-Dec-24) IFT (1) (15-Dec-24)

Ground path impedance

Ground Path Impedance

0.66

IFT (2) IFT (1)

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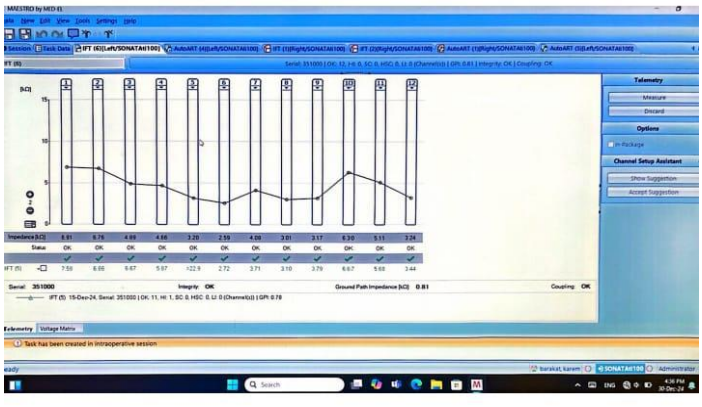

Conclusion:

The youngest age went through cochlear implant operation in Kuwait is 7months old, after being diagnosed profound SNHL post bacterial meningitis.

Bacterial meningitis can be followed by profound SNHL especially the streptococcal and Haemophilus influenza. Such complication needs an urgent interference as regard hearing loss management, cochlear implant operation, due to rapid calcification of the cochlea, which starts within 4 weeks of the attack and can end up with complete calcification by end of 8 weeks. Inserting electrodes in calcified cochlea is not an easy one to be done, as it needs drilling of the cochlea in order to be inserted. In addition, if inserted the electrodes, the results of hearing threshold level and speech discrimination post-switch on of the device will be poor and the patient will not properly benefit for the cochlear implant.

As regard telemetry testing results, the impedance will be on the high side, T-level will show to be on high level because of some ossification post meningitis.

Therefore, Meningitis cases especially the bacterial type, need to be immediately managed and should be a rule that all post- meningitis cases to be investigated for hearing, in order to diagnose and start intervention and management as an urgent procedure, whatever the age is. By this important procedure we can avoid the serious complications of hearing loss post- meningitis, especially in children the poor development of speech and language.