Scholars Journal of Medical Case Reports
Abbreviated Key Title: Sch J Med Case Rep
ISSN 2347-9507 (Print) | ISSN 2347-6559 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

ENT and Neck and Head Surgery

Cochlear Implantation's Complications: Experience of the ENT Department of University Hospital Mohammed VI Marrakech Morocco

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DOI: 10.36347/sjmcr.2023.v11i02.020 | **Received:** 24.12.2022 | **Accepted:** 31.01.2023 | **Published:** 16.02.2023

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Abstract **Original Research Article**

Aims: Since its advent, several publications have described the complications of cochlear implantation; the majority of them classify these complications into minor and major ones. The objective of this study was to analyze the complications in our series of implanted adult and pediatric patients and to report our routes of management. ***Material and Methods:*** We thus, conducted a retrospective study reviewing complications of cochlear implantation performed in the ENT department of university hospital Mohammed VI Marrakech Morocco, from January 2010 to December 2020. ***Results:*** The average age of implantation was 5.15 years, 53% were girls. 24 postoperative complications were reported in our series, classified as either minor in 85% of the cases; where management is conservative, and major for 24%; requiring hospital management or even surgical revision. ***Conclusion:*** cochlear implantation remains a relatively safe procedure; mainly responsible for minor complications due to the progress of the surgical technique and the expertise of the surgeon.

Keywords: Cochlear implant, major/minor complications.

INTRODUCTION

Powerful rehabilitation tool; cochlear implant (CI) is an effective and well-confirmed and established aid implement for adults and children with profound sensorineural hearing loss. Nevertheless, it may lead to complications; that are linked to the patient, the surgical procedure, the foreign body emplacement, or the device failure [1]. Those said to be complications are classified in most researches into minor and major ones [1, 2], but other authors alphabetize them according to the delay of occurrence; perioperative: within 24h, early postoperative: less than 7 days, or late postoperative: thenceforward [3].

MATERIALS AND METHODS

We conducted a retrospective study from January 2010 to December 2020 covering 210 cases of cochlear implantation.

Cochlear Implantation was unilateral in all patients, and the implants used were: Med-El Concerto+ (n = 35), Neurelec Digisonic SP (n =53), Neulec ZTI Evo (n =92), Neulec ZTI Clas (n =30).

Age, gender, age of implantation, petrous malformation, type of cochlear implant, and time to onset of complication were documented. The complications observed were classified as major or minor complications.

RESULTS

The average age at the time of implantation was 5.15 years with ages ranging from 18 months to 70 years old. 53% were girls against 47% boys. 10 patients were adults and 33 % had malformations of the inner ear "Fig.1" and "Fig.2" Table (1).

24 postoperative complications were reported in our series, which converted to an overall rate of 10.9% complications Table (2).

Table 1: Demographic and clinical characteristics of the patients implanted between 2010 and 2020

Variable	Percentage
Age	
Adulte	42%
Children	58%
Gender	
Male	47%
Female	53%
Origine	
Urbain	65%
Rural	35%
Socio-economical level	
Low	50%
Average	50%
Side implanted	
Right	65%
Left	35%
Malformations of the inner ear	
Yes	*33 %*
No	67%
Age at implantation	
Min	18 months
Max	70 years
Mean	5.15 years

Table 2: 24 Minor and major postoperative complications in cochlear implant patients

Complications	Number
Minor complications	
Facial palsy	1
hematoma	4
vertiginous attacks	4
wound infection	4
Ulcers	2
erythematous lesions	1
periorbital and facial edema	2
Major complications	
Device failure	3
Post trauma	1
Spontaneously	2
Meningitis	1
mastoiditis	2

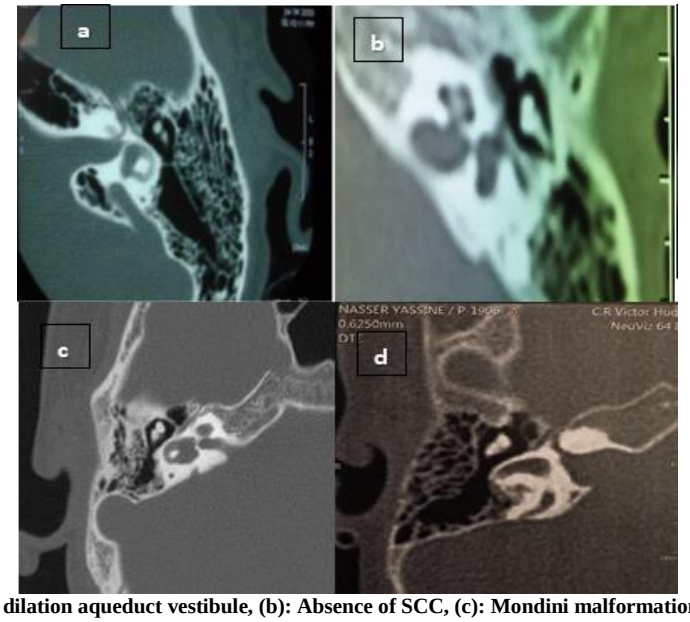

Figure 1: CT scann of: (a): dilation aqueduct vestibule, (b): Absence of SCC, (c): Mondini malformation, (d): expansion of the CAI

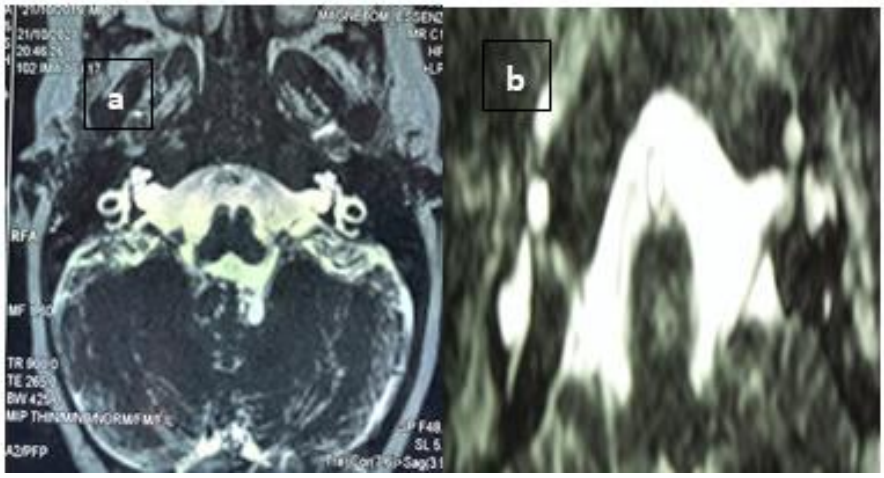

Figure 2: MRI imaging of: (a): expansion of the CAI, (b): Mondini malformation

Major Complications

2.4% of complications were major (6 cases), devised to:

- 3 cases of cochlear implant failure were presented, in which they were caused by post-implantation head trauma in a 9 months child, and 2 spontaneous failures were discovered at fitting. The defective implants: Med-El Concerto and Neurelec Digisonic SP; were sent to the manufacturer for further examinations and expertise.
- 1 case of meningitis; revealed by postoperative headache and vomiting with meningeal stiffness; was found in a 5-year-old girl without any malformation of the inner ear nor an intraoperative incident. Lumbar puncture was normal; CSF culture and PCR were negative. The patient was treated as viral meningitis with IV Aciclovir with good clinical improvement and was discharged in 10 days.
- 2 cases of mastoiditis; a 5 and 4-year-old boys with a history of SMO, revealed 18 months and 6 months succeeding the implantation respectively. The examination objectified in both cases a retro-auricular painful mass with a bulging inflamed eardrum and CT revealing a filling of the middle ear and the mastoidectomy cavity. The patients were thus, put under ceftriaxone for 10 days with good evolution.

Minor Complications:

8.5% of the complications were described as minor (18 cases):

- 1 case of House-Brackmann grade III facial palsy on day 1 postoperative was found "Fig.3", the patient had no ear malformation but showed prolapse of the third portion of the facial with intraoperative exposure. The patient was treated with corticosteroids with full recovery of facial function" Fig.3".

Figure 3: (a): Poqtoperative House-Brackmann grade III facial palsy, (b) full recovery after treatment

- 4 cases of hematoma were presented. None of them had trauma or any bleeding disorder. The treatment was conservative, with antibiotic therapy and corticosteroid therapy with a slightly compressive dressing Table (3).

Table 3: Resume of the 4 cases of hematoma

Patients	Implantaion age	Device type	First episoed		Second episod	
			Occurrence date	Resolution	Occurrence date	Resolution
1	4y 5m	Digisonic SP	7m	2d	2y 8m	5d
2	5y 2m	Digisonic SP	9m	4d	3y	3d
3	3y 2m	Neuro Zti E	2y	3d	-	-
4	5y 1m	Difisonic SP	4m	7d	-	-
y: years m : Month d : day occurrence date : after implantation						

- Four patients presented severe vertiginous attacks with neurovegetative signs which required prolonged hospitalization with treatment by injectable Tanganil. 3 of them were adults without ear malformation and 1 was a 14-year-old with Gusher ear.
- 4 cases of wound infection with released sutures "Fig.4" between D6 and D11 postoperatively were found. There was no skin necrosis or exposure of the implant and the treatment was medical by local and oral antibiotics with regular dressings, with good evolution in all cases.

Figure 4: Wound infection with released sutures

- 2 cases of skin abrasion, without necrosis, after the use of the external processor. Both patients benefited from changing the magnet to a less powerful one with good evolution.
- Two cases of periorbital and facial edema secondary to a compressive dressing were reported "Fig.5". Ophthalmological examination and blood work were within the normal range. Regression of the edema a few days after corticosteroid treatment and dressing change was observed.

Figure 5: Periorbital and facial edema

- A boy had erythematous lesions of the pinna of the ear "Fig.6", 10 days after the implantation without fever or pain with negative infectious blood test. This dermatologic lesion was due to an allergic reaction to the dressing. The patient was treated with local and oral antibiotic with local corticosteroid; with good development.

Figure 6: Erythematous lesions of the pinna of the ear

DISCUSSION

The first description of the complication of cochlear implantation was made by Cohen and Hoffman in 1991 [2], reporting an 11.8% rate of surgical complications. Various classifications and organizations have been sketched; the most reported

one is a minor/major one [1-6]. The latter describes complications requiring either reoperation or hospitalization, meanwhile, the first ones resolve after medical treatment without any further surgery [1, 4]. Thence, many authors conducted studies where the overall complications rate rage from 7% to 19.9% [1-5, 7, 8], with 2.3 to 6.6% rate for major complications and from 10.3 to 18% for minor ones [1, 4, 9]. Similar and favorable results were reported in our studies with a complications rate of 2,4% for major complications versus 8,5% for the minor's. Note that the major complications regard mostly the surgical technique, summing electrode extrusion, flap breakdown, device failure, and permanent facial paralysis, while the minor ones incorporate, temporary facial nerve weakness, transient vertigo, and delayed wound healing [4].

In our study, 1.4% of patients were reimplanted due to device failure versus 6% and 9.6%, respectively for Venail *et al.*, [10] and Kandogan *et al.*, [11]. Tarkan *et al.*, [12] and Farinetti *et al.*, [5] reported a failure devise rate of 6% and 9.6%, respectively. For the record, in our study, the cause of the failure is either traumatic or spontaneous.

Up to 20 cases of post-CI meningitis are reported worldwide per year. Cochlear malformations, CSF leakage, immune deficiency, type of electrode used, and young age all play roles in its occurrence [12-14]. We do not report any cases of bacterial meningitis in our study; however, Cohen *et al.*, [14] reported 21 cases of post-CI meningitis among 24488 cochlear implantations, 2 of which were fatal. Vaccination, early antibiotic treatment, surgical experience, and the insurance of cochleostomy sealing; does contribute to the reduction of this particular and serious complication [4, 14].

Mastoiditis is reported in 1.25% in the Kempf series [15], 1.7% in the Migirov series, and 0.9% in the Ramos series [17], whilst our series showcased 0.47% of mastoiditis. These cases are characterized by rapid progression due to mastoidectomy and favored by a young age, a history of OSM, and are treated with antibiotics and drainage in case of abscess [16].

Facial palsy's incidence in the literature is estimated to be between 0.4–0.71% [11, 12], in our series it is down to 0.47%. Transient facial nerve paralysis; which has been reported to have a complete recovery after a few months; was secondary to reactivation of viruses or intraoperative heating of the nerve or trauma during electrode insertion. It can be prevented by facial nerve neuromonitoring and the CT scan preoperative assessment of the facial nerve route [5].

Hematoma is reported between 0.4% to 5.8% in the literature, caused by trauma and coagulopathies [4, 12, 18]. In our series, the hematoma was present in 1.9% of cases, with recurrence in two cases.

Cutaneous complications are described in 0.2% to 7.7% in the literature [5, 7, 12, 19]. They are favored by young age; wide incisions, superficial peeling and devascularization of the flap, and magnet compression and can progress to skin necrosis and extrusion of the implant. In our series, we have two cases of skin suffering secondary to compression by the magnet with no necrosis or extrusion of the implant.

Other complications were described in the literature: migration of the implant, displacement of the electrodes, facial stimulation, secondary cholesteatoma, injury to the external auditory canal, scalp numbness, tympanic membrane perforation, tinnitus and Dysgeusia [1, 2, 4, 5, 8, 11, 12, 20], nevertheless they were not encountered in our series.

CONCLUSION

Though the described complications; cochlear implantation remains a relatively safe procedure. Most reported complications are minor, being the major ones are decreasing thanks to technological progress and improved surgical technique. Nevertheless, surgeons must acknowledge their occurrence and be able to manage them properly.

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