ORIGINAL ARTICLE

Current Standards in Cochlear Implantation. Preliminary Results of a Survey Among Politzer Society

Franco Trabalzini, Enrico Muzzi, Eva Orzan

Department of Sense Organs, Otology and Skull Base Surgery Unit, Siena University Hospital, Siena, Italy (FT)
Department of Pediatrics, Audiology and ENT Unit, Institute for Maternal and Child Health, IRCCS "Burlo Garofolo", Trieste, Italy (EM, EO)

Background: the preoperative assessment, the surgical procedure and the postoperative evaluation of cochlear implantation (CI) are evolving fast to improve effectiveness and to reduce complications.

Objective: to disclose the current trends in CI and the customs of practice of CI teams worldwide.

Methods: a survey on CI had been conducted through an online questionnaire posted on the Global Otology Online Discussion Forum of the Politzer Society - The International Society for Otologic Surgery and Science. Questions were grouped into general informations, preoperative issues, surgical procedure, postoperative issues and free comments. A preliminary statistical analysis was performed.

Results: one-hundred and twenty-one responses were recorded, coming from 43 nations in the 5 continents. CI in single sided deafness (SSD), CI at extreme ages, the relationship between electrode array technology and outcome, minimally invasive CI techniques, quality of life after CI were investigated.

Conclusion: some facets of CI are still a controversial topic, resulting in very different standards of practice among CI teams.

Submitted : 02 October 2012 *Accepted : 26 October 2012*

Introduction

Cochlear implantation (CI) is the procedure of choice for the treatment of profound cochlear hearing loss. Technological development, increased surgical experience and positive outcomes have been leading to an increased demand and broadened candidacy criteria to CI. Although the grounds of CI are established [1], preoperative evaluation, surgical procedure and postoperative assessment are evolving fast to improve effectiveness and to reduce complications. On this way, often CI teams develop different standards of practice [2-12]. The aim of this survey is to disclose the current trends in CI, and to outline the subjective opinions of otologists with knowledge in this field.

Materials and methods

The survey had been conducted through an online questionnaire, available at http://ciquesteaono.techfriuli.it/CIquestEAONO.php, which had been active from June to December 2011. The invitation letter and monthly reminders, restricted to members, were posted on the Global Otology Online Discussion Forum of the Politzer Society - The International Society for Otologic Surgery and Science. The questionnaire encloses open-ended as well as multiple-response and multiple-choice questions. Items are grouped under five subheadings: general informations, preoperative issues, surgical procedure, postoperative issues (Table 1-4) and free comments. Statistical analysis was performed using the Chi-squared test and the Fisher exact test.

Corresponding address:
Enrico Muzzi
Audiology and ENT - Department of Pediatrics -
Institute for Maternal and Child Health - IRCCS "Burlo Garofolo" - Trieste - Italy
+393481330194
E-mail: muzzi@burlo.trieste.it
Financial disclosure
There are no conflicts of interest or financial matters to be disclosed.

Results

One-hundred and twenty-one responses were recorded. Country coverage is broad, including 43 nations in the 5 continents (Figure 1). Sixty-four otologists (53%) declare more than 100 CI surgeries in their own personal experience. Rough data are reported in the tables (Table 1-4). The experienced group of surgeons perform most of the bilateral and sequential operations ($p<0.01$ and $p<0.05$ respectively). Single stage bilateral CI is preferred by 54% of the surgeons. CI in single-sided deafness is performed seldom. The option about the brand of the device is not related to surgical experience. CI with Electrical-Acoustic Stimulation devices (EAS) is performed by 37% of the respondents. Senior surgeons are more often involved in CI at extreme ages ($p<0.001$). Dealing with very young children results in significant changes in the CI procedure ($p<0.05$). No changes in CI procedure are suggested for elderly people. For the 35% of the surgeons, array and shape of the electrode can significantly influence CI outcomes. In the routine radiologic assessment of the temporal bone, X-rays are included in 2% preoperatively and 68% postoperatively, computed tomography (CT) in 91% preoperatively and 12% postoperatively, magnetic resonance (MR) in 74%

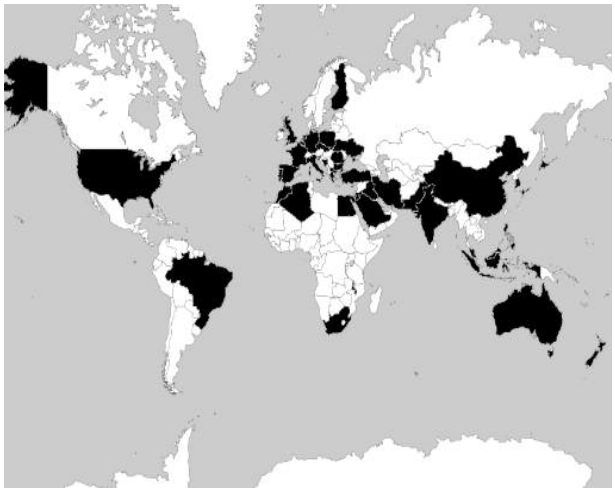

Figure. Country coverage of the survey

Table 1. General informations

Query	Legend	Answers (n)			
		a	b	c	d
How many cochlear implants have you performed?	a = >100	64			
Have you any experience in bilateral cochlear implantation?	a = yes	79			
if yes, which timing do you think is the most suitable?	a = single stage, b = sequential	43	39		
Have you any experience in cochlear implantation in unilateral deaf subjects?	a = yes	9			
if yes, please provide a reference or explain shortly	a = commented*	9			
Which cochlear implant brands are available at your institution?	a = Advanced Bionics, b = Cochlear, c = Med-El, d = MXM Neurelec	59	107	86	19
Do you apply devices with electric-acoustic stimulation strategy?	a = yes	45			
Do you perform cochlear implantation in patients younger than 1 year of age?	a = yes	44			
if yes, do you change your standard surgical procedure in patients younger than 1 year of age?	a = yes	9			
if yes please provide a reference or explain shortly	a = commented*	9			
Do you perform cochlear implantation in patients older than 80 years of age?	yes	58			
if yes, do you change your standard surgical procedure in patients older than 80 years of age?	yes	2			
if yes please provide a reference or explain shortly	a = commented*	2			
Do you think that array shape and length can significatively influence outcome?	yes	42			
if yes please provide a reference or explain shortly	a = commented*	35			

**see text for comments*

Table 2. Preoperative issues

Query	Legend	Answers (n)		
		a	**b**	**c**
Which imaging studies of the temporal bone do you request routinely?	a = X-ray, b = CT, c = MR	3	110	89
Do you employ the intraoperative facial nerve monitoring?	a = always, b = in selected cases, c = never	77	18	26
Do you use perioperative antibiotic prophylaxis?	a = always, b = in selected cases, c = never	116	3	2
Do you employ custom made surgical instruments for cochlear implantation?	a = yes	47		
Do you pay attention to cosmetic hair shave?	a = yes	61		

CT, computed tomography
MR, magnetic resonance

Table 3. Surgical procedure

Query	Legend	Answers (n)				
		a	**b**	**c**	**d**	**e**
Which kind of skin incision do you prefer?	a = classic, b = small, c = minimally invasive	24	67	29		
if minimally invasive incision, please provide a reference or explain shortly	a = commented*	0				
About skin flap elevation: which kind of flap do you raise usually?	a = full thickness, b = bilayer, c = trilayer	49	66	2		
Which kind of surgical access to the cochlea do you prefer?	a = posterior tympanotomy, b = other	115	6			
on which landmarks do you rely to avoid facial nerve injury?	a = lateral semicircular canal, b = incus, c = bony buttress, d = chorda tympany, e = digastric ridge	89	94	31	50	19
do you routinely skeletonize the mastoid segment of the facial nerve?	a = yes	33				
if other access to the cochlea, please provide a reference or explain shortly	a = commented*	8				
Which kind of cochleostomy do you prefer?	a = fenestral,b = promontorial	79	42			
Do you use soft insertion techniques?	a = yes	61				
if yes, please provide a reference or explain shortly	a = commented*	60				
Do you drill a bony recess for the receiver/stimulator?	yes	93				
if yes	a = bony floor, b = bony island, c = full thickness	62	26	20		
How do you usually secure the receiver/stimulator to the skull?	a = sutures passed through holed, b = screws, c = periosteal sutures, d = other	48	11	36	28	
if other, please provide a reference or explain shortly	a = commented*	32				

**see text for comments*

Table 4. Postoperative issues

Query	Legend	Answers (n)			
		a	b	c	d
Which imaging studies of the temporal bone do you request routinely?	a = X-ray, b = CT	82	15		
When do you plan to activate the cochlear implant ?	a = perioperatively, b = in 2 weeks, c = in 4 weeks, d = later	12	17	83	9
Do you measure the outcome of cochlear implantation by means of Quality of Life questionnaires?	yes	31			
if yes, please provide a reference or explain shortly	a = commented*	15			

**see text for comments*

preoperatively, without significant differences between the surgeon groups. Several opinions were expressed about electrode array technology. The 64% of the surgeons uses always the facial nerve monitoring whereas 15% only in selected cases. Almost all the surgeons prescribe an antibiotic prophylaxis perioperatively (96%). Custom-made instruments are present in the 39% of the CI surgical kits. Half of the respondents pay attention to cosmetic hair shave. Small size skin incision is preferred (55%) to standard incision (20%). Minimallly invasive incisions are also common (24%). Young surgeons rely more often than senior surgeons on the traditional skin incision with posterior extension over the receiver-stimulator area ($p<0.001$). Full thickness (40%) ad bilayer (55%) flaps are predominant. Mastoidectomy and posterior tympanotomy are the procedure of choice for 95% of the respondents. The insertion of the array through the round window insertion of the array prevails on promontorial cochleostomy (65% vs 35%) and is preferred by more experienced surgeons ($p<0.05$). One-half of the surgeons, and more often senior surgeons ($p<0.001$), rely on soft insertion techniques. The receiver-stimulator is secured by sutures passed through the bone (40%) or the periosteum (30%), screws (9%), or by other techniques (23%). The implant is usually activated in 1 month after surgery (69%), but 14% of the CI teams activate the device perioperatively, and 10% in the first 2 weeks. In some CI centres the implant is activate even later (7%). Quality of life after CI is measured by 26% of CI teams, predominantly including experienced surgeons ($p<0.01$).

Discussion

The contributors were invited to express their opinions on controversial aspects of CI practice through open-ended questions. CI in single sided deafness (SSD), CI at extreme ages, the relationship between electrode array technology and outcome, minimally invasive CI techniques, quality of life after CI were investigated. CI in patients with SSD is sporadic (n=9) and includes cases of intractable tinnitus (n=3), expected progression to profound bilateral deafness (n=2), failed stapes surgery (n=1), Ménière disease (n=1) and patient's will because of intolerable asymmetrical hearing (n=1). In SSD associated with tinnitus, suppression test through direct round window stimulation is suggested as prognostic indicator (n=1). Dealing with vey young children, a subperiosteal pocket (n=1) or a full-thickness well (n=1), drilled down to the dura (n=1), are suggested to lodge the receiver-stimulator. The need of a pediatric anesthesia care is highlighted (n=3). Removing the incus for enhancing the exposure of the facial recess (n=1) or the "Veria" transcanal approach for CI [6] (n=1) may be also indicated in these patients. Overnight hospital stay should be considered for elderly patients (n=1). Several opinions are expressed about electrode array length (n=14) and shape (n=15) in order to ensure adequate insertion (n=10), close contact to the modiolus (n=8) and to preserve residual hearing (n=10), also in view of possible re-implantation in the future (n=2). No comments were added about the skin incision. Six surgeons routinely use alternative techniques without mastoidectomy to approach the cochlea. The suprameatal (n=3) [2], the "Veria" transcanal (n=2) [6] or the pericanal (n=1) [5] approaches are reported. Retrofacial route through the sinus tympani can overcome an aberrant lateral course of the facial nerve (n=1) [10]. Soft insertion techniques are

likely the main concern of the surgeons, as even 60 comments where added. Advanced Off-Stylet technique (Cochlear, Australia) is the atraumatic procedure of choice by 18 surgeons. Careful exposure of the endosteum of the cochleostomy or of the round window [12] and gentle incision or puncture, are often recommended (n=13). Stapedotomy instruments may be helpful for the incision (n=1). Topical steroids (n=4), systemic steroids (n=3), or both (n=1) are given. Hyaluronic acid may be used to lubricate the array (n=8) [8]. Slow insertion, up to 2 minutes, is advocated (n=4) [7]. Transcanal cochleostomy [9] is advocated by 2 surgeons. Some differences in the cochlear trauma among brands are supposed (n=2). Suction in the cochlea must be avoided (n=2). Laser can be adopted to minimize the insertion trauma and the introduction of bone dust into the scala tympani (n=1). The effective impact of soft techniques is sometimes criticized (n=2) [4]. Some references are also provided [4, 7, 11]. A subperiosteal pocket (n=16) or a full-thickness well (n=2), drilled down to the dura (n=1), are suggested to lodge the receiver-stimulator [3]. The classical technique of passing the sutures through holes drilled in the cortical bone are suggested in only 2 cases. A channel in the cortical bone of the posterior edge of mastoidectomy can be drilled to secure the receiver-stimulator (n=3). Mixed techniques with bony-periosteal sutures are described (n=2). The use of mesh is reported in 2 cases. Thirteen contributors actually use thirteen different quality of life questionnaires to measure CI outcomes.

Interestingly, there is often lower agreement than expected between the group of most experienced and the group of less experienced surgeons. Among the most answered items (at least 10% of the respondents) that were analyzed, a concordance of 80% or higher was recorded on only 4 items, including the limited experience with MXM devices, the need of routine preoperative CT, the uselessness of routine postoperative CT, and the lower rate of confidence with the digastric ridge as a surgical marker. These results may be due to a grouping bias. The threshold of 100 CI to set surgeon's experience is indeed arbitrary. Moreover, the work setting may influence the answers. CI is today a widespread procedure that can be performed in research hospitals, paediatric hospitals as well as otology clinics or general ear, nose and throat services, depending on the differences among healthcare systems and among local facilities. Thus, the different backgrounds of surgeons may influence the answers.

Conclusion

The preliminary report of a brief survey among Politzer Society highlights the current opinions on CI of surgeons all around the world. Some facets about preoperative assessment, surgical procedure and postoperative evaluation are still a controversial topic, resulting in very different standards of practice among CI teams. Technical refinements are partly related to the experience of the surgeons. Sharing opinions and exchanging experience among CI teams should be encouraged, and issues should be addressed in the future with an evidence-based approach.

Acknowledgements

We wish to sincerely thank the colleagues who participated in the survey and Professor Nuri Ozgirgin, President of The Politzer Society, for hosting on the Global Otology Online Discussion Forum.

Confliet of interest: None

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