Cochlear Implantation in Children with Cardiac Conditions: Experience in a Tertiary ENT Centre in India

Dr. Kiran Natarajan, Consultant ENT Surgeon, Madras ENT Research Foundation, Chennai, India
Dr. M. Jagannath, Senior Consultant Anesthetist, Madras ENT Research Foundation, Chennai, India
Dr. Madan Mohan, Consultant Cardiologist, Madras ENT Research Foundation, Chennai, India
Prof. Mohan Kameswaran, Senior Consultant ENT Surgeon, Madras ENT Research Foundation, Chennai, India

Introduction

Profound deafness may be associated with cardiac conditions which may influence cochlear implantation (CI).

Objectives

- To analyze the various cardiac conditions encountered in 1000 cochlear implantees from 1997 till date
- To develop a protocol for managing cardiac issues in CI

Materials and Methods

- History and ENT examination
- Audiology and Electrophysiology
- CT and MRI of temporal bone, brain
- Consults - Cardiology, Pediatric, Ophthalmology, Anaesthesiology, Clinical Psychology, Occupational Therapy

Observation and Results

- Cardiac conditions - in 90 profoundly deaf candidates (9%)

Categorization of cardiac conditions

Groups	Features	Numbers (n = 90)	Percentage (9%)
A	Isolated Patent Ductus Arteriosus	16	1.6%
B	Syndromes and other anomalies associated with PDA	24	2.4%
C	Syndromes without PDA association	50	5%

Group A - 16 patients - diagnosed with PDA during pre-op evaluation for CI

Group B

Patent Ductus Arteriosus (PDA) with	Numbers	Percentage
Rubella	10	1%
Pulmonary stenosis	4	0.4%
Pulmonary stenosis and Rubella	5	0.5%
Pulmonary stenosis, Rubella and Patent Foramen Ovale	2	0.2%
Goldenhar syndrome	1	0.1%
Pulmonary hypertension	2	0.2%

Group C

- Jervell Lange Nielsen (JLN) Syndrome – 50 patients (5%)
- Long QTc in ECG - greater than 440 msec
- Tachyarrhythmias, including ventricular tachycardia, Torsade de pointes, ventricular fibrillation
- Syncopal attacks, sudden death

ECG - Long QTc

Distribution of QTc Interval

Management protocol

Pre-operative

- Premedication
- Infective endocarditis prophylaxis
- Air filter in the IV line to prevent air embolism

Intra- & Post-operative (Group A & B)

- CI - with Med EL pulsar device
- Balanced anesthesia
- Systemic vasoconstrictors avoided
- Normoxia, normocarbia, normothermia, normotension
- Fluid overload avoided
- Diuretics - SOS
- Awake Extubation
- Post-op - Nasal O₂ for 6 hours

Pre-operative (Group C)

- Long QTc interval - corrected by pre-op beta blocker
- Maintainance of normal serum K⁺, Ca²⁺ and Mg²⁺

Intra-operative (Group C)

- Propofol for induction
- Inhalational agents avoided
- Maintenance with Propofol, nitrous oxide and oxygen
- Intermittent fentanyl, atracurium,
- IV magnesium sulfate, Antiarrhythmic drugs e.g. Beta blockers - SOS
- Electrocautery - avoided
- Drugs that prolong QT interval - avoided
- Pacing - SOS
- Defibrillation (1J / Kg) - SOS
- Avoiding Neostigmine reversal
- Spontaneous recovery

Defibrillator on stand-by

Intra-op monitoring

Post-operative (Group C)

- Intensive care unit monitoring - continuous ECG, SpO₂
- Good analgesia
- Post-op Beta blockers - if QTc > 480 msec
- Demand Pacing - SOS
- AVOID DRUGS THAT PROLONG QT INTERVAL**

Conclusion

- Meticulous investigative protocol in children presenting with hearing loss is mandatory.
- Issues related to pre-, intra- and post-operative care have to be appropriately addressed in children with cardiac conditions undergoing cochlear implantation.

References

1.Taussig HB. Patent Ductus Arteriosus and Loss of Hearing. Ann Intern Med. 1968;69:167.
2.De Santis M, Cavaliere AF, Straface G, Caruso A. Rubella infection in pregnancy. Reprod. Toxicol. 2006;21(4):390–8.
3.Green JD, Schuh MJ, Maddern BR, Haymond J, Helffrich RA. Cochlear implantation in Jervell and Lange-Nielsen syndrome. Ann Otol Rhinol Laryngol Suppl. 2000;185:27-8.
4.Senthil Vadivu A, Kameswaran M. Int J Ped Otorhinolaryngol. 2013;77:1303–1307.
5.Baidya DK, Dehran M. Anesthesia for cochlear implant. Trends Anaesth Crit Care. 2011;1:90–4.