

Navigating the narrow path: Dexmedetomidine infusion in a child with Arnold-Chiari malformation for bilateral cochlear implantation.

Submitted: 05 Sep 2026

Revised: 14 Sep 2026

Accepted: 20 Sep 2026

Published: 30 Sep 2026

Authors:

Shoba Philip, Head of the Department of Anaesthesiology, Lourdes Hospital, Pachalam, Kochi, Kerala 682012.

George Kuruvilla, Head of the Department of ENT, Lourdes Hospital, Pachalam, Kochi, Kerala 682012.

Corresponding Author:

Dr. Shoba Philip. Mob No: 9847920355, ORCID ID : <https://orcid.org/0000-0001-8579-1881>, Email ID : dr.shobaphilip@gmail.com

Access This Article Online



Website:
theanaesthesiologist.com

How to cite this article: Shoba Philip, George Kuruvilla. Navigating the narrow path: Dexmedetomidine infusion in a child with Arnold-Chiari malformation for bilateral cochlear implantation. TAISAK 2026; 2 (2): 106-110

ABSTRACT

Bilateral cochlear implantation in young children is the standard of care for severe hearing loss not amenable to standard hearing aids. Anaesthetic challenges in a child with Arnold Chiari malformation for cochlear implant include difficult paediatric airway compounded by congenital malformations, abnormalities of spine, difficulty in positioning for optimum laryngoscopy in addition to challenges as a result of the pathophysiology itself. Here with presenting a 4 year old child who was posted for bilateral cochlear implantation under general anaesthesia with controlled ventilation. Dexmedetomidine infusion in low dose helped to achieve haemodynamic stability with good intraoperative and post-operative analgesia, bloodless surgical field without affecting the recovery and offering smooth extubation without any delay.

Keywords: Cochlear implantation, dexmedetomidine infusion, haemodynamic stability

Case Report

A 4 year old boy weighing 20kg, height 110cm, BMI 16.5 underwent preanaesthetic checkup for bilateral cochlear implantation under general anaesthesia. On examination, all systems were within normal

limits except he exhibited bilateral hearing loss, no features of cerebellar dysfunction and his spine was normal; motor power was grade 5. He gave history of having undergone Foramen Magnum decompression for Arnold Chiari malformation 8 months back at another centre following which repeat MRI

Case Report

showed expanding syringomyelia. All routine preoperative investigations except MRI were normal. MRI brain and spine revealed Arnold Chiari type 1 with persistent expanding syringomyelia. The case was accepted under GA with informed consent about the probable requirement of videolaryngoscope and fiberoptic scope for intubation. On the day of surgery, child was allowed to take 100ml of clear apple juice at 6am (2 hrs before surgery). Syrup phenegan 10ml was given at 6am along with tab Pantodac 20mg and tab Perinorm 5mg. IV cannula 20G was secured after application of EMLA cream to the proposed site after explaining to the mother and getting consent. The child was calm and shifted to the operation theatre. The operation theatre temperature was set to 21 degrees, humidity at 55% with high efficiency particulate air (HEPA) filters, laminar air flow; anaesthesia workstation and well functioning suction & operating table were checked, soda lime was fresh and Sevoflurane vaporizer was tested for leak. Endotracheal tubes (both microcuff & standard endotracheal tubes) of sizes calculated for his age, Videolaryngoscope (VLS) with jockey stylet, paediatric bougie, size 3 blade of VLS, Macintosh blades, nasal airway size 16F (4mm) were kept ready. Standard ASA monitors Pulse oximeter, ECG, Precordial Stethoscope, Non-invasive blood pressure were applied. Post-induction monitors included end-tidal capnography, temperature probe, urine output and neuromuscular monitor to check train-of-4 count. After preoxygenation for 3mts with 100% O₂, combined intravenous & inhalational induction with Sevoflurane 2-3% was done along with iv midazolam 0.5mg, ondansetron 2mg, iv dexona 3mg, glycopyrrolate 0.1mg, iv fentanyl 40mcg, xylocard 30mg, Propofol 40mg & ketamine 10mg. IV Atracurium 10mg was used to achieve relaxation of vocal cords for intubation and gentle intubation in the neutral position was done with shoulder roll kept and ramped up to attain laryngeal and pharyngeal axes inline. VLS Blade 3 was used & intubated with 5.5mm microcuff endotracheal tube. Ventilation was confirmed both clinically and by ETCO₂; child was connected to the ventilator and ventilated with total flow 4L/mt VC PS mode -TV 180MLml/mt, AIR-O₂

AT 50% each, RR -18/mt to achieve end tidal CO₂ around 30-35. Soda lime used was fresh, all fresh sterile circuit tubings were used, temperature probe was inserted orally to prevent nasal trauma and temperature maintained at 36-36.5 degrees throughout the procedure. Warming devices were used and maintained at 38 degrees, fluids were transfused after warming. IV fluid used was Ringer lactate @ 4ml/kg/hr to account for the fasting period and intraoperative maintenance. Anaesthesia was maintained with air-O₂-Sevoflurane at 0.8 MAC with Dexmedetomidine infusion @ 0.3-0.4mcg/kg/hr and bolus doses of Atracurium 5mg to a total of 20mg. Analgesia was supplemented with 250mg Paracetamol suppository. Auditory evoked potentials were monitored intraoperatively and Atracurium was timed without interfering with the recordings. Anti-seizure drugs were given as per the neurologist's orders. The whole procedure including implant placement in both the ears was completed in 7hrs. Dexmedetomidine infusion was tapered once closure began & stopped 20mts before end of surgery. In spite of the long procedure, the child could be extubated within 10mts of skin closure after confirming with neuromuscular monitor & shifted in the modified Sim's position till full recovery in the postoperative ICU. The child was allowed sips of orals at 4hrs post procedure and solid food at 6hrs. The child made an uneventful recovery & could be shifted out of the ICU AFTER 2HRS IN A STABLE CONDITION.

Discussion

Arnold Chiari malformation is the condition when the lower part of the brain, mainly the cerebellum pushes part of the brain tissue into the spinal canal. It can occur at birth & develops as the child grows. There are 3 types of Arnold Chiari malformation-1, 2, 3 depending on the degree of herniation and

symptoms present accordingly. Type 2 & 3 are more common and present at birth. There are 3 theories for the pathophysiology-1. Molecular 2. Hydrodynamic & 3. Mechanical. In type1, there is early closure of the suture lines & it is associated with chromosome 1 & 22 mutation; the signs & symptoms are secondary to the compression of the neural structures & obstruction to CSF flow. The signs and symptoms may present as neck pain & headache precipitated by Valsalva manoeuvre, ocular symptoms, hearing loss, vertigo, ataxia, sleep apnoea & fatigue. Late stages can present as difficulty in deglutition, loss of pain & sensation in the lower limbs and extending sometimes to the upper limbs, difficulty in walking due to cerebellar involvement, downbeat nystagmus. The diagnosis is confirmed by MRI. The treatment is surgery by Posterior fossa decompression. Sometimes shunting is required to drain the CSF. This child had hydrocephalus for which he had undergone Foramen Magnum decompression but follow up status showed widening Syringomyelia; however no neurological deficits except hearing loss was there and was free of any respiratory infection; hence, evaluated & posted for Bilateral Cochlear implantation under GA[1]. The anaesthetic challenges in Arnold Chiari are: 1) Skeletal deformity at the craniovertebral junction leading to restricted neck extension & difficult intubation, 2) autonomic dysfunction especially in type2, 3) abnormal response to anaesthetic agents, 4) raised intracranial pressure (ICP), increased hypertensive response to intubation, pain & light plane of anaesthesia, 5) Aspiration & pneumonia in the child especially in type 2 & 3 if surgery timed late, 6) delayed awakening due to sensitivity to neuromuscular and sedative agents, 7) Spinal scoliosis causing difficulty in positioning for procedures. In spite of no significant neurological dysfunction, hearing loss made communication for preoperative airway tests difficult except Mallampatti could be elicited, it was class 2; oral hygiene and teeth were normal. He was on antiepileptics which were continued as per neurology orders.

Dexmedetomidine in low doses 0.2mcg to 0.5mcg/kg/hour infusion is proved to be a useful adjunct for neurosurgical procedures due to its haemodynamic

stability, sedative & analgesic potentiation, smooth extubation [2] Here, soon after endotracheal intubation, the child was put on DEXMEDETOMIDINE INFUSION @ 0.3 TO 0.4 mcg/kg/hr to obtain stable haemodynamics, reduced response to pain & surgical stimulation, achieve adequate plane of anaesthesia. It also reduced the sevoflurane consumption, offered clear surgical field and was cost-effective [2].

Challenges in cochlear implantation surgery: 1) Acoustic stimulation causes discomfort to the patient hence general anaesthesia is required despite the bone having no pain receptors. 2) Inner ear vibration & caloric stimulation from suction irrigation are strong stimulants of the vestibular system causing postoperative nausea and vomiting hence agents with different levels of antiemetic action are required to take care of this like preemptive metoclopramide, ondansetron, dexamethasone and stemetil. 3) Controlled mild hypotension or normotension maintaining cerebral perfusion is required to facilitate clear, bloodless surgical field. This can be achieved by using inhalational agents like Sevoflurane to achieve MAC 0.8 with air-O₂ technique alongside intravenous agents like Dexmedetomidine OR by using Total intravenous anaesthesia TIVA with agents like Remifentanyl, Propofol, Dexmedetomidine. Here we have used Dexmedetomidine infusion at low rate to achieve this. At this rate, bradycardia and hypotension do not occur. 4) Facial nerve monitoring while drilling is useful hence neuromuscular blocking agents maybe judiciously used under monitoring after discussion with the surgeon or TIVA can be practised. 5) Air embolism also has been described. 6) Children have to be protected against hypothermia as well as against hyperthermia, hence core temperature monitoring is a must. 7) Malignant hyperthermia can occur. Thermal safety implants [3] are now used to prevent skin heating, tissue discomfort and thermal

hazards. Local targeted therapeutic hypothermia by cooling the cochlea to 4-6 degrees via external application to reduce cell metabolism & minimize residual hearing loss from trauma of electrode insertion is practised. This can be done by using ice-chilled water for irrigation of the ear canal or with specialised catheters. Yet core temperature is maintained at 34-36 degrees. This can increase at the time of drilling, though. Maintenance of at least 0.5ml/kg/hr of urine output ensures adequate tissue perfusion and prevents dehydration. Postoperative management includes iv fluids till nil per oral status breaks, analgesics, antiemetics, antibiotics, vital

signs monitoring & watching out for any fever episodes.

Conclusion

Thorough knowledge of the pathophysiology of Arnold Chiari malformation together with its clinical implications, challenges of the surgical procedure of cochlear implantation, good team work with the surgeon and audiologist and lastly, a patient listener to the anxious parents and the need to explain to them while getting consent for anaesthesia can result in an excellent outcome.



Positioning of the child for intubation (left)



Glottic view seen by VLS (right)



Dexmedetomidine infusion



Monitor during drilling



Ventilator settings

References

- 1 . A Case of Anaesthetic Management of Arnold-Chiari Malformation: A Contest to Anaesthesiologists Cureus.2023 Jan16;15(1): e33848. Vidur Mago, Vivek Chakole, Roshan Umate doi:10.7759/cureus.33848
2. A retrospective study of the effect of dexmedetomidine infusion in cochlear implant surgery among paediatric patients Indian Journal of Clinical Anaesthesia 9(1) :71-74,2022 doi.org/10.18231/j.ijca.2022.015 Darshna Dhedhi, Vishwal I Patel
3. Thermal Characteristics of Different Types of Cochlear Implants in Paediatric Cochlear Implant Users: A Comparative Digital- Infrared Thermal Imaging Analysis J Int Adv Otol.2022 Jul1;18(4): 278-284. Doi:10.5152/ia0.2022.21620 Enes Yigit, Okan Ovunc, Ozur Yigit

Conflict of interest: NIL

Financial support :NIL