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Surgical treatment of paediatric unilateral tinnitus due to cochleovestibular nerve compression by intrameatal anterior inferior cerebellar artery (AICA) loop

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Key words:

Cochleovestibular nerve, intrameatal anterior inferior cerebellar artery (AICA),
Tinnitus, Pediatrics, Surgery

Running title: surgical treatment of pediatric surgery

Surgical treatment of paediatric unilateral tinnitus due to cochleovestibular nerve compression by intrameatal anterior inferior cerebellar artery (AICA) loop

Abstract

Objectives: Cochleovestibular nerve compression syndrome due to intrameatal anterior inferior cerebellar artery (AICA) that causes tinnitus is an extremely rare condition with special therapeutic challenges and implications. Here we present the first surgically treated paediatric case of tinnitus showing microvascular conflict of cochleovestibular nerve and intrameatal AICA loop.

Methods: A paediatric case of tinnitus is described and a surgical technique is elaborated with video material. A Pubmed literature search was performed to identify surgically treated paediatric cases of intrameatal compression of eighth nerve with AICA loop.

Results: Tinnitus was completely resolved and hearing was intact immediately after surgical decompression. The patient was free from further symptoms after a short follow up of 12 weeks. Microsurgical decompression, including opening of IAC and transposition of AICA, was an effective treatment option in this case.

Conclusion: Decompression of the cochleovestibular nerve including opening of IAC and transposition of AICA appears to be an effective treatment option for cases with radiologically confirmed intrameatal vascular compression of eighth nerve causing unilateral pulsatile tinnitus.

Key words:

Cochleovestibular nerve, intrameatal anterior inferior cerebellar artery (AICA), Tinnitus, Paediatrics, Surgery

Introduction

Continuous or pulsatile tinnitus may be due to variety of pathologies, such as tumours of cerebellopontine angle and vascular pathologies, including dural AV fistula (DAVF), intracranial aneurysms, atherosclerotic diseases of intracranial vessels, and medical conditions with high cardiac output (such as hypertension, anaemia or thyreotoxicosis) (3, 4, 7, 10). Vascular conflict with eighth cranial nerve is another possible cause of tinnitus. Neurovascular conflicts of the trigeminal, facial, and glossopharyngeal nerves are relatively common and have an established therapeutic strategy. Tinnitus caused by cochleovestibular nerve compression syndrome due to intrameatal anterior inferior cerebellar artery (AICA) is an extremely rare condition. More than 500 cases of microvascular decompression surgery of eighth nerve have been described to date in the literature. However, there are less than 10 surgically treated cases of tinnitus due to intrameatal anterior inferior cerebellar artery (4). None of these cases were paediatric. Surgical treatment of such cases is challenging and the existing evidence is minimal due to few surgically treated cases. Here, we present a paediatric case of microvascular conflict of cochleovestibular nerve with intrameatal AICA treated surgically in our centre (Helsinki live course). Opening of the internal auditory canal (IAC) and microsurgical decompression and mobilization of AICA relieved tinnitus without any other focal neurological deficit.

Materials and methods

Case report

A 15-year-old female presented with a history of right-sided intractable tinnitus of over 5 years duration. On examination the patient was alert and oriented to all

48 qualities. Visual field was intact and pupil size was normal and reactive to light. The
49 patient showed normal hearing and facial nerve function. MRI scan showed an
50 approximately 1-cm long arterial loop of AICA coming into contact with the
51 cochleovestibular nerve (Fig 1 A, B, C, D). There was no other obvious pathology in
52 the cerebellopontine angle. Due to failure of conservative treatment (including
53 counselling) patient desired surgical treatment.

54 **Literature review**

55 A literature search for surgically treated cases of paediatric tinnitus due to intrameatal
56 compression of eighth nerve was performed using Pubmed, Ovid Medline and
57 Scopus database. We used the PRISMA checklist as a guide to achieve accepted
58 standards for reporting systematic reviews. The first author performed all steps and
59 discussed with senior author. We used the keywords “tinnitus” in combination with
60 “microvascular decompression” and “intrameatal AICA”. A total of four articles with
61 nine case reports were found on surgically treated decompression of intrameatal loop
62 of AICA. Paediatric cases were not found.

Results

Surgical decompression and operative findings

Surgery was performed via a retrosigmoid approach using OPMI PENTERO 900 microscope (Carl-Zeiss, Germany). Dura was opened in a curved fashion. The basal cistern was opened to release CSF. The AICA loop entering in the internal auditory canal (IAC) was identified and dissected from arachnoid. The IAC was drilled and the AICA loop and eighth nerve was exposed. Microvascular decompression was performed and the AICA loop was mobilized and fixed with dura using a 10-0 suture (Fig. 2. A, B, C, D, and video 1). The IAC was closed using fibrin glue and muscle fascia. Dura was closed in a water-tight fashion.

Post-operative outcome:

Tinnitus was completely relieved immediately after the surgery without any new focal neurological deficit. No other complications occurred. The patient was discharged from the hospital after 4 days. The patient was completely symptom free after a follow up of 12 weeks.

Discussion

Microvascular decompression surgery is a standard treatment for trigeminal neuralgia, glossopharyngeal neuralgia, and hemifacial spasm (1, 6, 8). However, microvascular decompression with ontological symptoms (including tinnitus, vertigo, and hearing loss) is debatable as in multiple cases the arterial conflict with eighth nerve is a normal variant. However, in the case of pulsatile tinnitus there is an 80-fold greater chance of microvascular conflict than in non-pulsatile tinnitus, thus showing a

relatively strong association (2, 5). Microvascular decompression in cases of tinnitus is less successful in comparison to trigeminal neuralgia, glossopharyngeal neuralgia, or hemifacial spasm. However, the cases described in literature are a mixture of various neurovascular conflicts with the eighth nerve. A meta-analysis of over 500 surgically treated cases of cochleovestibular nerve decompression revealed only nine cases of tinnitus caused by intrameatal loop (4). Interestingly, tinnitus was successfully treated in all nine cases with a decompression and mobilization of AICA loop (4). To the best of our knowledge, none of these cases were paediatric. We demonstrated a successfully treated paediatric case of tinnitus caused by the intrameatal loop of AICA. Most paediatric cases of tinnitus are treated conservatively. However, our patient with a pulsatile unilateral tinnitus failed over several years all types of non-surgical treatment options. Although there are only a few cases of surgically treated tinnitus due to intrameatal AICA loop, surgical treatment resolved tinnitus in all cases as in our case. Hence, surgery could be a valid option for selected cases with unilateral pulsatile tinnitus and radiologically confirmed intrameatal vascular conflict (4, 9, 11). Proper patient selection is however crucial.

Conclusion

Decompression of the cochleovestibular nerve including opening of IAC and transposition of AICA seems to be an effective treatment option for cases with radiologically confirmed intrameatal vascular compression of eighth nerve causing unilateral pulsatile tinnitus.

Figure legends

Figure 1: MRI scan showing microvascular conflict between AICA loop and vestibulocochlear nerve in IAC (A, B, C, D).

Figure 2: Intraoperative images showing different steps of neurovascular decompression (A, B, C, and D). Upper arrow shows AICA loop; lower arrow shows the VIII nerve (D) after opening internal auditory canal.

Video 1: Decompression surgery demonstrating different steps of surgery and surgical anatomy.

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Conflict of interest

The authors certify that they have no affiliations.

Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the research committee of the University of Helsinki and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

The parents of the child provided informed consent.

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MRI Scan showing AICA loop compressing VIII nerve in IAC

A

B

C

D

A

B

C

D

Abbreviations:

Cochleovestibular nerve, intrameatal anterior inferior cerebellar artery (AICA),

Tinnitus, Pediatrics, Surgery