

Supplemental Material S3. Characteristics of studies on the prognostic value of MRI findings for CI outcomes.

Study Country	Study design	Diagnosis	Number of Participants: total, girls	Age, mean, or range	Age at CI (months)	Device	Uni/Bi	Follow-up period (months)	Imaging	Outcome measures	Findings
Kari 2022 (USA)	Retro	CVN abnormalities, 20 with AD	40, 18	7-78 months	NR	CLs, HAs, Bimodal	18/2 20 HAs	NR	T2 MRI and CT scan	SAT	IAC midpoint diameter and the number of nerves in the IAC were predictors of post-CI outcomes.
Han 2019 (Korea)	Retro	Bilateral CND	25, 12	21.0 months	NR	Nucleus	NR	24	MRI	CAP, IT-MAIS	The area ratio of CN to FN at the CPA was correlated with CAP and IT-MAIS scores.
Gaurav 2019 (India)	Pros	SNHL with or without MRI abnormalities ^a	50, 25	5.06 years	NR	Nucleus, AB	NR	12	MRI	CAP, MAIS	MRI abnormalities observed in 15 children were associated with lower post-CI outcomes.
Chung 2018 (Korea)	Retro	CND SNHL	56, NR G1: 17, CNC<1.44mm G2: 14 CNC between 1.4-2 mm G3: 25 CNC>2mm	NR	G1: 27.92 G2: 29.32 G3: 33.43	NR	NR	6, 12, 24, and 36	MRI in the axial plane	CAP, open-set speech tests, picture vocabulary test	Groups 1 and 2 with smaller CNC diameters had poor post-CI outcomes, and group 3 with normal CNC diameters showed good CI outcomes. ^b
Birman 2016 (Australia)	Retro	CND G1: aplasia 64% G2: hypoplasia 25% G3: normal CN 11% 54% with ADs	50, 24	0-16 years	Median 25	NR	29/21	12	MRI	CAP	CI outcomes were significantly affected by aplasia/hypoplasia and developmental delay. CAP scores were obtained between 5 and 7 for 47% and 89% of children with aplasia and hypoplasia, respectively. The main mode of communication was significantly influenced by the presence of developmental delay.
Chao 2016 (China)	Retro	Bilateral CND Matched SNHL No AD/C	CND: 10, 6 SNHL: 10, 6	NR	CND: 4.45 (1.5-7.4) year SNHL: 4.0 (1.3-6.5) year	Nucleus	All uni	12	T2 MRI in the axial plane and CT scan	CAP, SIR	Poor outcomes in children with CND compared to children with SNHL. No association was identified between CN and CNC diameters and CI outcomes in CND.

											Overall, better results were obtained in children with CN>FN.
Jeong 2015 (Korea)	Retro	CVN malformation A: 16 B: 31 C: 6 D= 6° No narrow CNC with ADs	59, 27	5.8 years	A: 5.82 B: 6.58 C: 3.07 D: 5.32	Nucleus	NR	36 or more	TBCT, MRI	Open-set MWT	Better post-CI speech perception scores were reported in CN malformation types A and B compared to types C and D. The test scores did not differ between types A and B and those without CN malformation.
Jeong 2013 (Korea)	Retro	ANSD with CND	15, 5	3.5 years	70	Nucleus	NR	72.8	MRI and CT scan	CAP, IT-MAIS, open-set MWT	The normal size of CNC and CN was correlated with excellent speech perception abilities after CI. A narrow or obliterated CNC and a deficient CN were associated with poor speech perception abilities.
Yamazaki 2015 (Japan)	Retro	CND, 4 with AD	19, NR	NR	2.67 (11.5)	Nucleus	5/14	24	T2 MRI in the axial plane and CT scan	Pre/post-operative CAP	Poor speech performance was found in children with FN>CN.
Valero 2012 (Canada)	Retro	ANSD with hypoplasia Matched SNHL	19, 10	NR	ANSD: 50.4 (12 to 155) SNHL: 51.24 (12 to 172.2)	Nucleus	ANSD : 17/2 SNHL : 17/2	At CI activation and every 3 months up to 24 months	MRI and CT scan	ESP, IT-MAIS, WIPI, GASP, MLNT, BKB words, LNT phonemes, BKB phonemes	Speech performance, the PROSPER score, ^d was poor in both the initial and the most recent assessment and did not improve over time.
Teagle 2010 (USA)	Retro	ANSD with medical comorbidities, 42% with prematurity	52, 19	7.3 years	47, 12-213	Nucleus, AB	2/50	41 (6-118)	MRI and CT scan	ESP, PBK, MLNT, LNT, IT-MAIS	38% had abnormal findings on preoperative MRI of the brain and inner ear. 50% demonstrated open-set speech perception abilities, and nearly 30% were unable to complete the test because of low CI experience or developmental delays. No child with CND achieved open-set speech

perception abilities. In a subgroup of children with the results of MRI and PBK tests, good open-set speech perception skills were associated with normal MRI results.

AB: Advanced Bionics, AD/C: additional disabilities/comorbidities, ANC: auditory nerve canal, ANSD: auditory neuropathy spectrum disorder, BKB: Bamford-Kowal-Bench sentence test, CAP: Categories of Auditory Performance, CDI: child development inventory, CI: cochlear implant, CN: cochlear nerve, CNC: cochlear nerve canal, CPA: cerebellopontine angle, CVN: cochleovestibular nerve, ESP: early speech perception, FN: facial nerve, GASP: Glendonald Auditory Screening Procedure, HINT: Hearing in Noise Test, IAC: internal auditory canal, LNT: lexical neighborhood test, MLNT: Multi-syllable Lexical Neighborhood Test, NR: not reported, Pros: prospective, PROSPER: Pediatric Ranked Order Speech Perception, Retro: retrospective, SAT: speech awareness threshold, SIR: Speech Intelligibility Rating, SNHL: sensorineural hearing loss, SP: speech perception, TBCT: temporal bone computed tomography, VCN: vestibulocochlear nerve, WIPI: Word Intelligibility by Picture Identification.

^a Demyelination of the brain white matter ($n = 9$), Mondini's dysplasia ($n = 1$), communicating hydrocephalus ($n = 1$), asymmetrical cochlear size ($n = 1$), and features of mastoiditis ($n = 3$).

^b Overall, the correlation between CAP score and CNC diameter at 24 and 36 months was 0.377 and 0.395; the correlation between open-set word discrimination score and CNC diameter at 24 months was 0.533, and the correlation between CNC diameter and picture vocabulary test score was 0.342.

^c Four subtypes of cochleovestibular nerve (CVN) malformation were introduced based on the cochlea and modiolus morphology: normal cochlea and normal modiolus (type A, $n = 16$), malformed cochlea and partial modiolus (type B, $n = 31$), malformed cochlea and no modiolus (type C, $n = 6$), and no cochlea and no modiolus (type D, $n = 6$).

^d The Pediatric Ranked Order Speech Perception (PROSPER) score allows for the comparison of speech and language outcomes across varying testing conditions, both between participants and within a single participant tested repeatedly over time. In PROSPER, tests are ranked according to their relative difficulty and quantified from 0 (least complex) to 34 (most complex) (Arjmandi et al., 2022; Valero et al., 2012).