Incidence of Infectious Complications Following Cochlear Implantation in Children and Adults

Cochlear implantation is the treatment of choice for patients with severe to profound sensorineural hearing loss.1 Infec-
tion following cochlear implantation can result in hearing loss secondary to implant removal and, rarely, meningitis.2 Published rates of infection after cochlear implantation vary widely (1.4%-8.2%),3,4 and there is a paucity of generalizable, large-
scale data regarding the risks of infection after implantation. This study aimed to determine the incidence and timing of in-
fected complications following cochlear implantation.

Methods | A retrospective cohort study was conducted using 
the Healthcare Cost and Utilization Project (HCUP) State Inpa-
tient Databases, State Emergency Department Databases, and 
State Ambulatory Surgery Databases5 from Florida, Maryland, 
New York, Vermont, and Wisconsin. States were chosen with 
longitudinal, encrypted personal identifiers to link patient vis-
its. We included patients 1 year and older with an Internationa-
lar Classification of Diseases, Ninth Revision or Internationa-
lar Statistical Classification of Diseases and Related Health Problems,
Tenth Revision (ICD-9/10) or Current Procedural Terminology,
Fourth Edition procedure code for cochlear implantation in 
the State Inpatient Databases or State Ambulatory Surgery Datas-
bases from January 1, 2006, to September 30, 2016. Infectious 
complications were defined as ICD-9/10 diagnosis codes after 
implantation for meningitis, petrositis, mastoiditis, prosthetic 
inflammation/infection, labyrinthitis, postauricular fistula, scalp 
cellulitis, or site-specific wound complications plus a Staphy-
loccus or general incision and drainage code. Additionally, 
ICD-9/10 diagnosis codes within 180 days of implantation for 
postoperative infection, unspecified cellulitis, or general wound 
complications plus a Staphylococcus or general incision and 
drainage code were included as infectious complications. Codes 
for infectious complications within 2 weeks of each other were 
considered a single complication. Complications were evalu-
ated separately in children and adults.

Complication rates were calculated per 1000 person-
years with 95% confidence intervals, and mean cumulative 
functions were generated accounting for recurrent infec-
tions. Per HCUP standards, events with fewer than 11 cases were not reported to preserve patient anonymity. All statistical analyses 
were performed in SAS version 9.3 (SAS Institute Inc). This study was exempted from review by the Washington University 
School of Medicine institutional review board.

Results | In total, 1975 children and 5474 adults received coch-
lear implants. Of the children, 51% were boys, with a median age 
at implantation of 4 years (interquartile range [IQR], 2-8 years) 
and median follow-up of 5.3 years (IQR, 2.5-8.0 years). Infect-
ious complications occurred in 64 children (3.2%) at a rate of 
8.2 complications per 1000 person-years (95% CI, 6.6-10.2). Chil-
dren aged 1 and 2 years had the highest rates of infectious com-
lications, 15.4 and 14.8 complications per 1000 person-years, 
respectively (Figure 1).

Among the adults, 53% were women, the median age at im-
plantation was 63 years (IQR, 48-75 years), and the median follow-
up time was 4.3 years (IQR, 2.0-7.3 years). Infectious complications occurred in 110 adults (2.0%) at a rate of 5.2 complications 
per 1000 person-years (95% CI, 4.3-6.1). Adults 65 years and older did not have a higher rate of complications than younger adults.

Fifty-five percent (n = 47/86) of pediatric complications oc-
curred within 180 days of implantation, compared with 43% 
(n = 56/131) of adult complications (Figure 2). Of the 64 chil-
dren with infectious complications, 22% (n = 14) developed re-
current infectious complications, while 14% (n = 15) of the 110 
adults with infectious complications developed recurrent in-
flections. Prosthetic inflammation/infection (n = 86 [40%]) was 
the most common infectious complication, followed by masto-
iditis (n = 56 [26%]) and cellulitis (n = 32 [15%]). Fewer than 
11 cases of meningitis were observed.

Discussion | The low rates of infectious complications in coch-
lear implant recipients in this study support the safety of coch-
lear implants and are useful as reliable point estimates for fu-
ture investigations. Meningitis was exceedingly rare.

Young children aged 1 and 2 years experienced infectious complications more frequently than older children. However, 
the benefits of early implantation on language development are 
well established,6 and the low absolute risk for infection does 
not outweigh these substantial benefits.
The overall increase in infectious complications in children was predominantly driven by repeat and early complications, occurring within 180 days. Increased vigilance by physicians is warranted when caring for young children early after implantation and children with prior implant infections.

Limitations of this study include poor sensitivity for non-surgical, outpatient complications and no studies validating the ICD-9/10 codes defining infectious complications.

Daniel P. Lander, BS
 Nedim Durakovic, MD
 Dorina Kallogjeri, MD, MPH
 Pawina Jiramongkolchai, MD
 Margaret A. Olsen, PhD, MPH
 Jay F. Piccirillo, MD
 Craig A. Buchman, MD

Author Affiliations: Department of Otolaryngology–Head and Neck Surgery, Washington University School of Medicine in St Louis, St Louis, Missouri (Lander, Durakovic, Kallogjeri, Jiramongkolchai, Piccirillo, Buchman); Division of Infectious Diseases, Washington University School of Medicine in St Louis, St Louis, Missouri (Olsen).

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Corresponding Author: Daniel P. Lander, BS, Department of Otolaryngology–Head and Neck Surgery, Washington University School of Medicine in St Louis, 660 S Euclid Ave, Campus Box 8115, St Louis, MO 63110 (daniel.lander@wustl.edu).

Author Contributions: Mr Lander had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Dr Kallogjeri is Statistics Editor and Dr Piccirillo is Editor of JAMA Otolaryngology–Head and Neck Surgery. Concept and design: All authors. Acquisition, analysis, or interpretation of data: Lander, Durakovic, Kallogjeri, Jiramongkolchai, Olsen, Buchman. Drafting of the manuscript: Lander, Buchman, Piccirillo. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: Lander, Kallogjeri, Piccirillo. Obtained funding: Lander, Durakovic, Buchman, Piccirillo. Administrative, technical, or material support: Jiramongkolchai, Olsen, Buchman. Supervision: Durakovic, Olsen, Buchman, Piccirillo.

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Differences in Central Line–Associated Bloodstream Infection Rates Based on the Criteria Used to Count Central Line Days

Central line–associated bloodstream infection (CLABSI) rates are an important quality performance indicator associated with patient morbidity, mortality, and increased costs. Hospital CLABSI rates are tracked, reported, and tied to reimbursement by the Centers for Medicare & Medicaid Services. This creates incentives for hospitals to reduce CLABSI rates with standardized best practices for the management of central lines. Between 2008 and 2017 the CLABSI standardized infection rate reported to the National Healthcare Safety Network (NHSN) fell by approximately 49% in acute care hospitals. The NHSN reporting guidelines specify 3 options for measuring the number of central line days: a once-a-day count at a fixed time for all patients with a central line; a sampling-based approximation to the once-a-day count; and an electronic count that may be used “after a validation of a minimum 3 consecutive months proves the data to be within 5% (+/-) of the manually collected once-a-day counts.” We evaluated the differences in CLABSI rates per 1000 central line days based on the choice of the time used for the once-a-day count and based on the use of electronic data collection.