

Review

Safety and outcomes of cochlear implantation in the elderly: A review of recent literature

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Abstract

Global demographic changes related to longevity are leading to increasing numbers of the elderly, for whom hearing loss is a significant cause of morbidity and disability. Once met with reticence, severely hearing impaired older adults are increasingly being considered for cochlear implantation (CI). Significant data indicate that CI in the elderly population is safe, well-tolerated, and effective. Risks from CI surgery and anesthesia are low and generally comparable to rates in other age groups. Outcomes studies regarding CI in older adults have shown excellent improvements to speech perception, quality of life, and even cognition. Overall, currently available data suggests that advanced age should not, in itself, be considered a barrier to implantation. This review paper will highlight selected articles from recent medical literature regarding the safety and efficacy of CI in the elderly population.

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1. Introduction

1.1. Epidemiology

The global prevalence and impact of hearing loss on health and function is becoming increasingly recognized. According to the World Health Organization, hearing impairment is the third-highest cause of years lived with disability (YLD) in adults worldwide (Cruikshanks et al., 2003). This is a particularly crucial health concern for the geriatric population. Incidence of hearing loss increases with age, with more than 70% of adults older than 75 experiencing some degree of loss (Cruikshanks et al., 2003; Sprinzl and Riechelmann, 2010). Many of these individuals experience hearing loss too severe to be adequately treated with conventional amplification or hearing aids. Individuals with severe to profound sensorineural hearing loss (SNHL) are candidates for cochlear implantation (CI).

Unlike a hearing aid, a CI bypasses the inner hair cells through a surgically implanted intra-cochlear electrode and provides electric signals directly to the spiral ganglion cells of the cochlear nerve. Sound perception with CI requires the remainder of the auditory pathway, from the spiral ganglion cells to the auditory cortex, to be intact and uncompromised. Age-related degeneration of the peripheral and central auditory pathways, long-term auditory deprivation, cognition, and neural plasticity were once considered barriers to implantation in this population, but are now areas of active, multidisciplinary investigation. Robust data are now available to calm historical concerns over peri-operative morbidity in older adults and suggest that CI candidacy evaluation in elderly hearing-impaired patients should not depend on age alone. Reports in the United States indicate that only 5–10% of adult CI candidates receive implants, thereby underscoring the need for greater understanding of the barriers to, and benefits of, CI in this population (Sorkin, 2013).

This paper will review the data from recent literature on cochlear implantation in the elderly population. Recent data on the negative effects on hearing loss in older adults and the potential mitigating impact of CI will be reviewed. Issues of peri-operative safety, specifically surgical and anesthetic-related complications, will be addressed. Finally, available literature examining post-CI outcomes in this population, including speech understanding in quiet and noise, quality of life and cognition, are reviewed.

1.2. Significance

Historically, attitudes regarding treatment of the elderly with CI ranged from reluctant to cautiously optimistic for multiple reasons, many of which pertain to age-related changes in the auditory pathway. Cadaveric studies have demonstrated age-related effects on the peripheral auditory system, specifically, decreased spiral ganglion cell counts within the cochlea (Nadol et al., 1989). On a cellular level, the aging brain is associated with decreased synaptic density and dendritic cell numbers, which may have implications for neural plasticity (Dickstein

et al., 2007). Centrally, changes to neuron number and composition within the cochlear nuclei have been observed (Dickstein et al., 2007; Mahncke et al., 2006).

In addition to degradation of the peripheral and central auditory pathways, the overall cognitive decline associated with aging may have an impact on auditory processing in the elderly (Mahncke et al., 2006). Elderly patients with hearing loss may face unique issues related to listening effort and attention. Tun et al. (2009) suggest that older adults require additional effort and attention to achieve meaningful listening.

In recent years, a growing body of knowledge has formalized and quantified the negative effects of hearing loss on health and function. Hearing loss has been associated with lower quality of life (QOL), social isolation, depression, personality changes, and reduced functional status (Mulrow et al., 1990; Carabellese et al., 1993; Cacciatore et al., 1999). In addition, recent data underscore the relationship between hearing loss and age-related cognitive decline. Lin et al. (2011) found that hearing loss is independently associated with higher rates of dementia in the elderly. A cohort of 639 older adults without dementia was followed prospectively, and those with hearing loss were more likely to develop dementia. Additionally, the incidence of dementia increased proportionately to the degree of hearing loss, with nearly five times higher rates of dementia in elderly patients with severe hearing loss when compared to those with normal hearing (Lin et al., 2011). In a separate study, Lin (2011) showed an association between hearing loss and cognitive decline in another large cohort of elderly patients. Of 605 patients, those with poor hearing performed worse on the Digit Symbol Substitution Test (DSST), a test of cognitive function. In this study, auditory rehabilitation using traditional amplification (hearing aids) was associated with better DSST performance (Lin, 2011). While a complete discussion of outcomes with traditional amplification is outside this review, data suggests that use of hearing aids can have significant effects on the lives of older adults. For individuals who not receive adequate rehabilitation from hearing aids, a cochlear implant may be considered. Interventions for hearing loss, such as cochlear implantation, have the potential to mitigate the widespread impact of hearing loss in this population. Available literature on the impact of cochlear implantation in older adults is reviewed in detail below.

2. Safety

2.1. Complications

Examination of the safety profile of CI and peri-operative morbidity is imperative when considering implantation in the elderly, who have more comorbidities and inherently poorer outcomes with many surgical treatments than younger adults. Multiple studies have shown that CI in the elderly population is well-tolerated and that risks of major and minor surgical complications are equivalent with rates in younger adults (Wong et al., 2016; Chen et al., 2013; Roberts et al., 2013; Carlson et al., 2010; Schwab et al., 2015).

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