Screening for hearing loss in adults with CF: does it make sense?

Andrew Jones

Cystic fibrosis (CF) is a condition characterised by chronic pulmonary infection and progressive lung damage with those affected requiring frequent course of antibiotics. *Pseudomonas aeruginosa* is by far the most common chronic pathogen in CF. While measures comprising regular screening for initial onset of *P. aeruginosa* infection, aggressive therapy for eradication of early carriage and stringent infection control precautions have extended the age of onset, the majority of patients still eventually develop chronic infection. An aminoglycoside combined with a β-lactam antibiotic is the first-line treatment option for patients with *P. aeruginosa* requiring intravenous antibiotics and therefore most patients with CF will be exposed to intravenous aminoglycosides during their lifetime, often on multiple occasions.

Several studies, including that by Vijayasingam and colleagues in this current issue of Thorax, provide compelling evidence that patients with CF have an increased risk for hearing impairment.[1] The findings of Vijayasingam and colleagues concur with most other studies in CF that hearing impairment is closely associated with cumulative exposure to aminoglycosides and increasing age.[1–4] A degree of hearing loss was common, being found in 57 (45%) of 126 individuals. Ten (8%) of the subjects had hearing impairment in frequencies 0.5–4 kHz critical for speech recognition; half of these were under 50 years of age and all but one had a documented history of intravenous aminoglycoside exposure. As the study excluded any subjects who were already using hearing aids these figures may be an underestimation of significant hearing loss affecting speech recognition in the population at their CF centre. Hearing impairment is not the only side effect of aminoglycosides; the prevalence of significant vestibular toxicity and tinnitus symptoms were reported in 9.5% and 7.1% of subjects to Vijayasingam and colleagues—these symptoms can be disabling and distressing and are associated with aminoglycoside use in CF.[4]

Hearing loss is common in the general adult population with sensorineural age-related hearing loss (presbycusis) being the most frequent cause. In the UK, 40% of people aged 50 years old and 71% of people aged 70 years and older have a degree of hearing loss.[5] Although some paediatric studies suggest conductive loss is more commonly encountered than sensorineural problems in children with CF,[6] most other studies suggest hearing impairment is sensorineural, and has an association with aminoglycoside use.[1–4] With greater numbers of people with CF living longer lives, and many already having a degree of sensorineural hearing impairment, hearing loss is likely to be an increasingly encountered and significant problem in an ageing adult CF population. The study by Vijayasingam and colleagues highlights the need for an increased awareness of this potential problem among patients and CF caregivers, as hearing loss was present and unidentified in individuals in the clinic, despite presumably their high levels of frequent interaction with healthcare providers. Two of the priority research recommendations from NICE for hearing loss in adults are 'what is the prevalence of hearing loss among populations who under-present for possible hearing loss?' and 'what is the clinical and cost effectiveness of monitoring and follow-up for adults with hearing loss postintervention compared with usual care'?.[5] These are perhaps pertinent questions for CF teams and researchers.

Vijayasingam and colleagues have explored the potential of different systems to screen for hearing loss in adults with CF. The investigators evaluated a questionnaire, a web-based hearing test and tablet audiometry against formal sound attenuated booth audiometric testing. The current COVID-19 pandemic has accelerated a change in service provision in CF clinics towards an increased proportion of virtual encounters and home-based monitoring. Disappointingly, both questionnaires and web-based self-testing had poor sensitivity. The tablet-based audiometry still required outpatient contact, but evolving this to a home-based system would add further convenience for patients and potential costs savings.

The study by Vijayasingam and colleagues has a number of limitations: it is single centre with a relatively small number of adults to provide a more detailed evaluation of some of the initial findings, such as the particular traits of patients who developed more significant hearing loss in frequencies critical for speech recognition, the design is cross-sectional and it relies on retrospective data for evaluation of risk factors. The investigators gathered data on total intravenous antibiotic exposure over the last 10 years and intravenous aminoglycoside exposure in the last 5 years. However, given the median age in the cohort was 31.5 years it is likely that many years of previous exposure would be missed; recent usage history cannot be assumed to be an accurate surrogate for total lifetime exposure. The historic use of intravenous antibiotic data itself is challenging, as some courses may not always have included an aminoglycoside. Furthermore, the data on aminoglycoside may not take into account other factors including adherence for home intravenous courses, choice of aminoglycoside, dosing schedule and levels. The standard intravenous aminoglycoside for CF exacerbations is once daily tobramycin but the preference for tobramycin and switch to once daily administration has occurred after many of the patients may have received course of intravenous antibiotics in earlier life. Some patients were tested while receiving a course of intravenous antibiotics, this itself may have affected results. These are always the most accessible subjects for clinical studies but this also highlights the difficulty in interpreting results when such patients are included in studies because of convenience for sampling.

However, the limitations of their current study should not distract from the importance of the findings and investigators should be praised for their endeavour in beginning to evolve a screening protocol for hearing loss in CF. The loss of hearing, one of the basic human senses, can have a significant impact on the quality of life for an individual. Hearing loss is associated with an increased risk of developing depression and anxiety, conditions that are already recognised as having higher prevalence among people with CF.[7]

Further work is needed to evaluate the proposed protocol. A larger dataset will be required to define its utility and refine the algorithms for clinical application. As the onset of chronic *P. aeruginosa* infection will raise the possibility for a patient that they may begin to need an intravenous

Manchester Adult Cystic Fibrosis Centre, Manchester University Hospitals Foundation Trust, Manchester, UK

Correspondence to Professor Andrew Jones, Manchester Adult Cystic Fibrosis Centre, Manchester University Hospitals Foundation Trust, Manchester M23 9LT, UK; andrew.jones@mft.nhs.uk

antibiotic course that includes an aminoglycoside—should this be an indication for a hearing test? What is clear is that despite a literature that highlights the increased risk of hearing impairment among people with CF, specialist centres often do have local co-ordinated screening programmes to detect and manage. The UK standards of care for CF state that screening for hearing loss is not advocated but audiological assessment may be necessary in some patients.[8]

As we move into a new era for CF, with the advent of new therapies that will almost certainly further extend survival, we should consider the implications of treatment strategies on the CF population as they become older adults, hearing is just one of these. We should also begin to study potential risks for the development of renal and cardiovascular disease as adults with CF grow older, and continue to evolve screening and management guidelines for other complications that are being recognised at a higher frequency within the adult CF population. Adults with CF have an increased risk of gastrointestinal cancers and consensus guidelines for screening for lower bowel cancers have recently been developed.[9] Perhaps the study by Vijayasingam and colleagues may be the impetus for developing an evidence base for the next consensus screening recommendations for CF—a guideline for screening for hearing impairment in CF?

Contributors AJ is the sole contributor to the article.

Funding The author has not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Commissioned; externally peer reviewed.

To cite Jones A. *Thorax* 2020;**75**:619–620.

Accepted 23 June 2020
Published Online First 9 July 2020

► http://dx.doi.org/10.1136/thoraxjnl-2019-214177

Thorax 2020;**75**:619–620.

doi:10.1136/thoraxjnl-2020-215490

REFERENCES

1 Vijayasingam A, Frost E, Wilkins J, *et al*. Tablet and web-based audiometry to screen for hearing loss in adults with cystic fibrosis. *Thorax* 2020;75:632–9.
2 Garinis AC, Cross CP, Srikanth P, *et al*. The cumulative effects of intravenous antibiotic treatments on hearing in patients with cystic fibrosis. *J Cyst Fibros* 2017;16:401–9.
3 Al-Malky G, Dawson SJ, Sirimanna T, *et al*. High-frequency audiometry reveals high prevalence of aminoglycoside ototoxicity in children with cystic fibrosis. *J Cyst Fibros* 2015;14:248–54.
4 Handelsman JA, Nasr SZ, Pitts C, *et al*. Prevalence of hearing and vestibular loss in cystic fibrosis patients exposed to aminoglycosides. *Pediatr Pulmonol* 2017;52:1157–62.
5 NICE. *Hearing loss in adults: assessment and management. NICE guideline [NG98]*, 2019.
6 Kreicher KL, Bauschard MJ, Clemmens CS, *et al*. Audiometric assessment of pediatric patients with cystic fibrosis. *J Cyst Fibros* 2018;17:383–90.
7 Quittner AL, Goldbeck L, Abbott J, *et al*. Prevalence of depression and anxiety in patients with cystic fibrosis and parent caregivers: results of the International depression epidemiological study across nine countries. *Thorax* 2014;69:1090–7.
8 CF Trust. *Standards for the clinical care for children and adults with cystic fibrosis in the UK*. 2nd edn. Cystic Fibrosis Trust, 2011.
9 Hadjiliadis D, Khoruts A, Zauber AG, *et al*. Cystic fibrosis colorectal cancer screening consensus recommendations. *Gastroenterology* 2018;154:736–45.

Correction: *Screening for hearing loss in adults with CF: does it make sense?*

Jones A. Screening for hearing loss in adults with CF: does it make sense? *Thorax* 2020;75:619–20. doi: thoraxjnl-2020-215490

This article has been corrected since it was published Online First. The author name has been modified to list the first name and last name accurately and the author contribution section has been amended accordingly.

Thorax 2021;**76**:e2. doi:10.1136/thoraxjnl-2020-215490corr1