International Journal of Pediatric Otorhinolaryngology 112 (2018) 39–44

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

# Hyperacusis in children: The Edinburgh experience

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ARTICLE INFO

*Keywords:*
Hyperacusis
Tinnitus
Paediatric

ABSTRACT

*Objectives:* This study aimed to determine the factors associated with hyperacusis in children referred to an audiology-led paediatric hyperacusis clinic in a Paediatric tertiary centre. It also aimed to identify current management strategies in paediatric hyperacusis and their outcomes.

*Methods:* Retrospective cohort study conducted by case note and AuditBase® review over a 5-year period (March 2010 to March 2015) in a tertiary Paediatric ENT and Audiology service.

*Results:* 412 children were referred with hyperacusis during the 5-year period. All children were assessed and managed within a dedicated Paediatric hyperacusis clinic. Median age at referral was 7 years. 76% were boys (n = 313). On average, children were sensitive to 6 identifiable sound stimuli at presentation (range 1–20). 82% complained of sensitivity to noise from household appliances and hand dryers. 60% had a background history of autistic spectrum disorder (ASD), followed by attention deficit hyperactivity disorder (ADHD) and other neurodevelopmental problems. In 91% management comprised behavioural therapy and provision of a 'sound-ball' (Wellcare® Naturcare Relaxation Therapy Ball) to take home. Of these, 25% did not attend their first review appointment. A further 25% were considered to have sufficient symptom improvement to permit discharge after a single clinic review. Only 2% of children required more than 3 review sessions before achieving resolution of symptoms.

*Conclusions:* In our paediatric cohort, hyperacusis is more common in boys and in those children with ASD. A combined treatment approach with behavioural therapy and the provision of a sound-ball has a very high success rate in our experience.

## 1. Introduction

Decreased sound tolerance (DST) is a general term to describe lowered tolerance to sound that would not evoke the same negative response in an average listener [1]. It can be broadly categorised into hyperacusis and misophonia. Patients with hyperacusis may perceive sounds as uncomfortably loud, unpleasant, frightening, or painful. The sound's meaning and the context in which it occurs are irrelevant [2]. Misophonia is described as an abnormally strong reaction occurring to a sound with a specific pattern and/or meaning to an individual. Phonophobia is considered to be a subgroup of misophonia, whereby there is presence of an adverse emotional response involving fear of sound. It is often challenging to differentiate DST from recruitment, which refers to abnormal growth of loudness associated with outer hair cell dysfunction. In this paper, we use the term hyperacusis to refer to a general reduction in sound tolerance.

Hyperacusis can arise from both peripheral and central auditory systems. Central hyperacusis is found to be more prevalent, particularly in children with Williams syndrome (90%) [3,4]. Peripheral causes of hyperacusis may include otitis media with effusion (OME), Bell's palsy, Meniere's disease, perilymph fistula and sensorineural hearing loss. Data on paediatric hyperacusis in the published literature is currently limited. A recent systematic review of three studies estimated the prevalence of hyperacusis to be between 3% and 17% in children (age range from 5 to 19 years) [5]. Furthermore, as many as 42% of school aged children are bothered or annoyed with sounds without necessarily exhibiting abnormal reactions [6]. There is a high degree of co-morbidity between hyperacusis and tinnitus, with 42% of 11-year old children with hyperacusis also experiencing tinnitus [7]. Hyperacusis is a common feature in childhood learning and developmental disorder, and there is increasing evidence of its association with autistic spectrum disorder (ASD) [8]. While hyperacusis can be prevalent in certain psychiatric disorders such as anxiety and depression in adults [9], less is known in the paediatric population.

Hyperacusis in children can be distressing and their reactions to the unwelcomed sounds may range from mild gestures of avoidance to

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https://doi.org/10.1016/j.ijporl.2018.06.015
Received 5 December 2017; Received in revised form 7 June 2018; Accepted 8 June 2018
Available online 12 June 2018

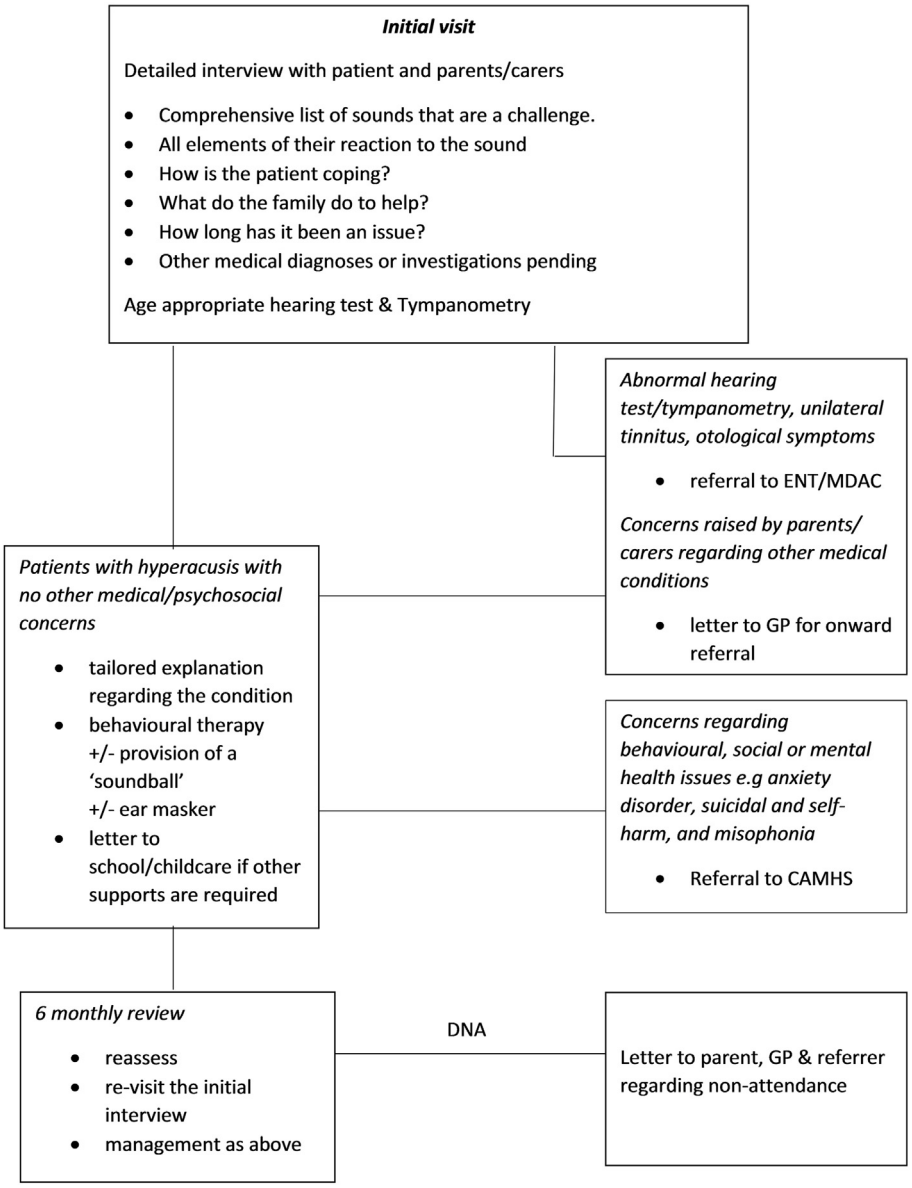


**Fig. 1.** Assessment and management protocol for Paediatric Hyperacusis clinic. ENT (Ear, nose and throat), MDAC (Multidisciplinary audiology clinic), GP (General Practitioner), CAMHS (Child and Adolescent Mental Health Service), DNA (Did not attend).

extreme behavioural and physiological responses. It is however difficult to diagnose hyperacusis in children as it is a subjective symptom and younger children may have difficulty in articulating their problems. The recommendation from the First International Conference on Hyperacusis in 2013 is that paediatric cases should be managed in a dedicated clinic with multidisciplinary involvement [10]. The principles of its management strategies include counselling, sound therapy protocols and optimal use of ear-level instrumentation.

Our paediatric hyperacusis clinic based in Edinburgh is currently managed by the Principal Paediatric Audiologist. The clinic receives referrals from various sources in Edinburgh and the Lothians, and liaises with multiple disciplines in the assessment and management of children with hyperacusis. In this study, we investigated the factors associated with hyperacusis in children referred to our audiology-led paediatric hyperacusis clinic and identified current management strategies and their outcomes.

## 2. Methods

A retrospective review of case notes and AuditBase audiology software system (Auditdata, Denmark) was performed of all children who were referred to the Edinburgh and Lothians paediatric hyperacusis clinic over a 5-year period from March 2010 to March 2015. Data on patient demographics, referrals, audiological evaluation, diagnosis, management strategies and follow-up were collected and analysed.

Our protocol in the assessment and management of children with hyperacusis is summarised in Figure 1. The assessment during the initial visit consists of detailed interviews with the child and parents/carers, age appropriate hearing test and tympanometry. If there are any concerns raised or identified regarding the child's hearing, medical conditions, behavioural and psychosocial issues, appropriate referral is made. Children and parents/carers are offered detailed explanation and management options, which include behavioural therapy, provision of a 'sound-ball' or puretone relaxation therapy ball (Wellcare® Naturcare Relaxation Ball) (Fig. 2), and/or an ear masker. The 'sound-ball' used in our patients with hyperacusis, is a sound generator that plays a choice