Auris Nasus Larynx xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Auris Nasus Larynx

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

Review

Treatment of pharyngotympanic tube dysfunction

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ARTICLE INFO

Article history:
Received 6 April 2017
Accepted 6 July 2017
Available online xxx

Keywords:
Eustachian tube dysfunction
Tubomanometry
Ballon dilation tuboplasty
Patolous Eustachian tube dysfunction
Medical management
Surgical management

ABSTRACT

Eustachian tube dysfuntion intends to describe a variety of signs, symptoms, and physical findings that result from the impairment of ET function. A large variety of methods have been employed to assess ET function in the literature. Due to the lack of high level evidence, it is difficult to draw conclusions on the effectiveness of medical and surgical treatments. There are various medical and surgical interventions available for chronic obstructive ET dysfunction including balloon Eustachian tuboplasty (BET) and laser or microdebrider tuboplasty. Consensus on diagnostic criteria for ETD is required to define inclusion criteria of future trials. There is however emerging work with reassuring, but preliminary, results that suggest evidence for safety in the surgical management of ETD. Like many newly introduced techniques the current data remains limited to non-controlled case-series, with heterogeneous data collection methods and lacking substantial long-term outcomes. Nevertheless, short-term data provide favorable results. Current treatment options comprising BET and patulous ET surgery may be offered as a treatment possibility to selected patients.

1. Introduction

The Eustachian tube (ET) is part of a system including the nose, palate, rhino-pharynx, and middle ear spaces [1]. This comprises the tympanic cavity, which includes the bony ET and the mastoid air cell system (Fig. 1). The tympanic cavity and mastoid cells are interconnected and allow for gas exchange and pressure equalization. The ET is a complex organ consisting of a dynamic, mucosal lined canal, cartilage, surrounding soft tissue, peritubal muscles, superior bony support and the sphenoid sulcus. Clinical experience as well as numerous patient studies and animal models prove that the ET plays an important role in various middle ear pathologies [2–4]. Despite improvement of knowledge of ET function, significant uncertainties remain due to its complex anatomy, multiple functions as well as the impact of intrinsic and external factors [5,6]. Intermittent transitory tubal dilation is probably the major mechanism for equalising middle ear cleft and ambient atmospheric pressure [7]. Barometric and chemical receptors within the middle ear cleft are assumed to provide autonomic nervous system feedback that impacts on the frequency of involuntary tubal opening [8,9]. Our understanding of the anatomy and physiology of the ET still continues to evolve. Recently McDonald and co-workers demonstrated that the ET might have a sequential peristaltic-like mechanism [10]. Currently, there are various medical and surgical interventions available for chronic obstructive ET dysfunction including balloon Eustachian tuboplasty (BET) and laser or microdebrider tuboplasty [11–17]. However, the small sample size in the reviewed literature represents a significant limitation. The

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http://dx.doi.org/10.1016/j.anl.2017.07.001
0385-8146/

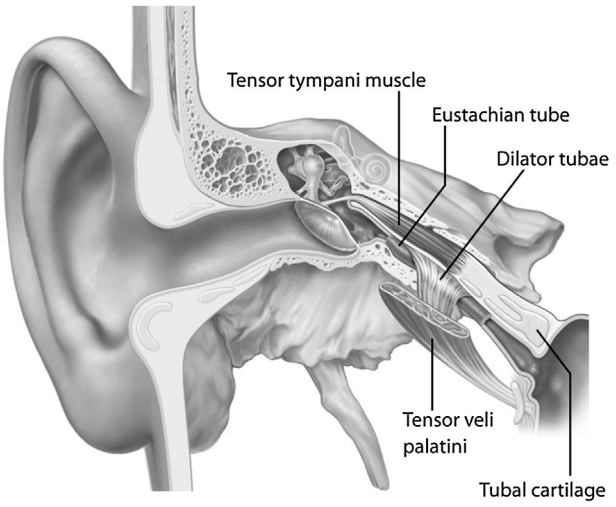

Fig. 1. Right coronal temporal bone view including the external and middle ear, the cartilaginous and bony portion of the Eustachian tube, and the adjacent muscles.

majority of available studies are underpowered to detect a significant effect [18]. Long-term results with these procedures still have to be established.

2. Eustachian tube dysfunction

2.1. Definition

The term Eustachian tube dysfuntion (ETD) intends to describe a variety of signs, symptoms, and physical findings that result from the impairment of ET function. This condition may not necessarily lead to detectable middle ear pathologies. Dysfunction of the ET can either be acute or chronic. Acute ETD can occur during nasal congestion due to e.g. a common cold or allergic rhinitis and is generally transient. ETD lasting longer than three consecutive months has to be considered chronic. Chronic ET dysfunction can be due to obstruction or due to a patulous ET. ETD is nevertheless a poorly defined condition [18]. Allergic disposition with accompanying mucosal hyperplasia and nasopharyngeal acid reflux also play important roles in ET function. ETD may lead to clinical symptoms such as aural fullness, impaired pressure equilibration, altered middle ear aeration, hearing loss and autophony. ETD is estimated to be present in about 1% of the general population [19] Because the most common cause of obstructive dysfunction is mucosal inflammation within the cartilaginous ET, patients should be questioned about inflammatory processes such as allergic rhinitis, chronic rhinosinusitis, laryngo-pharyngeal reflux (LPR), and smoke exposure [20,21] ETD was more likely to be associated with a higher number of nasopharyngeal reflux events and higher reflux finding score in adult patients [22]. Pediatric ETD may be caused by adenoidal hypertrophy and mucosal swelling due to acute or chronic upper respiratory tract infections. Cleft palate, granulomatous diseases, cystic fibrosis, Samter's triad, or Kartagener's syndrome are predisposing factors. ETD may be a contributing factor to vertigo [23,24] It is important to distinguish ETD from other causes of aural fullness such as temporomandibular joint (TMJ) disorders, superior semicircular canal dehiscence syndrome, Meniere's disease and increased intracranial pressure employing a tailored assessment. Almost 40% of all children up to the age of 10 develop temporary ETD [25,26]. Studies accessing pediatric and adult patient cohorts demonstrate that ETD is detectable in up to 70% of patients undergoing middle ear surgery [27]. A sufficient ET function is believed to be important for the successful outcome of middle ear surgery [28,29]. Patients with a PET usually present with positional autophony and hearing both voice and breathing sounds or aural fullness [26]. The precise distinction between the obstructive and patulous tube is essential for appropriate medical or surgical treatment. Patients with PETs may benefit from augmentation or reconstructive procedures [30,31].

3. Eustachian tube dysfunction assessment

A large variety of methods have been employed to assess ET function [31–39], with more than 40 described in the literature [31]. Due to the lack of high level evidence, it is difficult to draw definite conclusions on the effectiveness of any therapy. None is able to give detailed insight to all aspects of ET physiology and pathology. Clinical tests such as otoscopy, endosocopy, Politzer test, Valsalva and Toynbee manoeuvre may give initial guidance. Manometric testings (tympanometry, reflex decay tympanometry, nine-step inflation deflation test, modified inflation deflation test, forced response test and tubomanometry (TMM)) have some value [31–39]. TMM was described by Estève et al. in 2001 [36,37] and is a tool to measure the opening of the ET tube and the transportation of gas into the middle ear by registering pressure changes (Fig. 2). A stimulus of a controlled gas bolus is applied to the nasopharynx during swallowing and recorded by a pressure sensor in the occluded external ear canal. If ET opening is registered, the time of opening in relation to pressure application can be measured (opening latency index or index R). An R value of <1 indicates early opening of the ET, which is considered optimal [36].

For inter-individual as well as prospective comparison of ET function, the ET score (Table 1) was proposed as a semi-objective tool [12]. It is a rating system incorporating clinical symptoms and TMM results. The score can range from 0 (=complete obstruction) to 10 (=normal tubal function). The clinical symptoms "clicking sound when swallowing" and "positive Valsalva's manoeuvre" are rated with 0 points for "never", 1 point for "sometimes" and 2 points for "always". TMM results at 30, 40 and 50 mbar are incorporated in the ET score as well: an immediate opening of the ET ($R \leq 1$) is weighted with 2 points, a delayed opening ($R > 1$) with 1 point and no opening (negative or not measurable R) with 0 points. The ET score gives a quantitative assessment of ET function and allows inter-individual as well as prospective comparison.

The pressure chamber is a useful device to assess ET function under varying pressure conditions, regardless of whether the ear drum is intact or perforated [31]. However, pressure chambers are complex and expensive and thus not widely available.

Please cite this article in press as: Sudhoff HH, Mueller S. Treatment of pharyngotympanic tube dysfunction. Auris Nasus Larynx (2017), http://dx.doi.org/10.1016/j.anl.2017.07.001