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The Immediate Effect of Power Assisted Endoscopic Adeno with Microdebrider on Eustachian Tube Function in Children

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ABSTRACT:

Objectives: To evaluate the effect of power assisted endoscopic adenoidectomy with Microdebrider on Eustachian tube function in the early postoperative period in children with adenoid hypertrophy and normal preoperative middle ear pressure.

Patients and Methods: Prospective study was conducted on 30 children with adenoid hypertrophy and normal preoperative tympanograms who underwent Power assisted endoscopic adenoidectomy with Microdebrider from April 2015 to February 2016. Tympanometry was done on the same day before operation, and repeated on the first, third and seventh day postoperatively.

Results: Thirty patients were included in the current study, 18 males and 12 females. The average age was 7.5 years. The middle ear pressure (MEP) of at least one ear was decreased on the first postoperative day in 12 (40%) patients and in 4 (13.3%) patients on the third postoperative day, and then returned to the normal preoperative MEP by the seventh postoperative day.

Conclusion: Immediate transient Eustachian dysfunction occurs in the early postoperative period in children after power assisted endoscopic adenoidectomy with Microdebrider, with early complete resolution. This transient Eustachian dysfunction may be due to oedema of nasopharyngeal mucosa, postoperative blood clots, or the very rarely unintentionally surgical trauma.

Keywords: Adenoidectomy; Microdebrider; Endoscopic; Tympanometry

Introduction:

Adenoid is a nasopharyngeal lymphoid tissue forming a part of the Waldeyer ring. It was initially described in 1868 by Meyer[1]. Adenoid enlargement is one of the common reasons of upper airway obstruction[2]. In children, adenoid enlargement is a common condition and can cause many upper respiratory tract symptoms such as nasal discharge, mouth breathing, snoring, sleep apnea, and hyponasality[3]. Adenoid hypertrophy also related to the pathogenesis of many conditions such as rhinosinusitis, recurrent otitis media, and otitis media with effusion[4].

Surgical removal of adenoid, adenoidectomy, is considered one of the most common surgical procedures in children. It is done either alone or in combination with tonsillectomy or insertion of ventilation tubes[5]. Obstructive sleep apnea, nasal obstruction, chronic rhinosinusitis, otitis media with effusion, and recurrent otitis media are the most common indications of adenoidectomy. In 1885, Wilhelm Meyer described the widely used conventional curette adenoidectomy[1]. Curettage adenoidectomy is the most commonly used procedure nowadays for adenoid removal. However, many complications were reported with this procedure such as incomplete removal, trauma to the underlying structures, and hemorrhage[6].

In the 1990s, the use of intranasal endoscopes became widespread in endoscopic sinus surgery, and the endoscopic assisted adenoidectomy became the natural evolution of conventional adenoidectomy. The main advantage is that the intranasal endoscope allows direct visualization of the operative field, which would decrease the incidence of residual lymphoid tissues. In addition, it also helps to avoid Eustachian tube injury that may cause its fibrosis[7,8]. Afterwards, many alternative surgical techniques had been developed, including suction Electrocautery ablation, Laser adenoidectomy and Power assisted endoscopic adenoidectomy (PAEA) with Microdebrider[9-12]. PAEA with Microdebrider is a recent method for decreasing the risk of adenoid recurrence. It is also considered an effective procedure for revision surgery as it provides complete removal of adenoid tissue. Under the assistance of endoscopic visualization, the use of the curved adenoid blade that properly fits into the nasopharynx makes the removal of adenoid tissue much easier in PAEA. In addition, the use of the endoscope reduces the risk of collateral injury to the neighbouring nasopharyngeal structures and pharyngeal muscles[13-15].

The Eustachian tube (ET) has three physiologic functions, which are regulation of middle ear pressure, protection of the middle ear from pathogens/foreign material in the nasopharynx, and clearance of the middle ear space[16]. Normally, the ET stays closed and opens during swallowing and other activities to equalize the middle ear pressure with the atmospheric pressure[17].

Hypertrophied adenoid tissue can lead to mechanical and/or inflammatory obstruction of the nasopharyngeal opening of the ET, leading to ET dysfunction, which represents one of the most frequent otological pathologies. ET dysfunction is the starting point for almost all acute or chronic otological inflammatory processes and their consequences[18]. ET dysfunction due to obstruction of its orifice by adenoid tissue was found to be associated with abnormalities in tympanometry indicating abnormal middle ear pressure[19].

This prospective study was conducted to evaluate the effect of power assisted endoscopic adenoidectomy with Microdebrider on the Eustachian tube function in the early postoperative period in children with adenoid hypertrophy and normal preoperative middle ear pressure.

Materials and Methods:

Subjects:

Prospective study was conducted on 30 children who had adenoid hypertrophy and who underwent power assisted endoscopic adenoidectomy (PAEA) with Microdebrider in the period from April 2015 to February 2016 at Ear, nose and Throat department, Sohag University Hospital, Egypt. Patients with normal tympanic membrane and preoperative type A tympanograms were only included in this study. Patients with any ear problem; preexisting craniofacial anomalies or neuromuscular disorders; having cleft palate (frank, submucosal, repair); were previously treated with adenoidectomy and/or tonsillectomy and/or ear surgery were excluded.

Methods:

Careful history taking as regards age, gender, nasal, aural & throat symptoms were taken. All subjects in this study were subjected to full ENT examination including anterior rhinoscopy, otoscopy and flexible fiberoptic nasopharyngoscopy. In Addition, radiological assessment in the form of X-ray neck soft tissue lateral view, pre and post -operative tympanometry were done.

Tympanometry:

The tympanometery using a 226 Hz probe frequency with positive to negative pressure sweeps of 600 daPa/s (+200 to -400 daPa/s) was performed to all subjects. Tympanometery was used to measure the middle ear pressure (MEP) on the same day before operation, and then repeated on the first, third and seventh day postoperatively. Tympanograms were generally classified into types A, B, and C according to Jerger classification[20].

Surgical technique:

Under general anesthesia with oral endotracheal intubation, a Boyle-Davis mouth gag was used to open the mouth. Using a 0-2.7 mm rigid telescope (4 mm for older children) or the 45° Hopkins 4-mm nasal endoscope, the posterior choanae and nasopharynx were assessed and the adenoid tissue was identified. In young children, the transoral approach was preferred. The sinuscope was passed through the nose and the curved adenoid blade was introduced through the oral cavity. Surgical debridement started from the lowest vegetation on the posterior wall of the nasopharynx and ended with the upper choanal tissue, including the peritubal region. In older children, Microdebrider with irrigating blades was used trasnasally. Sinuscope and Microdebrider

were passed either through the same nostril or the sinuscope through one nostril and debrider through the other. Under endoscopic vision, the shaver blade was passed through the nose with suction switched off to avoid trauma to the turbinates or the septum. Then, the suction was turned on drawing the adenoid tissue in and the rotating blade shaves it under constant endoscopic vision. The adenoidectomy was started high in the nasopharynx from upper limit of adenoid tissue until the inferior edge of adenoid was reached. Haemostasis was obtained by means of selective bipolar cauterization or suction diathermy. At the end of the procedure, a pack of gauze was inserted into the nasopharynx, kept for few minutes and then removed. Then, the mouth gag was removed.

Statistical analysis:

Data were analyzed using Statistical Package for the Social Sciences version 18.0 (SPSS Inc, Chicago, IL, USA). Multiple measures ANOVA were used to compare the categorical variables. A p- value <0.05 was considered statically significant. This study was conducted after receiving approval from the Research Ethics Committee of Sohag Faculty of Medicine.

Results:

Thirty children with adenoid hypertrophy underwent power assisted endoscopic adenoidectomy (PAEA) with Microdebrider in the period from April 2015 to February 2016 at Ear, nose and Throat department, Sohag University Hospital, Egypt. Of the 30 patients included in the present study, 18 (60%) were males and 12 (40%) were females. The mean age for the patients was 7.5 years with range between 3 and 12 years. All children had adenoid hypertrophy, normal tympanic membrane and type A tympanograms preoperatively as shown in Table 1. Tympanometry was repeated on the first, third and seventh day postoperatively.

On the first postoperative day, bilateral Eustachian dysfunction was found in 3 (10%) patients, and unilateral Eustachian dysfunction was found in 9 (30%) patients. On the third postoperative day, bilateral Eustachian dysfunction was found in one (3.3%) patient and unilateral Eustachian dysfunction was found in 3 (10%) patients. On the seventh postoperative day, all patients (100%) showed normal middle ear pressure (type A tympanograms). No type B tympanogram was detected in any patient, as shown in Table 2.

Average age (years)	7.5 years
Gender (M/F)	18/12
Adenoid Hypertrophy	All (N= 30 patients)
Preoperative Tympanic	Normal (N=60 ears)
Membrane Status	Type A (N=60 ears)
Preoperative Tympanogram	

Table 1: Preoperative descriptive Data of the patients**.**

Middle ear pressure was decreased in the first postoperative day, then started to increase in the third postoperative day, and returned to the normal preoperative MEP by the seventh postoperative day. Multiple measures ANOVA showed statically significant differences in MEPs between preoperative and postoperative days for both ears, as shown in Table 3.

Discussion:

The Eustachian tube (ET) connects the middle ear (ME) airspace with the nasopharynx, and provides ventilation of the middle ear. The most important function of the ET is equalization of MEP with the atmospheric pressure[21]. Prior literatures demonstrated the development of negative middle ear pressure with type C tympanogram in at least one ear following septal surgery, anterior & posterior nasal packing, and prolonged nasotracheal & nasogastric intubation, which resolved following removal of packs & tubes. These researchers thought that the change in MEP was most probably due to the effect of surgery, nasal packing, oedema of the nasopharyngeal mucosa, inflammatory mucosal reaction, direct occlusion of the ET, or tubal occlusion by excessive secretions of seromucous glands in the pharyngeal part of ET[22-26].

Adenoidectomy is commonly performed in children. Several adenoidectomy methods have been described in the literatures. Power assisted endoscopic adenoidectomy (PAEA) using a Microdebrider is a recently described procedure. The microdebrider has been used extensively for tissue debridement during endoscopic sinus surgery[27]. Adenoidectomy with Microdebrider using a transnasal endoscope has been described. Using the endoscope allows good visualization, which ensures complete removal of adenoid tissue located even high up in nasopharynx and intranasally without injuring the adjacent structures. Performing PAEA, harvests the advantages of both the endoscope as well as the Microdebrider. The special adenoid blade is longer, and has a window on its convex side for use transorally to adapt to the roof of nasopharynx[28,29].

The literatures contain little about the effect of adenoidectomy on the ME pressure and ET function

	Type B Tympanogram	Type C Tympanogram		Type A Tympanogram	
		Bilateral	Unilateral	Bilateral	Unilateral
First Postoperative Day	0	3 (10%)	9 (30%)	18 (60%)	9 (30%)
Third Postoperative Day	0	1 (3.3%)	3 (10%)	26 (86.7%)	3 (10%)
Seventh Postoperative Day	0	0	0	30 (100%)	-

Table 2: Results of postoperative tympanograms.

MEP	Preoperative	Postoperative First day	Postoperative Third day	Postoperative Seventh day	P-Value
Right	-16.33 ± 11.65	-128.25 ± 76,37	-68.32 ± 49.15	-21.34 ± 19.56	<0.05
Left	-18.12 ± 13.24	-119.81 ± 85.42	-61.09 ± 40.94	-19.87 ± 20.58	<0.05

Table 3: Comparison between the Middle ear pressures (daPa) measured preoperative, first post-operative day, third post-operative day and seventh post-operative day.
Data were presented as mean ± SD (standard deviation).

in the early postoperative period although it is one of the commonest surgical procedures in children. The present study used tympanometry to evaluate the effect of power assisted endoscopic adenoidectomy with Microdebrider on the ET function in the early postoperative period in pediatric patients with adenoid hypertrophy and normal preoperative middle ear pressure. In our study, 12 (40%) of 30 patients developed type C tympanogram in at least one ear on the first postoperative day, no type B tympanogram was detected in any patient. On the third postoperative day, type C tympanogram in at least one ear was detected in 4 (13.3%) patients. On the seventh postoperative day, all patients (100%) returned to the normal preoperative middle ear pressure (type A tympanogram). Oedema of the nasopharyngeal mucosa especially tissues surrounding the ET resulting in narrowing of the Eustachian tube orifice, blood clots occluding the tube orifice in the early postoperative period leading to Eustachian dysfunction, or the very rarely unintentionally surgical trauma to the Eustachian tube, or its orifice might be the explanations for these MEP disturbances. Unla et al[30] demonstrated type C tympanogram in at least one ear in 48 (75%) of 64 pediatric patients who had normal preoperative MEP and who underwent traditional curette adenoidectomy on the first postoperative day, and in 10 (15.6%) patients on the third postoperative day. MEP returned to the normal preoperative values by the seventh postoperative day except in two patients. Abou-Elhamd[31] reported that 57% of patients who underwent curettage adenoidectomy developed type C tympanogram one day postoperatively with complete recovery one month postoperatively.

From these results, both traditional curette adenoidectomy and power assisted endoscopic adenoidectomy with Microdebrider affect the Eustachian tube function, but the PAED produces a better outcome. It is clear that the more complete surgical removal of adenoid tissue especially in the peritubal area, usually allowed by endoscopic surgery, reduces the risk of peritubal and velopharyngeal muscle damage[28], and enhances restoration of the patency of the Eustachian tube facilitating middle ear ventilation and drainage.

Conclusion:

Immediate transient Eustachian dysfunction occurs in the early postoperative period in children after power assisted endoscopic adenoidectomy with Microdebrider with early complete resolution. This transient Eustachian dysfunction may be due to oedema of nasopharyngeal mucosa, postoperative blood clots, or unintentionally direct surgical trauma.

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