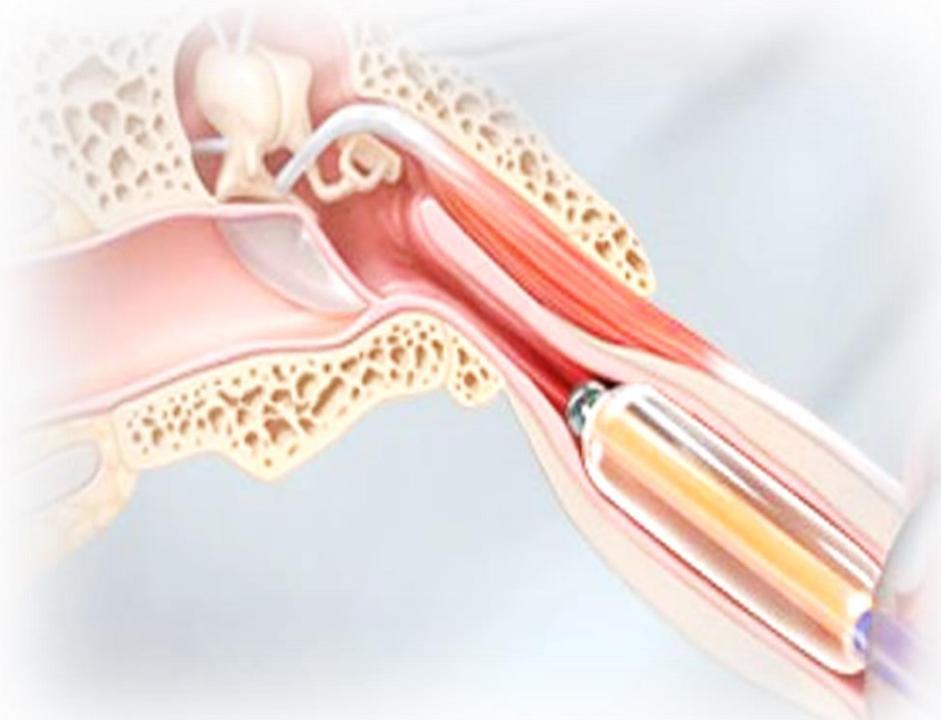


# E-tube dysfunction: diagnosis and treatment

台中慈濟 謝承祐醫師

# 耳咽管功能障礙:診斷與治療



# 目錄

1

耳咽管功能與  
分類

2

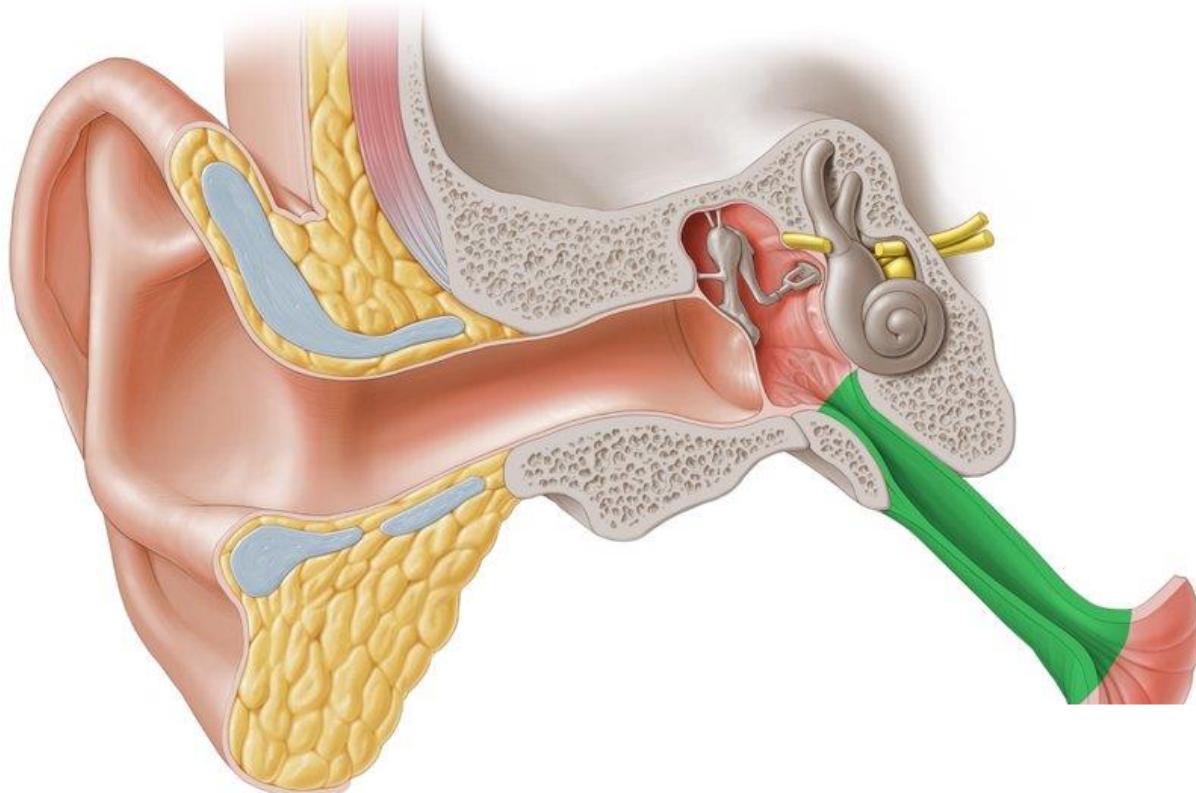
阻塞型耳咽管  
功能障礙

3

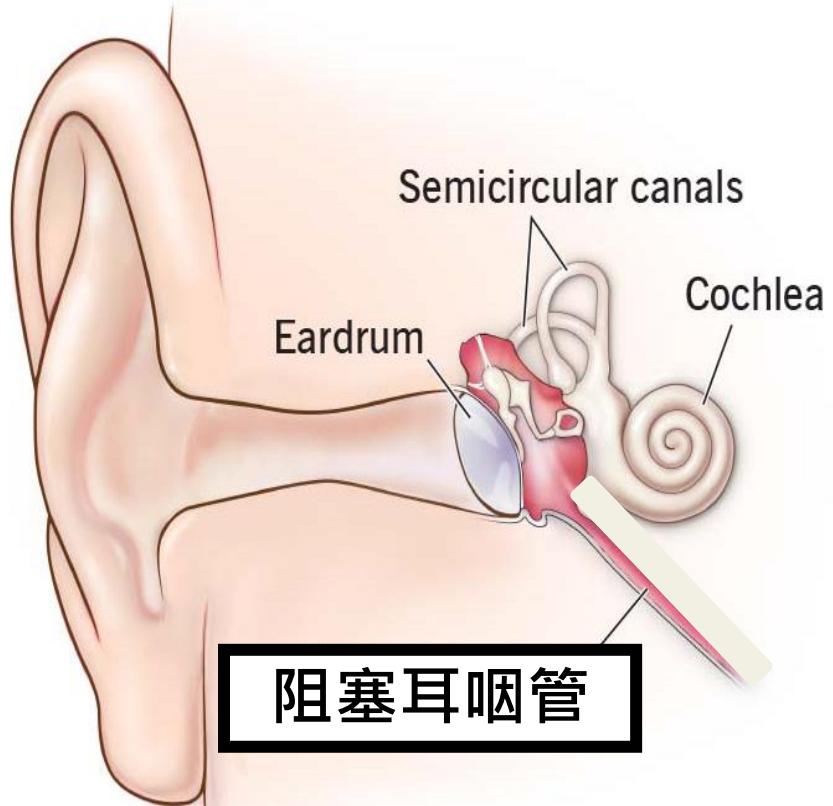
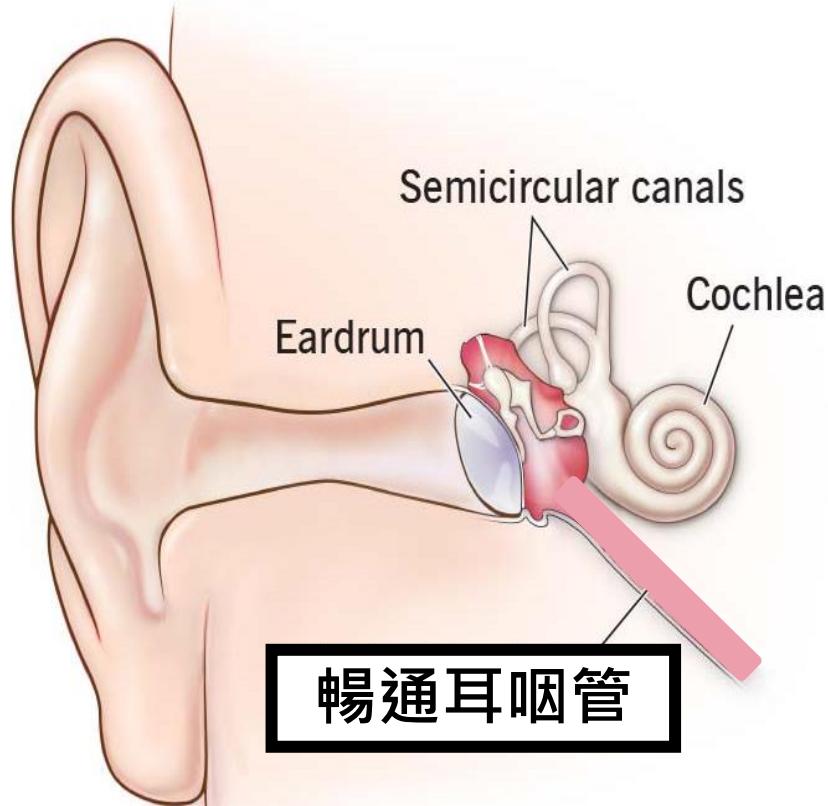
開放型耳咽管  
功能障礙

4

國考題分析



# 耳咽管功能



三大功能: 1. 通氣平衡 2. 保護中耳 3. 清除黏液

# 耳咽管功能障礙(ETD)定義

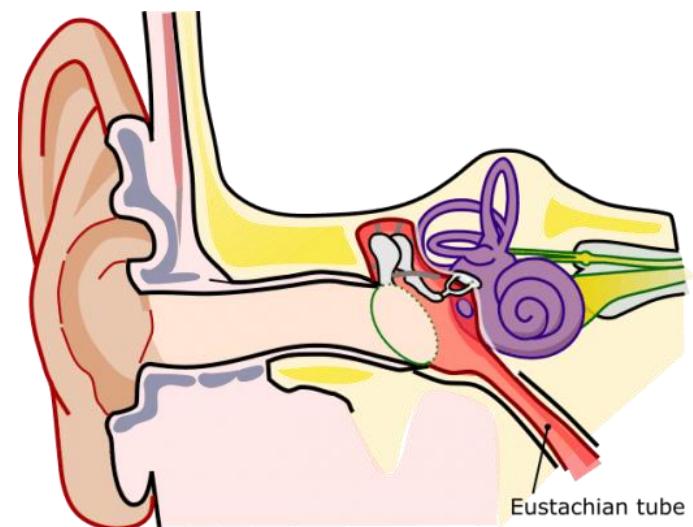
- Symptoms and signs of **pressure dysregulation in the middle ear**
- Subtype
  - Dilatory(obstructive)
  - baro-challenge
  - Patulous
- Acute ETD : < 3 months
- Chronic ETD: > 3 months

# 耳咽管功能障礙(ETD)診斷

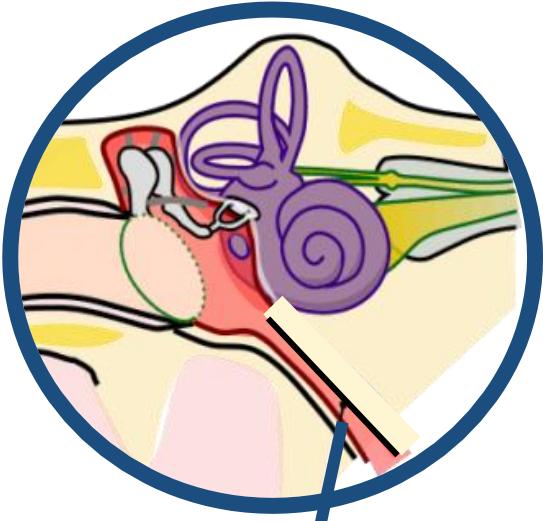
- Lack of golden standard for diagnosis of ETD
  - Poor understanding of E-tube function
  - Poor efficacy of intervention

## Consensus:

Subjective symptoms + objective tests



# ETD分類



## Obstructive

- Most common
- URI
- Inflammation of E-tube mucosa



## Patulous

- Weight loss
- Autophony



## Baro-challenge

- Change in pressure
- Flying or diving

# 主觀症狀 ETDQ-7

標準化嚴重度: 確認診斷 > 14.5

過去幾個月, 是否有下列症狀困擾著你	無或輕度		中度			重度	
耳內有壓力感	1	2	3	4	5	6	7
耳內有疼痛感	1	2	3	4	5	6	7
耳內有悶塞感或置身水下之感覺	1	2	3	4	5	6	7
鼻炎或感冒時 耳朵有不適症狀	1	2	3	4	5	6	7
耳內有喀拉聲或水泡破裂聲	1	2	3	4	5	6	7
耳內嗡鳴聲	1	2	3	4	5	6	7
聽力感覺悶脹或含混不清	1	2	3	4	5	6	7

# 治療

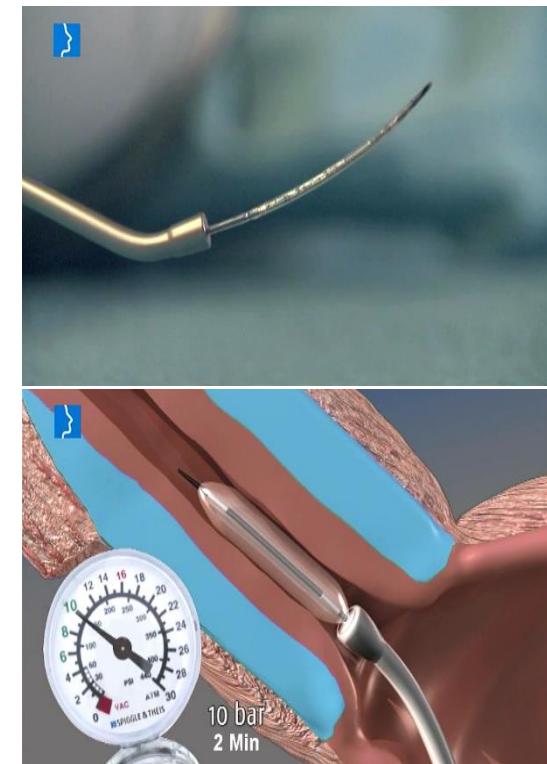
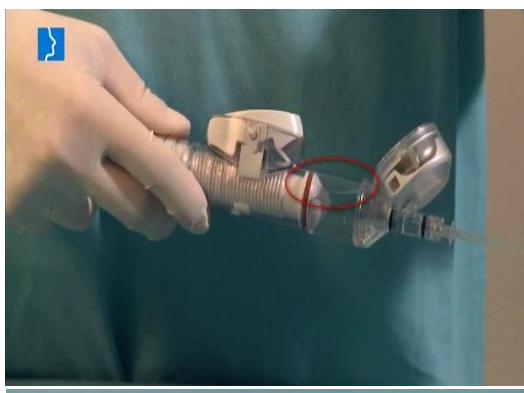
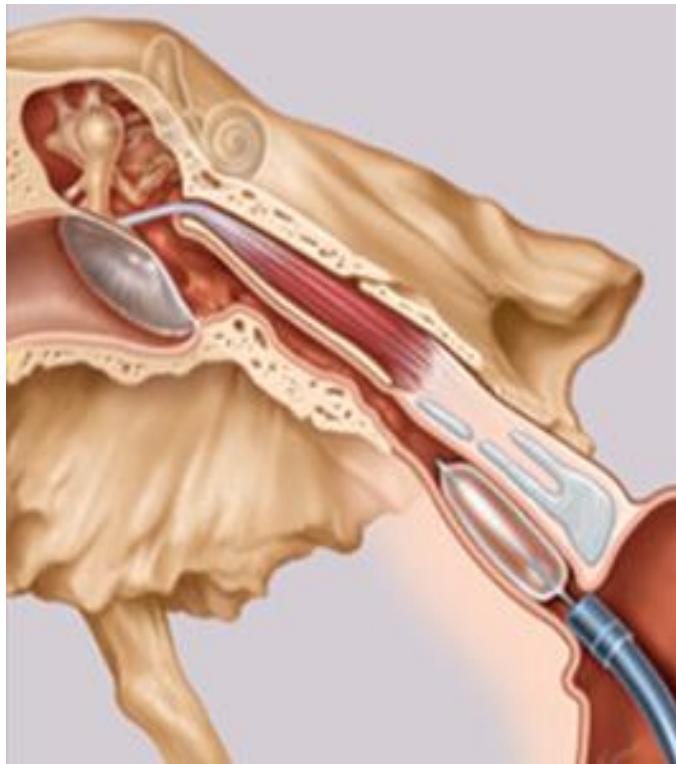
Obstruction ETD

Balloon dilation tuboplasty

Laser tuboplasty

# 耳咽管氣球擴張術

引進最新手術：氣球擴張術



BET (Balloon Eustachian Tuboplasty) 耳咽管氣球擴張術

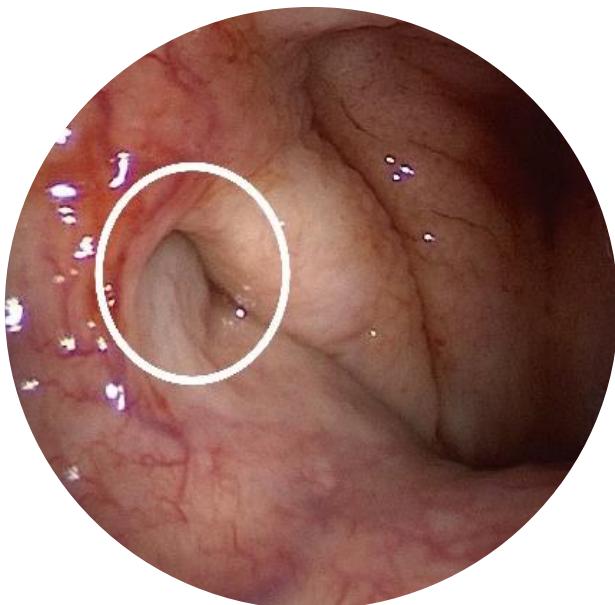
# 耳咽管氣球擴張術

引進最新手術：氣球擴張術

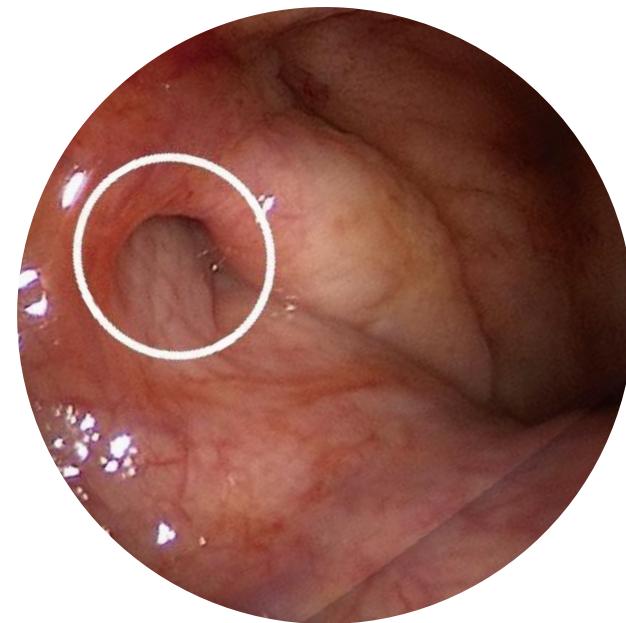


# 手術前後

手術經驗: 突破600次!



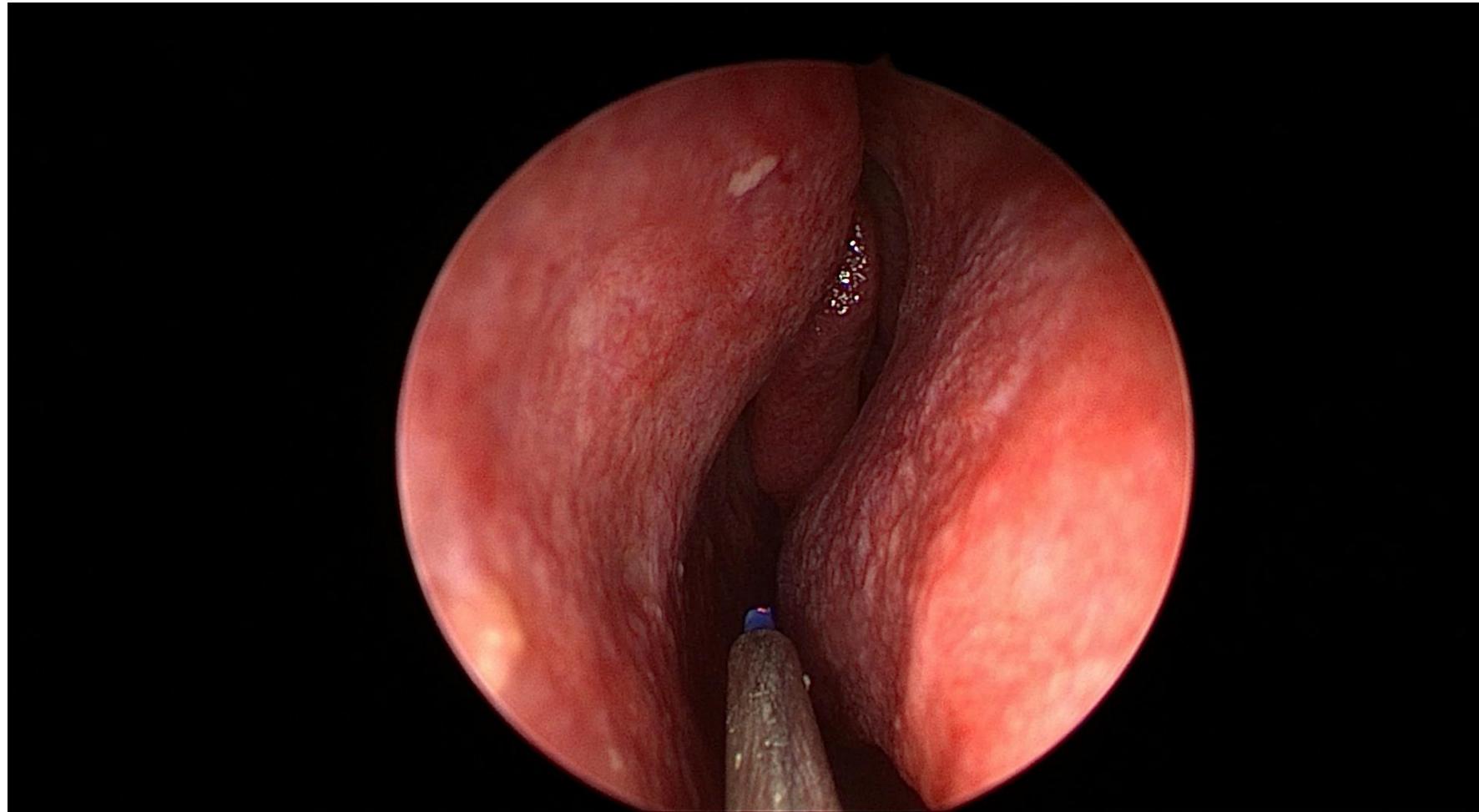
治療前:耳咽管閉鎖



治療後:耳咽管暢通

# 結合雷射

結合雷射: 加強效果

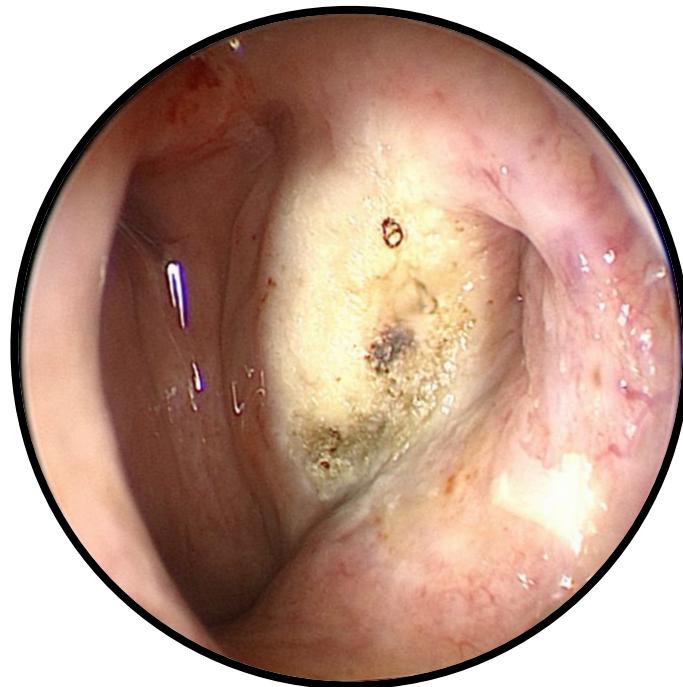


# 結合雷射

結合雷射: 加強效果



雷射前



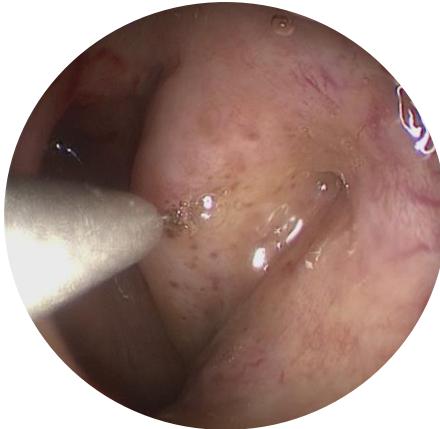
雷射後

# 治療

Patulous ETD

HA/ fat augmentation

Transcanal cartilage insertion

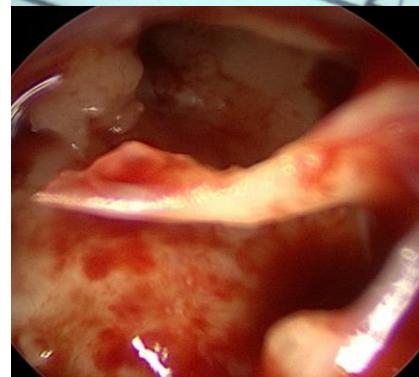


# 治療

## Patulous ETD

HA/ fat augmentation

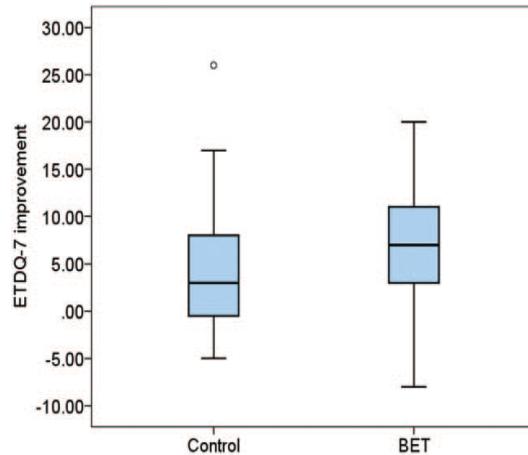
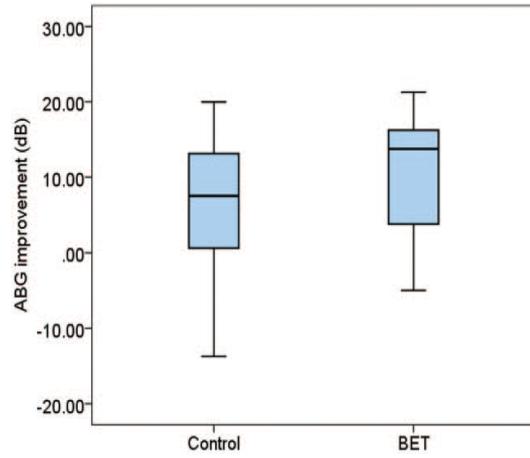
Transcanal cartilage insertion



# 研究論文

研究發表權威期刊

## 結合鼓膜成行與耳咽管氣球擴張術



手術成功率

耳咽管功能

聽力改善

Original Study

### Tympanoplasty With or Without Balloon Eustachian Tuboplasty for Chronic Suppurative Otitis Media With Obstructive Eustachian Tube Dysfunction

\*Cheng-Yu Hsieh, \*Chen-Jung Chang, \*Chuan-Hung Sun, \*Chee-Chee Lee, \*Giselle L. Gotamco, \*Chuan-Jen Hsu, and †Hung-Pin Wu

\*Department of Otolaryngology- Head and Neck Surgery, Taichung Tzu Chi Hospital, Buddha Tzu Chi Medical Foundation, Taichung; †School of Medicine, Tzu Chi University, Hualien, Taiwan (R.O.C.), and (Section of Otorhinolaryngology-Head and Neck Surgery, Department of Surgery, Chinese General Hospital and Medical Center, Manila, Philippines)

**Objective:** To further elucidate the role of balloon Eustachian tuboplasty (BET) in tympanoplasty, we conducted a study to compare the outcomes of tympanoplasty with and without BET for the treatment of chronic suppurative otitis media (CSOM) with obstructive Eustachian tube dysfunction (OETD).

**Study Design:** Case control study.

**Setting:** Tertiary medical center.

**Patients:** A total of 70 ears diagnosed with CSOM (tubotympanic type) and OETD were included in this study. Thirty-four ears were treated with standard tympanoplasty and tympanomastoidectomy between February 2018 and June 2019. Thirty-five control subjects were matched by sex and age to the intervention group and underwent tympanoplasty between July 2016 and January 2018.

**Interventions:** BET, tympanoplasty.

**Main Outcome Measures:** The graft take rate, hearing levels, and Eustachian tube function test results.

**Results:** The graft take success rate was higher in the BET group (88.0% vs 20.2%) than in the control group (68.6%, 24/35). However, the difference was not statistically significant. The average airbone gap (ABG) improvement was significantly higher in the BET group (10.0 dB) than in the control group, with a statistically significant between-group difference ( $p < 0.033$ ). Our findings suggest that BET can objectively and subjectively improve the Eustachian tube function, with a slight but significant improvement in ABG despite the lack of significant improvement in ETDQ-7. In summary, BET does not affect the graft take rate. In summary, BET could be used as an adjunctive procedure in the treatment of OETD.

**Conclusion:** BET is a safe and effective technique for improving ventilation and clearance of the middle ear in patients with CSOM and impaired ETDQ-7.

**Keywords:** Eustachian tube, tympanoplasty, tympanomastoidectomy, CSOM, ETDQ-7.

Tympanoplasty is a standard surgical treatment for perforated chronic suppurative otitis media (CSOM). The overall success rate is approximately 65 to 95% (1–4). Such success rate is mainly due to the graft function, graft tube function (ETF) may influence the graft take rate and hearing improvement following tympanoplasty (5,6).

Some reports have suggested that ETF is a major determinant of surgical outcome (1–4). A lower graft take rate and relatively poor hearing improvement after

tympanoplasty are likely to occur in patients with poor ETF. The success rate of tympanoplasty in patients with normal ETF is approximately 87 to 95% (2,4–6,7), while it is much lower in patients with poor ETF (1–4,7–10), in patients with chronic suppurative otitis media (CSOM) and impaired ETF.

The Eustachian tube regulates middle ear ventilation. Functional impairment of the eustachian tube dysfunction (OETD), both ventilatory and clearance functions are impaired, which commonly result in fluid retention and middle ear infection. OETD may also lead to negative middle ear pressure, followed by a poor healing outcome after tympanoplasty (8,11).

Balloon Eustachian tuboplasty (BET) has recently been introduced as an effective technique for creating ETF (12,13). BET improves ventilation and clearance of the middle ear by dilating the cartilaginous part of the Eustachian tube.

To further elucidate the role of BET in tympanoplasty, we conducted a study to compare the outcomes of

Address correspondence and reprint requests to Hung-Pin Wu, M.D., Ph.D., Department of Otolaryngology- Head and Neck Surgery, Taichung Tzu Chi Hospital, Buddha Tzu Chi Medical Foundation, No. 1, Fengling Rd., Tzu-Der, Taichung City 427, Taiwan (R.O.C.), E-mail: hungpin\_wu@tchz.org.tw.

The authors declare that they had no conflicts of interest (TCMFAR 105-01-01) from Tzu-Chi University.

TCMFAR 105-01-01: Tzu-Chi University Research Project to disclose.

DOI: 10.4097/jmao.0000000000002738

# 耳咽管障礙診斷流程

耳悶塞 耳部症狀

> 3 個月，排除因氣壓改變造成的耳咽管障礙與鼻部問題

疑似阻塞型耳咽管障礙

問卷 >14.5 , 鼓室圖壓力 < -50

疑似開放型耳咽管障礙

1.姿勢改變 2.耳膜震動

-  
充氣-減壓法  
Objective Valsalva  
音響檢查法  
內視鏡  
主動  
被動  
主動

阻塞型

疑似阻塞型

無

+ (1+2)

+ (1/2)

氣流動態檢查法  
Ohta method  
內視鏡

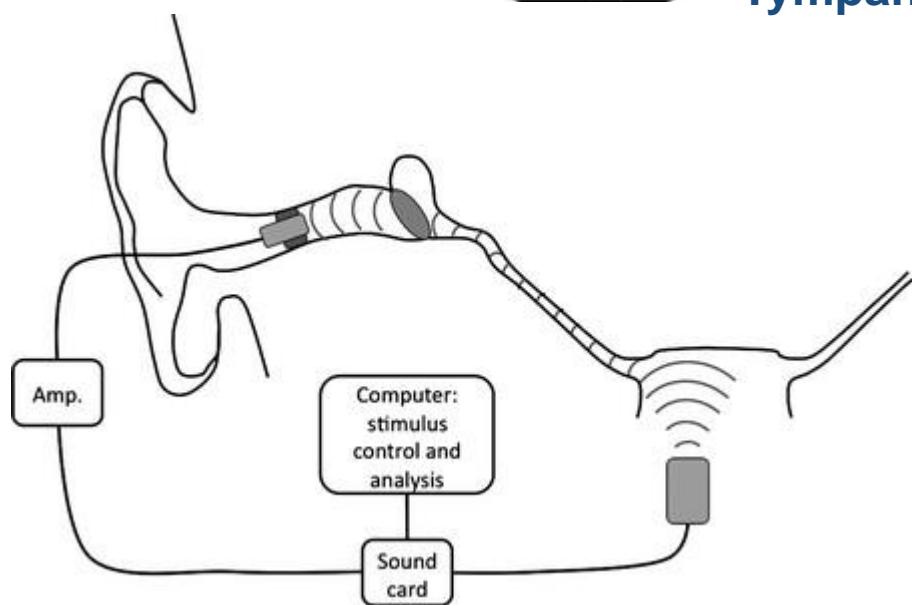
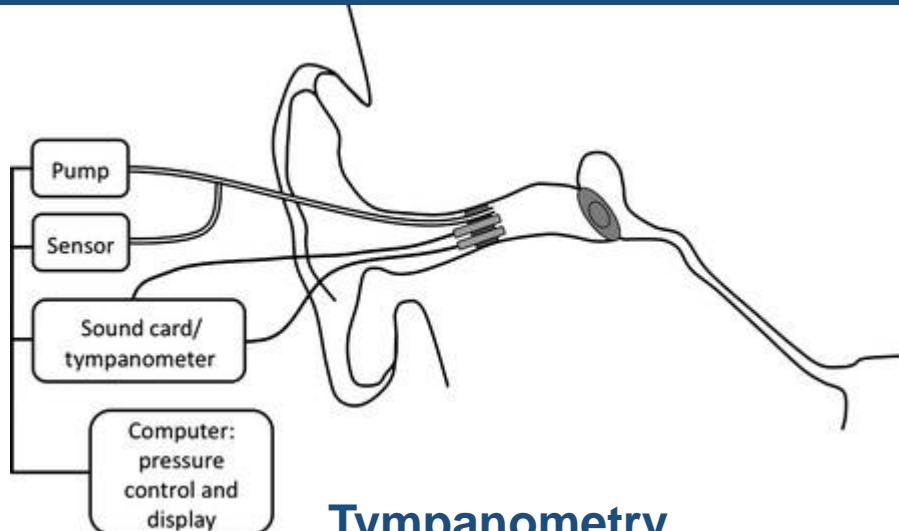
確診開放型

疑似開放型

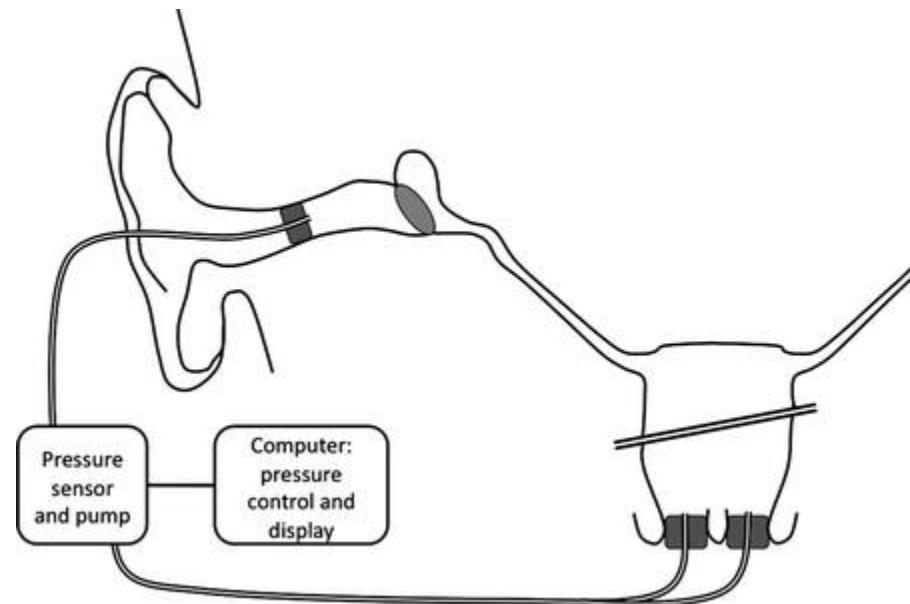
無



# 診斷儀器



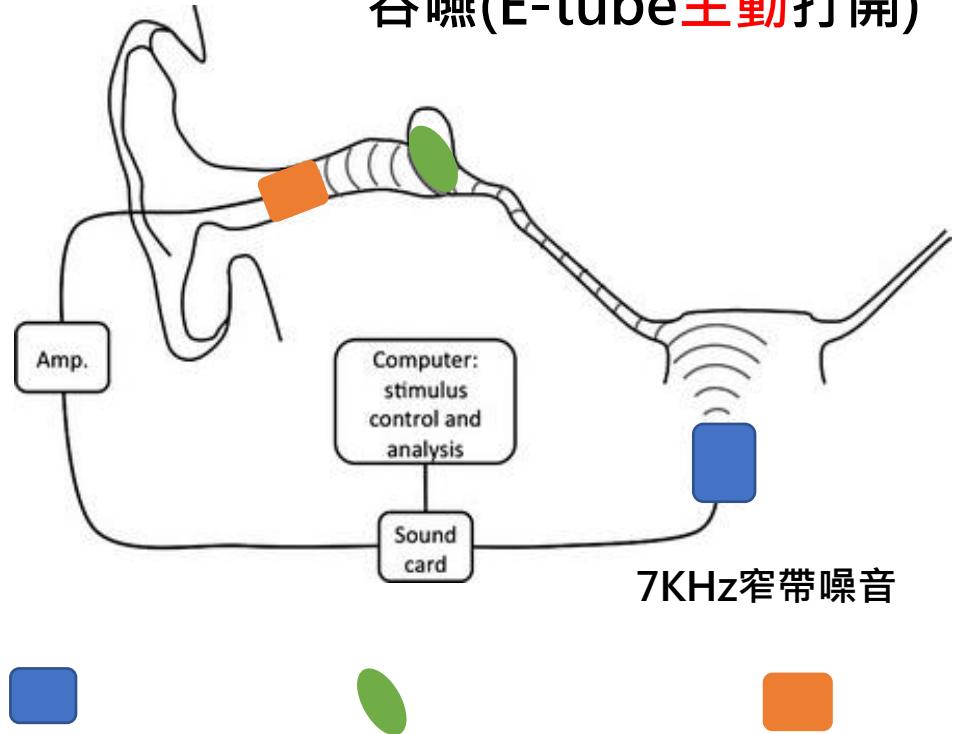
Sonotubometry



Tubomanometry

# Sonotubometry

吞嚥(E-tube主動打開)

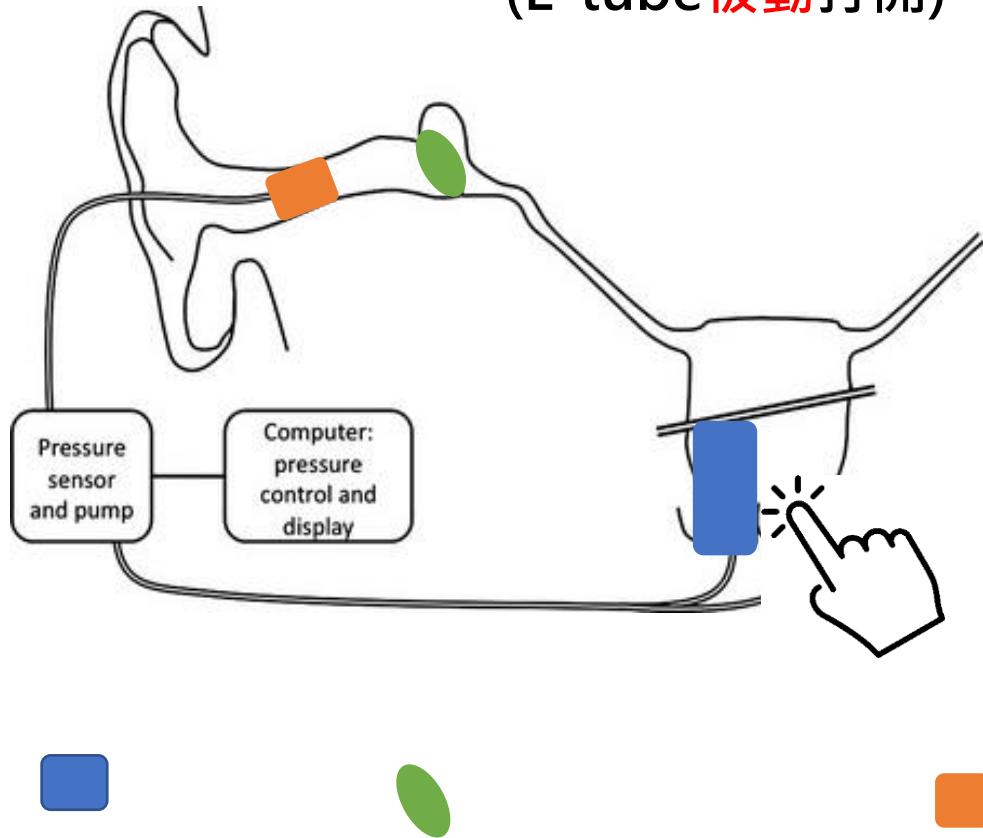


聲音 → 吞嚥 (打開E-tube) → EAC 接收



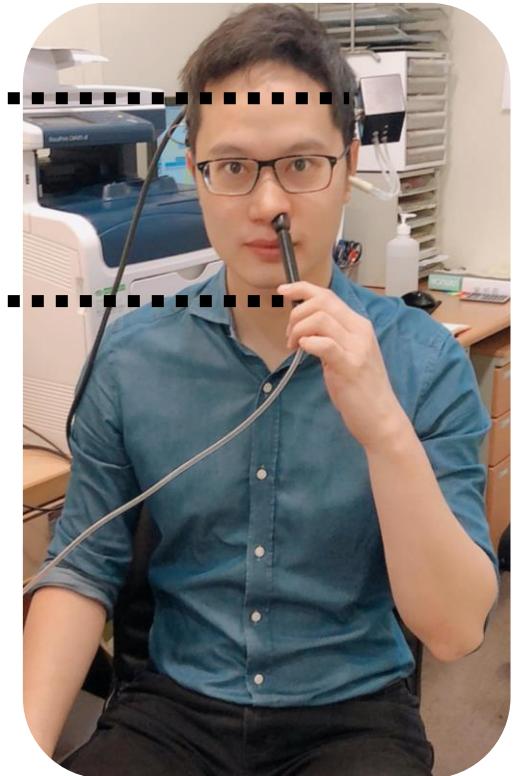
# Tubotympano-aerodynamic graphy (TTAG)

(E-tube 被動打開)



EAC  
pressure

Nasopharynx  
pressure



NP → Valsalva /Heavy Breathing → EAC

# Patulous ETD criteria

**1. Symptoms :** voice / breathing autophony, aural fullness

**2. Tubal obstruction procedures:**

- positional change: sitting/forward bending
- direct closure(Gel)

**3. Objective findings:**

- TM movement
- TTAG: synchronous
- Sonotubometry: 1. <100dB 2. plateau

1+2+3: Definite

1+2 or 1+3: Possible

# Patulous ETD criteria

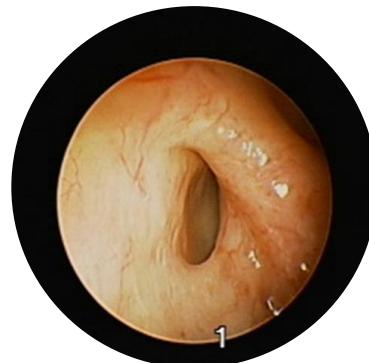
**1. Symptoms :** voice / breathing autophony, aural fullness, Habitual Sniffing

# Patulous ETD criteria

**1. Symptoms :** voice / breathing autophony, aural fullness

**2. Tubal obstruction procedures:**

- positional change: sitting/forward bending
- direct closure(Gel)

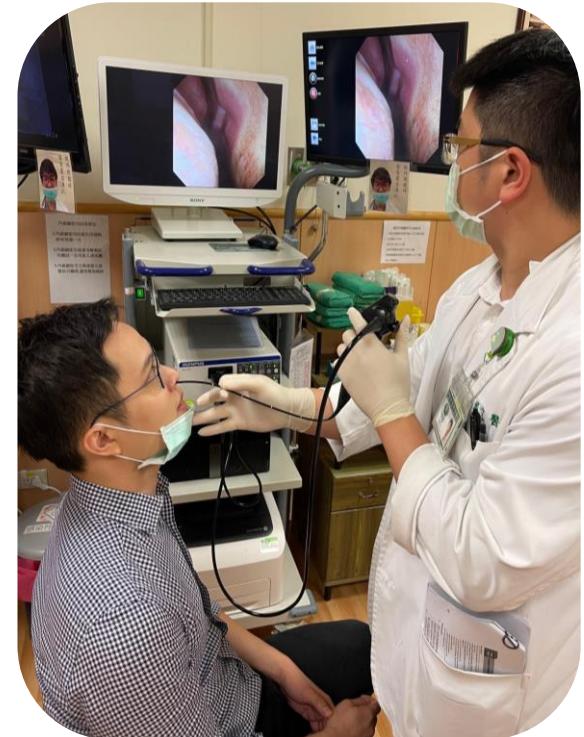


# Patulous ETD criteria

**1. Symptoms :** voice / breathing autophony, aural fullness

**2. Tubal obstruction procedures:**

- positional change: sitting/forward bending
- direct closure(Gel)



# Patulous ETD criteria

## 3. Objective findings:

- TM movement :respiratory fluctuation

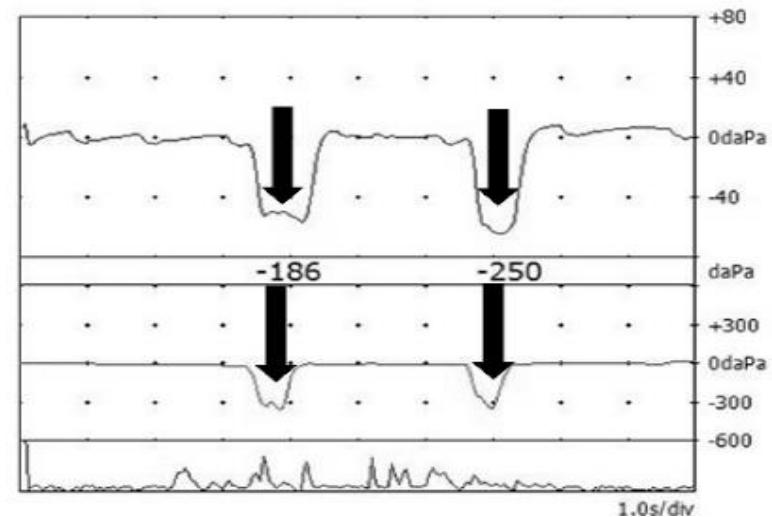
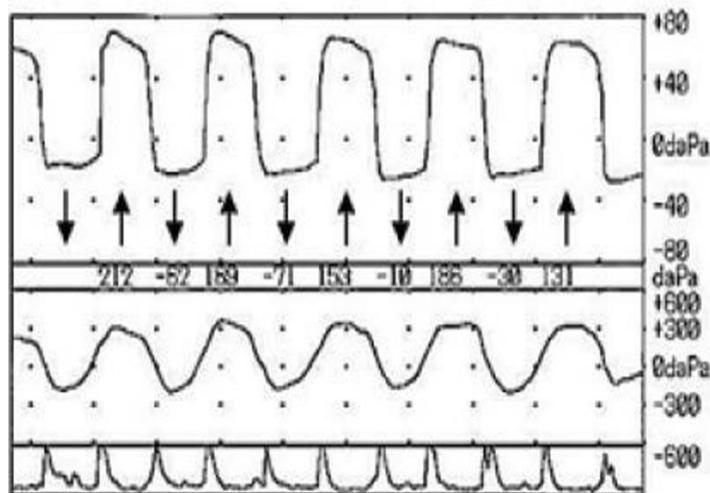




# Patulous ETD criteria

## 3. Objective findings:

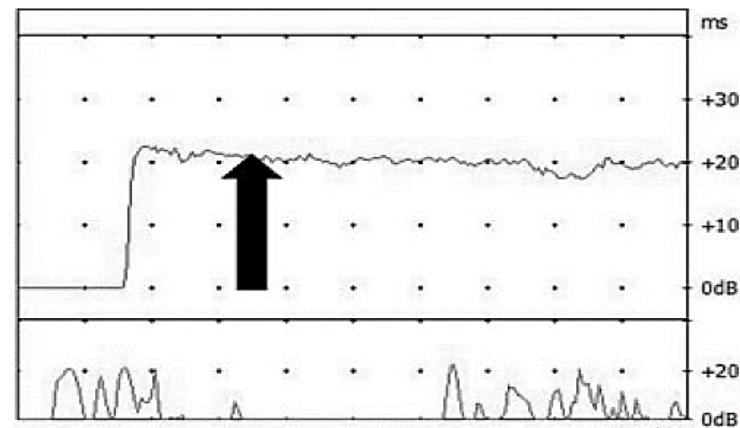
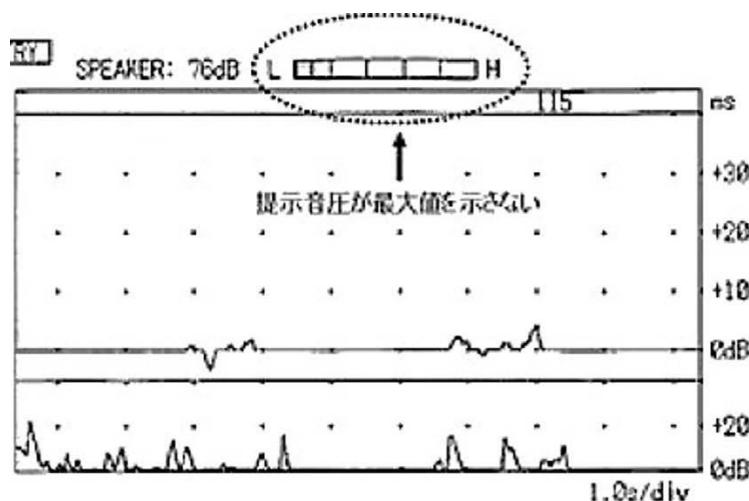
- TM movement
- TTAG: synchronous



# Patulous ETD criteria

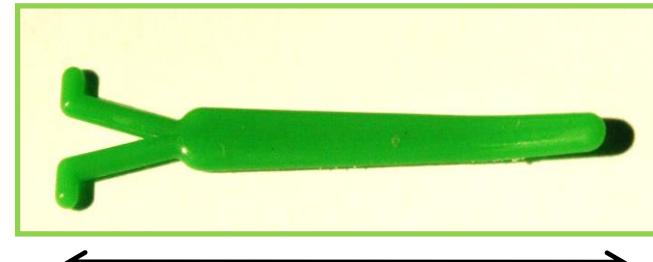
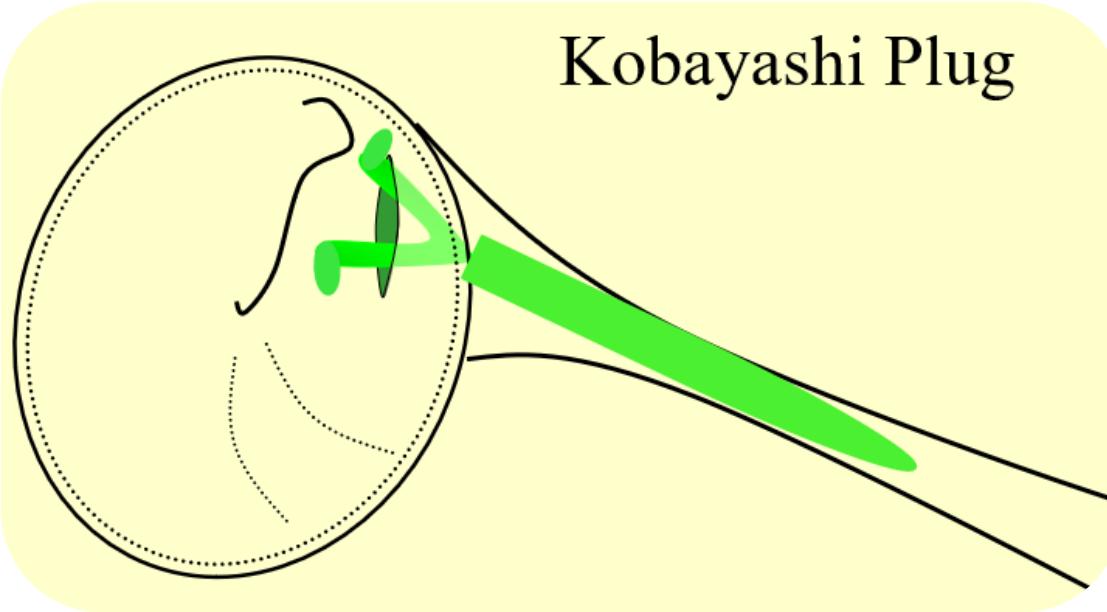
## 3. Objective findings:

- TM movement
- TTAG: synchronous
- Sonotubometry: 1. <100dB 2. plateau



# Patulous ETD treatment

Kobayashi Plug



23mm

E-tube dysfunction



Patulous type

Obstruction type



# Obstructive

# Patulous

# Obstructive

# Patulous

Aural fullness/Muffled/Pressure/Popping

Voice /Breath autophony/Aural fullness

---

# Obstructive

# Patulous

Aural fullness/Muffled/Pressure/Popping

Voice /Breath autophony/Aural fullness

ETDQ-7

PHI-10 , BBK score

過去幾個月, 是否有下列症狀困擾著你	無或輕度		中度			重度	
耳內有壓力感	1	2	3	4	5	6	7
耳內有疼痛感	1	2	3	4	5	6	7
耳內有悶塞感或置身水下之感覺	1	2	3	4	5	6	7
鼻炎或感冒時 耳朵有不適症狀	1	2	3	4	5	6	7
耳內有喀拉聲或水泡破裂聲	1	2	3	4	5	6	7
耳內嗡鳴聲	1	2	3	4	5	6	7
聽力感覺悶脹或含混不清	1	2	3	4	5	6	7

# Obstructive

# Patulous

Aural fullness/Muffled/Pressure/Popping

Voice /Breath autophony/Aural fullness

---

ETDQ-7

PHI-10 , BBK score

---

Valsalva maneuver

Positional change, TM movement

---

# Obstructive

# Patulous

Aural fullness/Muffled/Pressure/Popping

Voice /Breath autophony/Aural fullness

ETDQ-7

PHI-10 , BBK score

Valsalva maneuver

Positional change, TM movement

Inflation-deflation

Tympanogram

Endoscopy (orifice)

Tympanogram

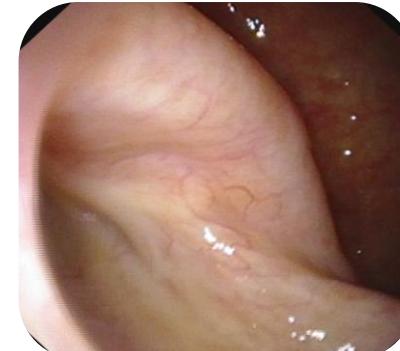
Endoscopy (orifice)

Obstruction test

Sonotubometry: 1. No change 2. < 5 dB

Sonotubometry: 1. <100 dB 2. Plateau

TTAG: synchronous

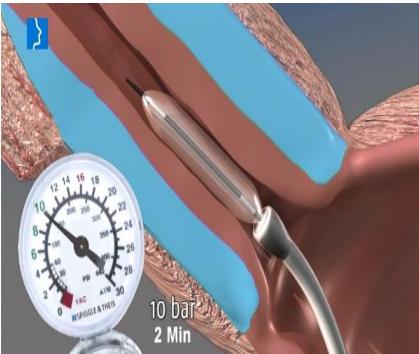


# Treatment

## Obstruction ETD

Balloon dilation tuboplasty

Laser tuboplasty

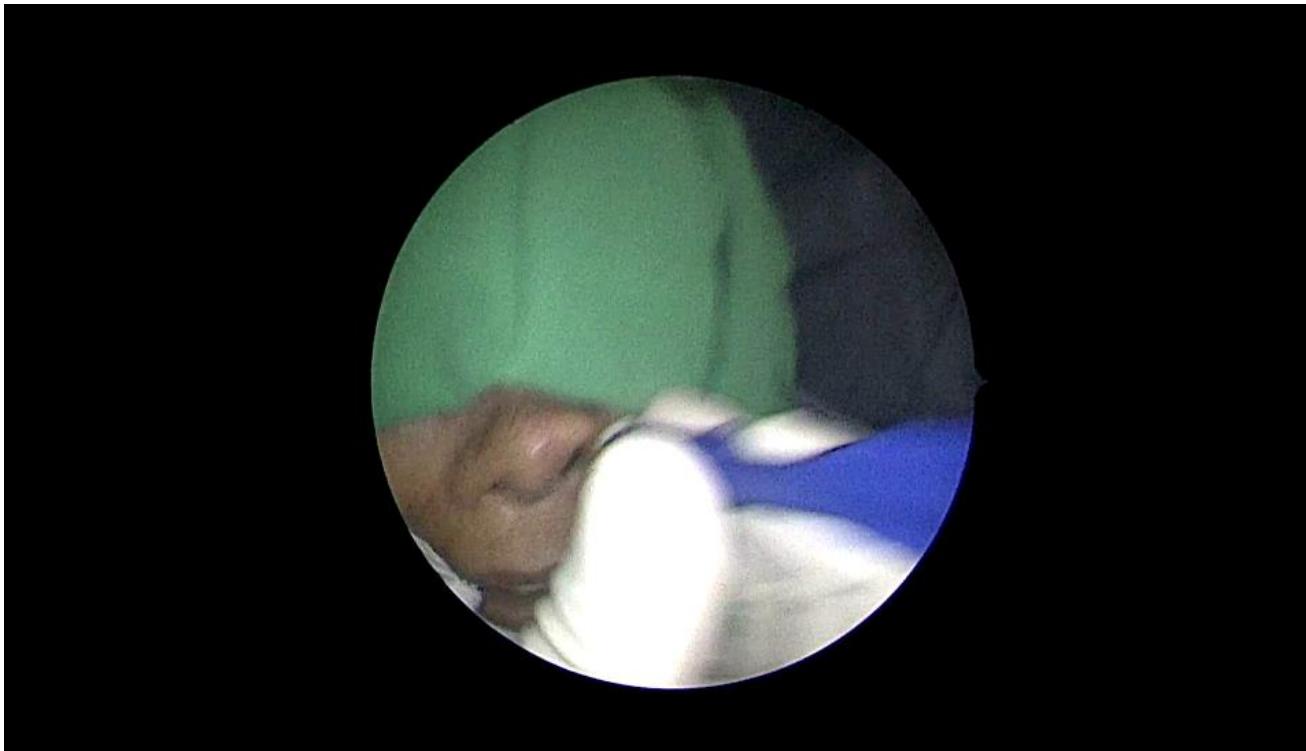


# Treatment

Obstruction ETD

Balloon dilation tuboplasty

Laser tuboplasty

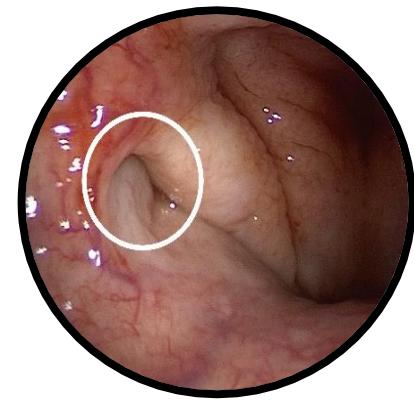


# Treatment

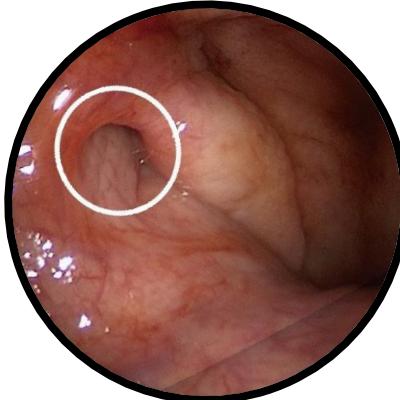
Obstruction ETD

Balloon dilation tuboplasty

Laser tuboplasty



Pre-op



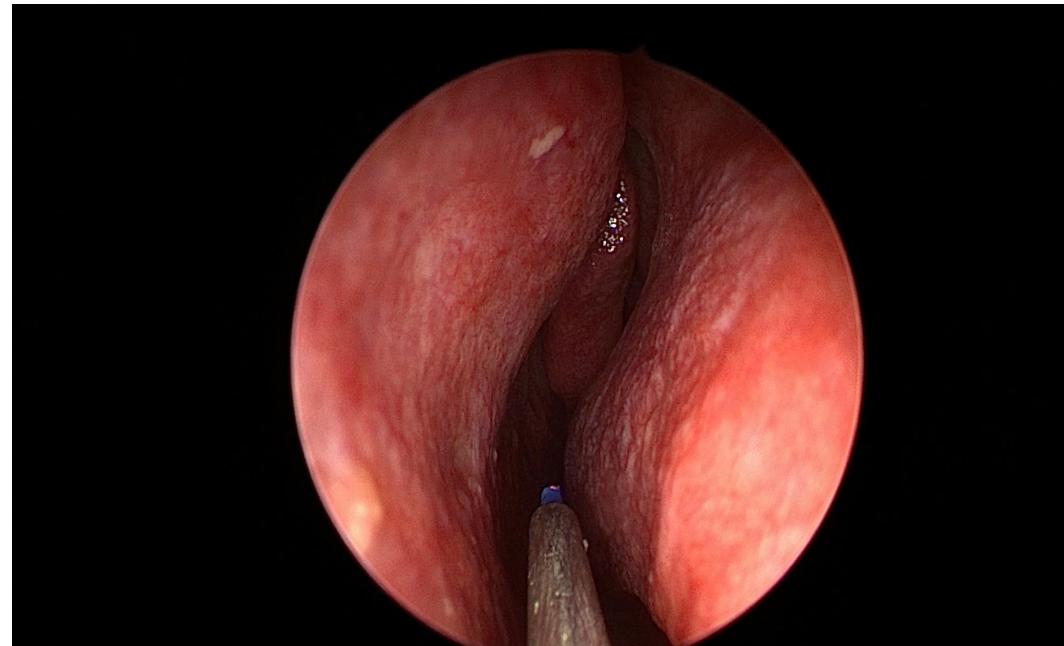
Post-op

# Treatment

Obstruction ETD

Balloon dilation tuboplasty

Laser tuboplasty



# Treatment

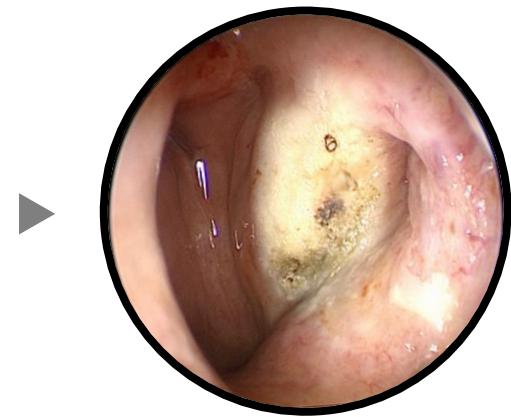
Obstruction ETD

Balloon dilation tuboplasty

Laser tuboplasty



Pre-op



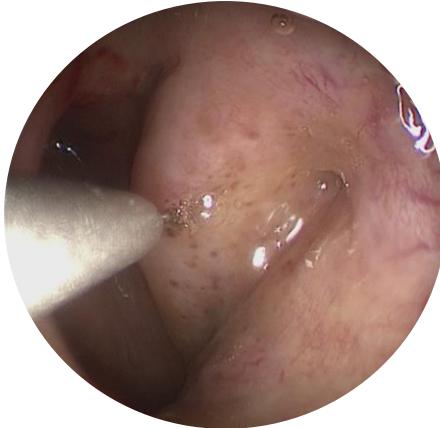
Post-op

# Treatment

Patulous ETD

HA/ fat augmentation

Transcanal cartilage insertion

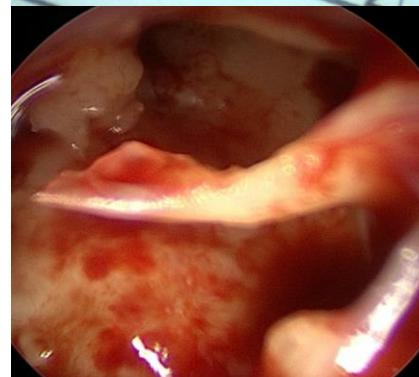


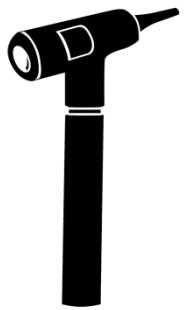
# Treatment

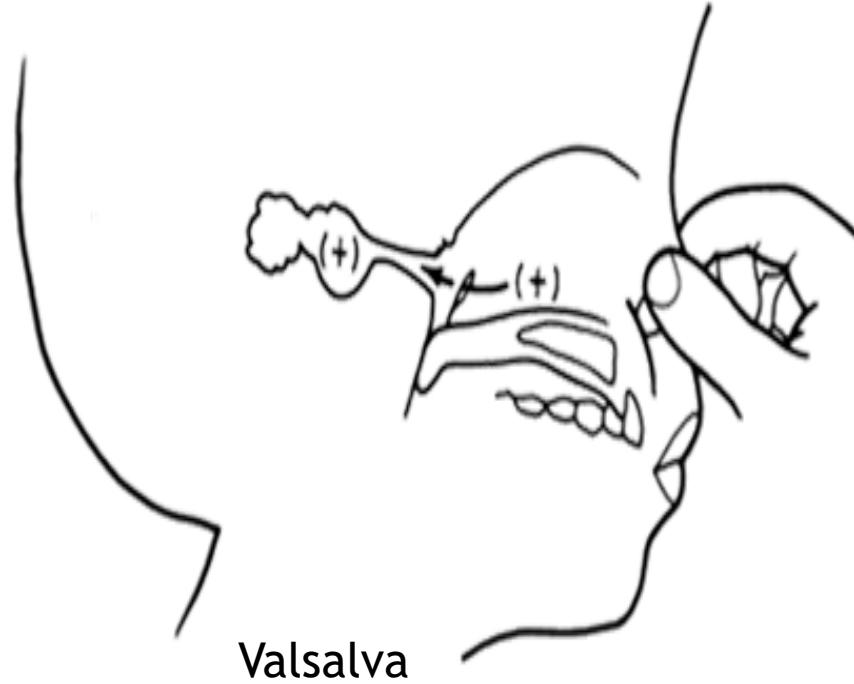
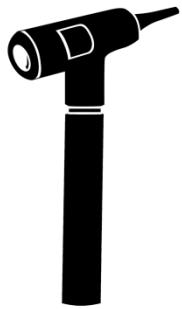
Patulous ETD

HA/ fat augmentation

Transcanal cartilage insertion







## Valsalva test

(+) → Good tympanoplasty outcome

## Toynbee test

→ Patent tube!! ; BUT not an overall normal function

# Tool



2080-2000

**Typ Eicken (45°), steril, 10 Stück/Box, lange Biegung /**  
Type Eicken, sterile, 10 pieces/box, long curve

2080-2070

**Typ 70°, steril, 10 Stück/Box /**  
Type 70°, sterile, 10 pieces/box

2080-2045

**Typ 45°, steril, 10 Stück/Box, kurze Biegung /**  
Type 45°, sterile, 10 pieces/box, short curve

2080-2010

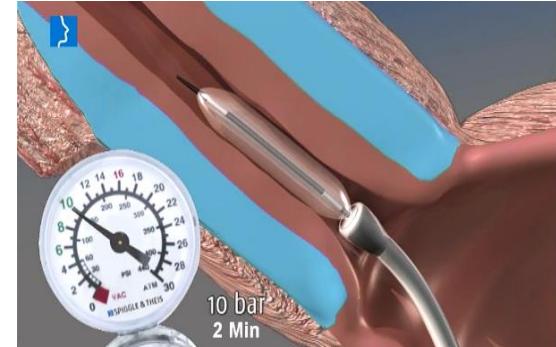
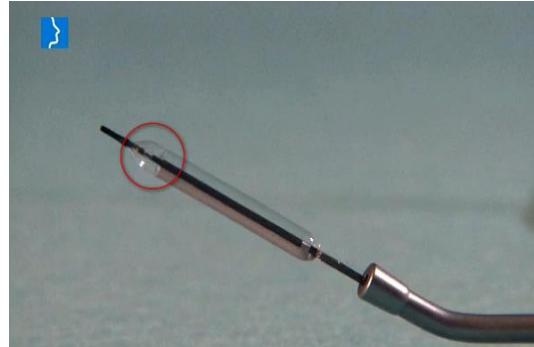
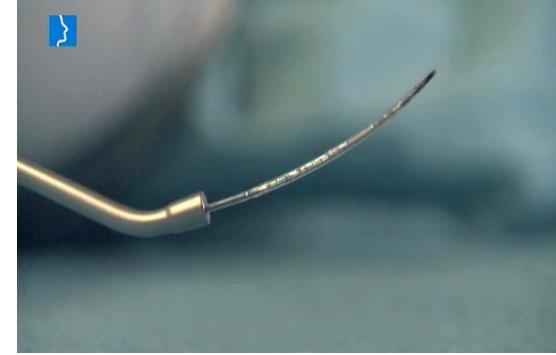
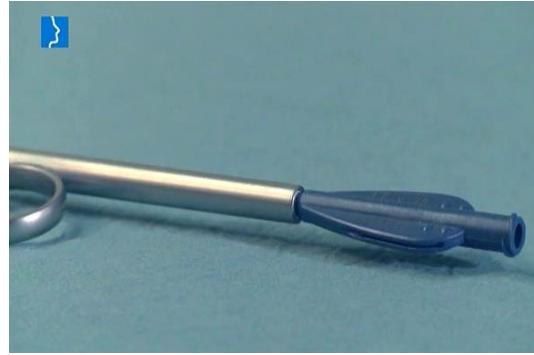
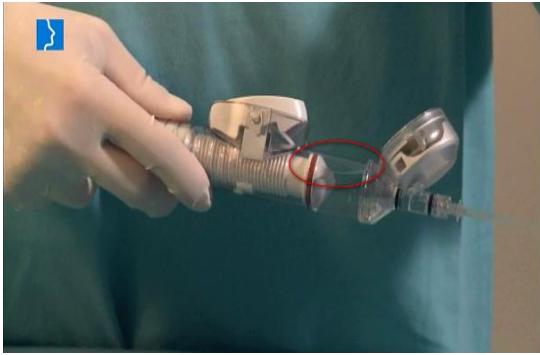
**Typ Ulm (60°), steril, 10 Stück/Box /**  
Type Ulm, sterile, 10 pieces/box

rip, pressure



# Step

- General anesthesia
- Balloon inflated
  - saline to 10 bars for 2 mins
  - 2 cm in length
  - In cartilaginous part of ET



# 治療耳咽管功能障礙新利器



## 耳咽管氣球擴張術

### 耳咽管是什麼？

為連接鼻咽部與中耳之間的構造，其功能有三種

通氣：平衡耳膜內外側的壓力、保護：避免鼻涕逆流或鼻部感染傳至中耳、清除：中耳腔黏膜的分泌物。

### 耳咽管功能障礙的原因。

發炎：最常見的病因為鼻部或耳部的慢性疾病，例如過敏性鼻炎、中耳炎、感冒及鼻竇炎、鼻涕倒流等，均會造成耳咽管開口周圍的黏膜發炎腫脹，進而造成耳咽管功能障礙。

### 有那些症狀呢？

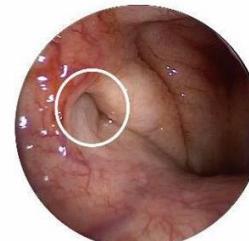
感覺部分 - 耳內有壓力感、悶塞感、疼痛感，或置身水下之感覺。

聲音部分 - 耳內有喀拉聲或嗡鳴聲，聽力感覺悶脹或含混不清。

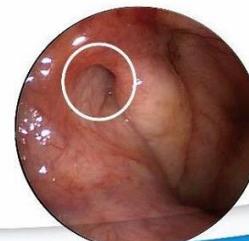
### 新治療 - 氣球擴張術

台中慈濟醫院為全台灣第一間引進最新治療方式 - 耳咽管氣球擴張術。

在內視鏡導引下，將裝有氣球的導管深入耳咽管，給予一定壓力使氣球擴張撐開閉鎖的耳咽管，使其通暢恢復功能。



治療前：耳咽管閉鎖



治療後：耳咽管通暢

耳鼻喉頭頸外科部 關心您