Abstract

We developed new otoendoscope combined with catheter for intra-tympanic injection. In this we tested the endoscope two cadaver temporal bones. The features of the endoscope with catheter is very useful for removing adhesion of RWN, preventing channel clogging to The elliptical shape can effectively captures the field in the light-guided area, resulting in bright, high quality images.

Methods and Materials

This otoendoscope consists of a fiber optic lens (0.6 mm) for viewing and two working channels (1.0 mm and 0.3 mm, respectively), a catheter channel for delivering drugs and a suction channel for removing adhesions. The working length of endoscope is 50 mm.

The diameter of this device is only 2.4 mm x 1.4 mm, which is small enough for use in the inner ear and for approaching the small space around the RWN.

To test this issue, we developed a new otoendoscope device that allows visualization of the RWN, removal of adhesions, and drug delivery.

Introduction

Local intratympanic injection (LITI) of drugs into the inner ear is a very attractive way for delivering therapy in Meniere’s disease and idiopathic sensorineural hearing loss1.

Delivering steroids by LITI is more efficient than systemic injection. Trials have demonstrated that LITI is effective and decreases chances of side effects related to systemic steroid injections2,3. LITI, however, is a blind procedure. When the round window niche (RWN) is covered with fibrous or connective tissue, which occurs in about 20% of cases4, it is impossible for drugs injected by LITI to reach the perilymph of the scala tympani via the round window membrane (RWM). Therefore, if the RWM cannot be visualized, adhesions covering the RWM should be removed first through otoscopy before drugs are delivered. Although drugs have been delivered successfully into the inner ear with the aid of microcatheters or otoscopy devices5 employing a working channel for drug injection, a separate instrument is needed to remove adhesions overlying the RWM. To address this issue, we developed a new otoendoscopy device that allows visualization of the RWN, removal of adhesions, and drug delivery.

Fig.1. Design of New otoendoscope

(A) Side view of the otoendoscope with catheter and needle
(B) The section of this endoscope demonstrated two working channels (W; working channel, *; suction, L; lens).
(C) The tip of the otoendoscope; A catheter (Ca) for angiography is also available for this scope. For inner ear procedures, a 31-gauge needle (N) is inserted into the tip of the catheter. (N: needle, Ca: catheter, E: endoscopy, *: 31 gauge needle)

Results

The small diameter of such devices, however, exposes them to four potential problems:

1. low-quality images,
2. increased chance of channel clogging with drug solution,
3. increased effort in channel cleaning, and
4. increased fragility, all of which we took into account during the development of our improved otoendoscope.

Our otoendoscope for inner ear drug delivery system has the following features:

1. A 31-gauge needle attached to a catheter to remove or perforate RWN mucosal adhesions and to inject drugs (Fig. 1).
2. A catheter threaded inside the channel to deliver drug solutions so liquids never directly contact the working channel, preventing channel clogging.
3. The elliptical shape of our otoendoscope device effectively captures the field in the light-guided area, resulting in bright, high-quality images.

Fig.2. View of the RWN captured with the new otoendoscope

(A) The otoendoscopic view demonstrated tympanic space (I: incus, S: stapes).
(B) Using the otoendoscope, we opened the connective tissue covering the RWN and injected a solution onto the RWN. The needle is indicated by the white arrow.

Conclusions

Our new otoendoscope combined with catheter can be used to evaluate the RWN before a local drug delivery system is put in place, for application of drugs directly onto the surface of the RWN, and to verify the correct placement of an inner ear drug delivery system, ensuring that it is safely in place.

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References