Strategies for the Management of Post-Irradiation Otitis Media with Effusion

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Post-Irradiation Otitis Media With Effusion (OME)

Nasopharyngeal carcinoma (NPC, figure 1) is the most common type of tumor originating in the epithelium of the nasopharynx, the narrow tubular passage that lies above the throat and behind the nose. Compared with other parts of the world, Southeast Asia is hyperendemic to NPC [1]. Indeed, epidemiological evidence has shown that the incidence of NPC is more than 10 times higher in Southeast Asia (including Taiwan, Hong Kong, and Singapore) than in the United States and Western Europe [2-4].

The mainstay of treatment for NPC is definitive radiotherapy. Recent advances in therapeutic techniques (e.g. intensity-modulated radiation therapy) have reduced the number of complications associated with radiation; nonetheless, anatomical complexities often lead to the exposure of non-target organs during head and neck irradiation. For example, these procedures can lead to post-irradiation otologic damage, the most common of which is OME (Figure 2).

Many post-irradiation NPC patients suffer from frequent recurrence of OME, which can result in conductive hearing impairment, ear discomfort, muffled, tinnitus, and vertigo. These structural and functional impairments can cause considerable stress among NPC patients, and adversely affect their quality of life. For example, the psychological burden of this condition often renders patients socially withdrawn and leads to the development of depressive disorders. These aspects emphasize the importance of raising awareness about the need for clinicians to evaluate the effectiveness of management strategies for post-irradiation OME.

Conventional Management Options and Limited Therapeutic Effects

Despite the afore-mentioned consequences of post-irradiation OME for NPC patients, complete or even slightly effective treatments remain unavailable. This situation often results in a conflict between clinicians and patients regarding the most appropriate OME management strategy. Many patients prefer aggressive therapy for immediate relief of symptoms, and other individuals measure the success of treatment according to degree to which OME is resolved.

Clinicians often adopt a conservative approach in the management of post-irradiated OME, such as observation or the introduction of hearing aids. For patients with intractable otologic symptoms, the relief of palliative symptoms is widely regarded as the main goal of treatment. Treatments of choice for post-irradiation OME include simple tympanic aspiration, incisional myringotomy, and ventilation tube insertion (VTI) [5]. However, the effects of simple tympanic aspiration and incisional myringotomy over short durations of 1-2 days are largely non-meaningful due to the high recurrence rate of OME [6-8]. Thus, some clinicians view VTI as the most viable treatment modality. Nevertheless, VTI can have several adverse effects, such as secondary acquired cholesteatoma or infectious otorrhea (incidence rate of 29% to 64%), which is the most common complication following tube placement and is often refractory to local or medical treatment [5,8-11]. In summary, no effective strategies for the management of otologic symptoms based on conventional approaches have been developed.

Revolutionary Therapeutic Concept: Treatment Rather than Cure

Given the complex processes involved in the development of...
OME in post-irradiated NPC patients, the pathogenesis of post-irradiation OME differs considerably from that of non-radiation related OME. Non-radiation induced OME (e.g. OME induced by an infection in the upper respiratory tract) is commonly caused by temporary dysfunction of the Eustachian tube with regard to ventilation, and can usually be "cured" using conventional treatments [12,13]. In contrast, the generally acknowledged etiologies of post-irradiation OME are associated with direct and irreversible radiation-induced damage to the Eustachian tube, including scarring of the tubal opening, poor mucociliary function, and fibrosis of tube-associated muscles. One critical but frequently ignored cause is radiation-compromised inflammation of the middle ear. Nonetheless, tumors also pose a threat to the integrity of the Eustachian tube prior to radiation therapy.

To date, researchers have been frustrated in the development of treatment schemes to overcome the otologic problems associated with radiotherapy in NPC patients. This underlines the need to re-think therapeutic strategies for the treatment of OME in post-irradiated NPC patients so that they are based on clinical practice and the etiology of the disease. To this end, the authors propose a revolutionary therapeutic concept to deal with post-irradiation OME [8], namely "treatment, rather than cure" Our research indicates that patients with post-irradiation OME should be treated as though they had a chronic disease, such as hypertension, hyperlipidemia, or diabetes mellitus. Well-intentioned attempts to cure post-irradiation OME are based on unrealistic expectations, considering the high recurrence rate of OME and the fact that the tumor-related destruction and radiation-induced injuries of the Eustachian tube are irreversible.

**Novel Management Strategy: LMIS**

In clinical practice, patients often hold overly optimistic expectations regarding the chances of therapeutic success. A realistic understanding of disease prognosis can help to reduce patients’ dissatisfaction following treatment. Thus, the proposed modality of “treatment instead of cure” could potentially be quite valuable for patients. Based on this approach, we have developed a novel strategy for managing post-irradiation OME which involves laser myringotomy followed by intratympanic injections of steroids (LMIS). These techniques are described in proceeding paragraphs.

Topical anesthetic (10% Lidocaine for 15 minutes) is first administered to the eardrum. A CO2 Flash scanner laser (OtoLAM, power output of 15 watts, spot size 1.9 mm, single pulse, and duration 0.2 seconds) is then used to perform circular laser myringotomy in the lower anterior or lower posterior quadrant of the eardrum (Figure 3). Middle ear fluid is cultured and then suctioned away and a steroid (0.5 ml dexamethasone, 5 mg/ml) is injected through the myringotomy into the middle ear (Figure 4). The affected ear is positioned so that the steroid remains in the same place for 30 min. Intratympanic steroid injections are repeated once a week for three consecutive weeks.

LMIS is meant to ventilate the middle ear and treat radiation-compromised inflammation. Administering a topical steroid to restore immune function and repair the epithelium of middle ear mucosa is a relatively safe and simple intervention. The administration of topical steroids can also delay healing of eardrum perforations, and prolonging dry perforations to the eardrum can allow for immediate and sustained relief of otologic symptoms (Figure 5, 6).

![Figure 3: Laser myringotomy](image1)

![Figure 4: Intratympanic steroid injection](image2)

![Figure 5: Post-LMIS dry perforation of the eardrum](image3)

![Figure 6: Post-LMIS dry perforation of the eardrum](image4)
We previously published research on LMIS in 44 ears of 27 NPC patients with post-irradiation OME [6]. The mean follow-up period was 37 weeks. We observed that the use of LMIS for the artificial creation of ventilation can last up to 6.5 weeks (range 1-24 weeks). The duration for transtympanic ventilation is much longer in patients with LMIS compared with those with simple tympanic aspiration and incisional myringotomy (1-2 days) [6,7,11]. In fact, a three-week period is regarded as the shortest time adequate for transtympanic ventilation [8,14,15].

Of the 44 ears, 23 (52.3%) had persistent eardrum perforation, 18 (40.9%) had recurrent OME, and 3 (6.0%) were disease-free. In our research, the recurrence rate of OME following LMIS was 41%, which is far lower than that of the conventional treatments reported in previously published studies (77.8%-88.9%) [5,8,14,16]. In addition, our research showed no evidence of severe complications that are commonly observed following tube placement and are often refractory to local or medical treatment, such as secondary acquired cholesteatoma and infectious otorrhea (incidence rate of 29% to 64%) [5,8,11]. The utility of LMIS is augmented by the fact that it is a quick, minimally-invasive, office-based technique, which allows for repeated procedures with minimal patient suffering.

**Conclusion**

No existing treatment scheme is capable of overcoming the otologic problems associated with radiotherapy in the treatment of NPC patients. “Treatment, rather than to cure” is a novel therapeutic approach to dealing with post-irradiation OME in NPC patients. LMIS is an effective management strategy based on this approach, which is capable of producing a longer-lasting dry perforation of the eardrum with the aim of sustaining relief from symptoms.

**References**


