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# Application of high resolution computer tomography in external ear canal cholesteatoma diagnosis

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## Abstract

**Objective:** To evaluate High Resolution Computer Tomography (HRCT) in the diagnosis of external ear canal cholesteatoma.

**Methods:** In this retrospective study, HRCTs of 27 patients with external ear canal cholesteatoma were reviewed. The changes in the external ear canal, tympanic membrane (TM), scutum, tympanum and mastoid were measured and categorized.

**Results:** Fourteen patients showed no or mild destruction in the external ear canal (stage I group). Eight patients had obvious enlargement in the external ear canal (stage II group) but showed limited destructions of the mastoid bone and no damage of the tympanums. Five patients had serious destruction of the mastoid bone and damage of the tympanum (stage III group). All patients in the stage III group showed a compression of manubriums and TMs, with 3 having damages on ossicular chain. Bone destruction of the vertical section of facial nerve canal was discovered in one case in the stage III group.

**Conclusion:** HRCT can provide detail information about the extent of external ear canal cholesteatoma. Such information can be used to identify special situations with serious complications and to differentiate external ear canal cholesteatoma from middle ear cholesteatoma.

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**Keywords:** External ear canal; Cholesteatoma; Computer tomography

External ear canal cholesteatoma (EECC), also known as obstructive keratosis, has an incident rate of 0.1% worldwide (Anthony and Anthony, 1982). In China, the incident rate of EECC is much higher because Chinese has relatively longer and narrower external ear canal than European or American. EECC usually occurs in adults with equal incident rates for both men and women. Single-ear involvement is more common (Xie et al., 2010; Xue, 2009). Since this disease is destructive and can invade the middle ear causing hearing damages, external ear canal cholesteatoma is easily confused with middle ear cholesteatoma during clinical diagnosis. High-Resolution Computer Tomography (HRCT) offers structure

images with high resolution and accurate anatomical positioning. It can provide important image information of external ear canal cholesteatoma for accurate diagnosis, better choice of surgical approach, and better prognostic assessment. In this study, we reviewed the HRCT image features of external ear canal cholesteatoma for patients treated at our hospital over the past a few years.

## 1. Materials and methods

### 1.1. Clinical data

Twenty-seven patients with external ear canal cholesteatoma who were treated at the 3rd affiliated hospital of Sun Yat-Sen University during the period between March 2008 and March 2011 were retrospectively evaluated in this report. The diagnosis of all cases was confirmed by pathology after

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surgery. Among those 27 cases, 10 were males and 17 were females, with the age ranging from 21 to 45 years and the median age of 36.4 years. The duration of disease was 1–5 years.

### 1.2. CT examination

CT 320 from Toshiba in Japan was used. Tube voltage was set at 135 kv, tube current was set at 350 mA and the slice thickness was 0.5 mm. The scanned images were sent directly to the workstation for multi-planar reconstruction and three-dimensional reconstruction.

### 1.3. Clinical classification

According to Holt staging (Holt, 1992), there are three stages for external ear canal cholesteatoma progression. Stage I is characterized by local pit in the external ear canal bone, but stage I has no or mild expansion and no destruction in tympanic membrane. Stage II is characterized by local pouch formation in external ear canal, with significant expansion and severe destruction in bone quality. Stage III is characterized by cholesteatoma in the mastoid and epitympanic cavity.

## 2. Results

Soft tissue density lesions in external ear canal presented in all cases. Clinical diagnosis showed that the canal was filled with keratin debris and surrounded by granulation tissue. CT value of the lesions was  $68.9 \pm 13.4$  HU. Among the 27 cases, 14 were at stage I with normal or mild destruction in external ear canal bone (as shown in Fig. 1). Patients at this early stage mainly experienced ear fullness, occlusion or slight hearing loss. Eight patients were at stage II with the external ear canal expanding significantly and showing flask-like shape. No destruction in epitympanic cavity presented in patients at stage

II (as shown in Fig. 2). Patients at this stage complained a mild to severe pain and otorrhea, as well as occlusion and hearing loss. Five patients were at Stage III with the development of epitympanic cavity. Manubrium mallei and tympanic membrane of all 5 patients were pressed and moved inward. Ossicular chains in 3 of them were damaged. Patients at this stage encountered more obvious otorrhea and hearing loss. Bone destruction of facial nerve vertical section was discovered in 1 case (as shown in Figs. 3 and 4) who fortunately survived a facial paralysis.

All patients were treated with debris aspirations under otoendoscopy. Topical antibiotic/steroid was applied to treat the granulation tissues and infections of the canal wall. All

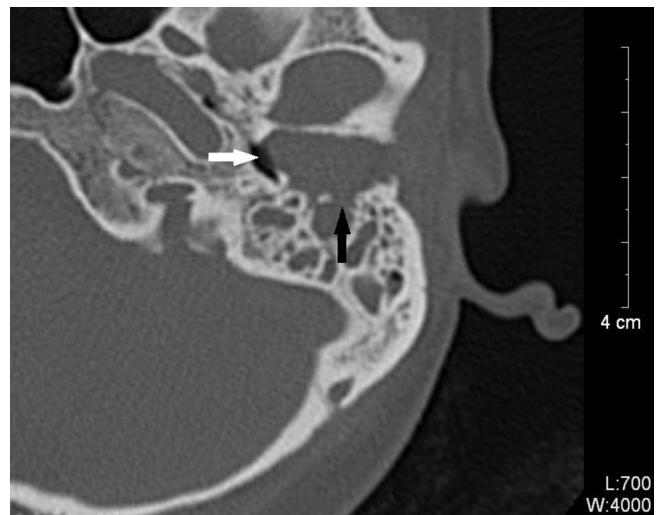


Fig. 2. (Axial scanning) Anterior wall of left mastoid was destroyed (black arrow), while tympanic cavity was still normal (white arrow).



Fig. 3. (Coronal view) Inward movement of tympanic membrane and ossicular chain in the left ear. A narrow gas chamber was still visible between the tympanic membrane and the intratympanic wall (white arrow). The external wall of epitympanic cavity and the inner wall of the ear canal were destroyed (black arrow).

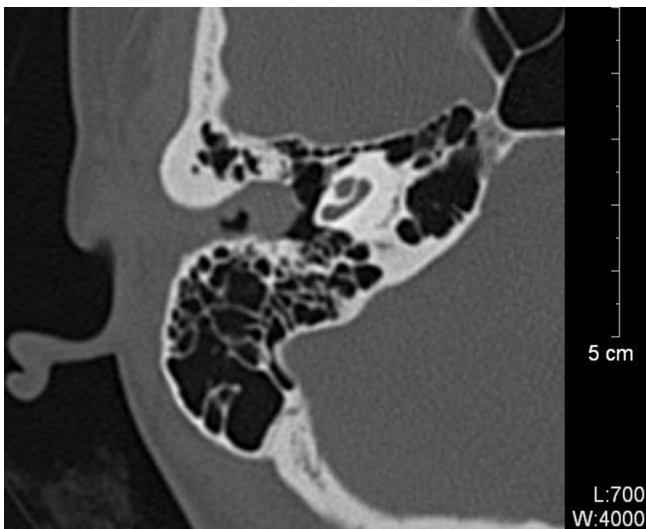


Fig. 1. (Axial scanning) The right external acoustic meatus showed mild enlargement. The edge was smooth.

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