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Can bone wax cause cholesterol granuloma in the petrous apex? A case report

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ABSTRACT

BACKGROUND: Cholesterol granuloma (CG) is a rare entity but is the commonest lesion in the petrous apex. They are associated with chronic ear disease and previous temporal bone surgery. While bone wax has been known to cause foreign body reaction due to its non-resorbable property in the mastoid, it has not been documented to cause CG formation.

CASE PRESENTATION: We described a 43 years old male who presented with a right mastoid swelling, nine years after a right retro-sigmoid craniotomy and excision for a cerebellopontine angle meningioma. He also had multiple cranial neuropathies involving trigeminal, facial and vestibulocochlear nerves. Temporal bone CT and MRI showed features suggestive of cholesterol granuloma with extensive bony erosions. He was treated with surgical excision and drainage where bone wax residues were found intra-operatively. Histopathological analysis of the lesion confirmed the diagnosis of cholesterol granuloma. Post-operatively, the mastoid swelling resolved and his recovery was uneventful.

CONCLUSION: Our case showed that CG could manifest as a complication of bone wax usage in a neuro-surgical procedure. Even though further study is needed to draw a definitive conclusion on this theory, we believe this paper will contribute to the current literature as it is the only reported case of cholesterol granuloma with bone wax as the possible causative agent. This is important so that surgeons are aware of this potential complication and use this haemostatic agent more judiciously.

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1. Introduction

Cholesterol granuloma (CG) is described as a cystic, slow growing and benign mass with blue-brown contents comprised of anaerobic breakdown products of red blood cells, which liberate cholesterol, inciting foreign body granulomatous reaction [1]. The on-going sterile inflammatory process can cause expansion of cyst and surrounding bony erosion. Bone wax has been known to cause foreign body reaction due to its non-resorbable property [2]. There have been a few reported cases of CG caused by previous temporal bone surgery [3,4]. We describe a case of CG (in line with the SCARE 2018 criteria [5]) that developed possibly as a result of bone wax usage from a previous neurosurgical procedure.

2. Case presentation

A 43-year-old man presented with a 5 years history of right-sided mastoid swelling that slowly increased in size, causing

intermittent pain. He also complained of a pre-existing right-sided facial weakness and numbness, hearing loss and tinnitus. There were no other associated otological symptoms. This patient had a right-sided cerebellopontine angle (CPA) meningioma nine years prior to this where he initially presented with a right-sided facial palsy and a right profound sensorineural hearing loss. He underwent right retro-sigmoid craniotomy and complete excision of the tumour under the neurosurgeons in the same year with no improvement in facial weakness and hearing post-operatively. Bone wax was used intra-operatively for haemostasis.

On physical examination, there was a diffuse, hard swelling over the right mastoid measuring 3 × 3 cm with no overlying skin changes, warmth or tenderness. Otoscopic examination revealed a bluish swelling over the right posterior ear canal wall with transmitted pulsation. Patient also had reduced sensation over the right trigeminal region and a pre-existing right lower motor neuron facial palsy (House Brackmann grade V) (unchanged since before the meningioma surgery). Other ENT and cranial nerve examinations were normal.

Pure tone audiometry showed a profound right-sided hearing loss (present since before the meningioma surgery) with normal hearing on the left side. High resolution computed tomography

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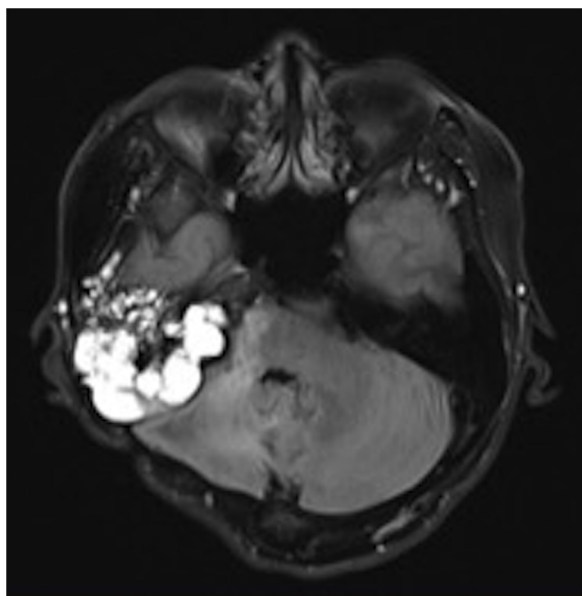


Fig. 1. Axial view of the MRI (T1-weighted with Gadolinium contrast) showing multi-lobulated cystic lesions occupying the right mastoid air cells, middle ear, inner ear, internal auditory canal and petrous apex.

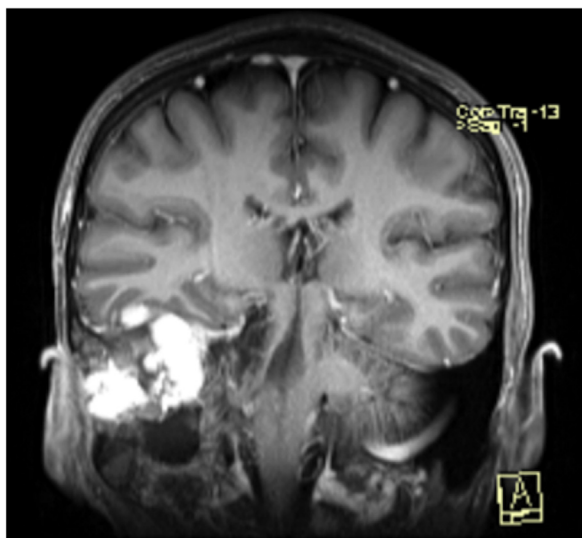


Fig. 2. Coronal view of the MRI (T1-weighted with Gadolinium contrast) showing an encapsulated cystic mass compression the right temporal lobe and cerebellum.

(HRCT) scan of the temporal bone showed a soft tissue density with peripheral enhancement within the right posterior mastoid air cells, middle and inner ear cavity, petrous apex and CPA region. There were associated lytic destruction involving the mastoid air cells, jugular foramen, internal auditory canal, carotid canal, part of clivus, petrous bone and labyrinth. Magnetic resonance imaging (MRI) (T1W and T2W sequences with restricted diffusion) showed a hyper intense lobulated lesion involving the petrous bone and CPA (Figs. 1 and 2). The right internal auditory canal was deformed with invasion of the facial, vestibulocochlear and trigeminal nerve. These findings were suggestive of petrous apex cholesterol granuloma with local bony destruction.

The patient was treated with surgical excision of the cholesterol granuloma via a transmastoid, infra-labyrinthine, pre-sigmoid approach. Intra-operatively, a 2 × 5 cm multi-lobulated brownish cystic lesion were found in the petrous apex with extensive bony erosion of the middle ear structures including mastoid, ossicles,

labyrinth and facial canal. Remnant of bone wax was also found intra-operatively around the petrous apex. The cholesterol granuloma sac was opened up and the entire lesion was resected off the underlying structures with ease with minimal bleeding.

Post-operatively, patient made good uneventful recovery. Histopathological analysis of the petrous apex lesion confirmed the diagnosis of cholesterol granuloma whereby cholesterol crystal clefts, multinucleated giant cells, hemosiderin and red blood cells were identified. Patient has not had any further mastoid swelling or new craniopathies at 6 months follow-up.

3. Discussion

Cholesterol granuloma (CG) is the commonest lesion arising from the petrous apex (PA) [6]. The classic pathogenesis entails resorption of trapped gas due to obstruction and impaired ventilation of PA cells outflow tracts [7]. The vacuum created trigger bleeding and transudation of blood [7,8]. This is followed by anaerobic breakdown of red blood cells, which release cholesterol causing foreign body granulomatous reaction [1]. Jackler and Cho [9] described a new hypothesis where over-pneumatization of PA causes coaptation of mucosa lined PA cell tracts and vascularized marrow. The resultant exposed marrow with tendency to bleed lead to chronic inflammation as the blood is metabolized [9].

Bone wax used nowadays constituted of sterile mixture of beeswax, isopropyl palmitate and paraffin [2]. It is employed as a hemostatic agent by applying tamponade on cancellous bony surfaces and intra-osseous vascular canals. Due to its relatively inert and non-absorbable properties, its use has been associated with complications. There were reported cases of foreign body reaction and granuloma formation as a result of bone wax usage in various sites such as the orbit, foot, mastoid, nasal cavity, cranial defects and cerebellopontine angle [2]. Each had its implications, some necessitated re-exploration. Experimental studies have shown that bone wax impair bacterial clearance in cancellous bone, increasing risk of infection [10]. It is also known to delay wound healing and hinder osteogenesis consequent to foreign body granulomatous reaction [11]. Cases of bone wax migration into sigmoid sinus with ensuing thrombosis and embolization have also been described [12,13]. Chun et al. [14] also reported a patient with saphenous graft thrombosis as a result of foreign body reaction. The granulomatous reactions were postulated due to intrinsic immunohypersensitivity towards bone wax especially in patients with multiple allergies [15].

A few reports of cholesterol granuloma development years after temporal bone surgery have also been illustrated in the literature [3,4]. In our case, we suspect the cholesterol granuloma has developed in the petrous apex as a result of bone wax usage from previous craniotomy procedure, considering that we found remnants of bone wax in the area intra-operatively. We believe that chronic foreign body reaction and granuloma induced by the bone wax caused an obstruction to the ventilation of petrous apex cells, which triggered the cascade of cholesterol granuloma formation as described above.

Management of CG is contentious depending on the extent of disease and hearing level. Most authors have described surgical drainage and resection for their patients with good results without much complication or recurrence [16–18]. Alternatively, a wait and scan anticipant approach can also be considered since most lesions stay inactive after diagnosis and this should be weighed against the potential risk of surgical management [18]. In our patient, we opted for surgical resection, as the CG was extensive, violating beyond the PA causing neurological deficits and hearing loss. It also breached the right carotid canal and caused compression of the temporal lobe.

Castillo et al. [19] documented that as many as 44% of patients experienced no resolution of symptoms post-operatively. Similarly, Stevens et al. [20] showed that none of his patients had recovery of hearing loss and tinnitus post-drainage, possibly due to the relatively more vulnerable inner ear structures and vestibulocochlear nerve. Our patient did not show any noticeable improvement in terms of craniopathies and hearing loss either after the operation. Therefore, it is important to address patients' realistic expectations pre-operatively regarding their post-operative symptoms resolution.

There is limitation to our report as it is a case study without any prior evidence in the literature describing bone wax causing cholesterol granuloma. Therefore, further study is needed before drawing definitive conclusions.

4. Conclusion

Numerous articles have cautioned against the indiscriminate use of bone wax due to its potential reactions. Even though further study is required to draw a definitive conclusion on this theory, we believe our paper will contribute to the current literature as it is the only reported case of cholesterol granuloma possibly caused by bone wax usage from previous neurosurgical procedure. This is important so that surgeons are aware of this potential complication and use this haemostatic agent more judiciously.

Declaration of Competing Interest

None.

Funding

None.

Ethical approval

This is a retrospective case report that does not require ethical approval from the ethics committee as there are no patient interventions and patient's privacy is protected.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request

Author contribution

Chee Chean Lim: Methodology, Writing - Original draft preparation.

Eugene Hung Chih Wong: Writing - Original draft preparation, Writing - Reviewing and Editing.

Cheng Ai Ong: Supervision, Reviewing.

Prepageran Narayanan: Supervision, Reviewing.

Registration of research studies

NA.

Guarantor

This is a retrospective case report. The primary author (Dr Eugene Wong) takes full responsibility for the work.

Provenance and peer review

Not commissioned, externally peer reviewed.

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