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Clinical, ultrasonographic and histopathological diagnosis of ceruminous gland tumors in cats

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Abstract

Ceruminous gland tumor is the most common tumor of the ear canal in cats. Otoscopic examination of the ear tumor is so difficult due to narrowing of the external ear canal. The present study aimed to investigate clinical, ultrasonographic and histopathological characteristics of feline ceruminous gland neoplasm in cats. Ten cats with unilateral ear canal swelling were subjected to thorough physical and clinical investigations. Ultrasound of the ear canal and parotid gland was performed using 8.00 MHz linear probe. Tissue specimens were collected after surgical excision (total ear canal ablation) for histopathological examination. Clinical examination of the ceruminous tumors revealed firm pinkish mass obliterated the ear canal with purulent or bloody aural discharge. Ultrasound examination of the ear tumor was helpful in detecting the size, shape, echogenicity and extension of the tumors to the surrounding structures as well as the nature of the feline ceruminous tumor. Histopathological examination was the main diagnostic tool for detecting the nature of the ceruminous neoplasms.

Introduction

Ceruminous glands are modified apocrine sweat glands located in the dermis of the external ear canal secreting waxy cerumen.[1] Ceruminous gland tumors are the most commonly reported aural tumors in cats and dogs.[2-4] Cytological and histopathological examinations of 25 cats with ear canal masses revealed that 18 out of 27 masses (66.00%) were ceruminous gland tumor.[5] The diagnosis of ceruminous gland neoplasms is usually based on otoscopy, radiography, computed tomography and magnetic resonance imaging and confirmed by fine needle biopsy.[5-9] Otoscopic examination of external ear canal tumors in cats is challenging due to the tortious nature of the ear canal with presence of aural secretions, waxy debris and tumor masses occluding the ear canal.[10] Radiographic interpretation of ear canal lesions is also difficult regarding the complexity of the skull, radiographic superimposition and the difficulty of head positioning due to ear lesions.[6,8] Ultrasound was efficiently used in detection of middle ear effusion and evaluation of the tympanic bulla.[11,12]

To our knowledge, there are no available reports describing the ultrasonographic characteristics of ceruminous gland tumors in cats. The purpose of the present study was to present the clinical, ultrasonographic and histopathological characteristics of the ceruminous gland tumors in cats.

Materials and Methods

The present study was conducted in 10 cats admitted to the clinic of Department of Surgery, Anesthesiology and Radiology, Faculty of Veterinary Medicine, Cairo University with a history of unilateral ear canal swelling not responding to medicinal treatment in the period between April 2016 and April 2019. All procedures of the study were approved by the institutional animal care and use committee, Cairo University with number (CU/II/F/38/18). All cats' owners were aware that their cats will be included in the study and signed a consent form indicating their approval. Cats were from different breeds (six Persian and four Egyptian Mau), sexes (six males and four females), ages (10.00 ± 2.00 years) and body weights (3.00 ± 1.20 kg).

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Clinical examination. Complete case history including the onset of the clinical signs and previous medications was collected. Visual examination of the ear canal was done and the color, size and site of the apparent part of the ear mass were recorded. The nature of aural discharges and the extension of the ear canal swelling were also reported at admission.

Ultrasonographic examination. The hair over the lateral aspect of the ear canal of both right and left sides was clipped and shaved and then an acoustic gel was applied. Without tranquilization, the cats were positioned in lateral recumbency with extended head and neck. Ultrasonographic scanning was performed using 8.00 MHz linear probe (Just Vision 200; Toshiba, Osaka, Japan). Initially, the transducer was placed perpendicularly over the lateral side of the ear canal for longitudinal scanning, then the transducer was situated over the ear canal perpendicular to the sagittal plane of the skull for transverse scanning[13] and the ultrasonographic characteristics of the ear canal swelling were recorded. Ultrasonographic evaluation of the adjacent parotid gland was conducted to detect the extension of the ceruminous tumors.[14]

Histopathological examination. All cats were treated surgically by total ear canal ablation using previously described technique.[15] Histopathological examination was performed on tissue samples collected after surgical excision.

Results

Clinical examination. Unilateral ceruminous gland tumors were diagnosed in ten cats. Ear canal swelling, continuous scratching, rubbing of the ear and offensive aural discharges were consistent findings in all cats. Head tilting, anorexia, inco-ordination and gradually increased para-aural swelling (within three weeks) were recorded in three cats.

Previous medications including local ear drops and systemic antibiotic were used. Ceftriaxone (Eipico Co., Sharqya, Egypt) was used at a dosage of 50.00 mg kg^{-1}, once daily intra-muscularly for five days in five cats. Aural drops were used in all cats for 2 - 4 months before admission. Flumethasone pivalate and clioquinol (Amoun Co., El Obour city, Egypt) along with framycetin sulphate, gramicidin, dexamethasone and HCl (Amoun Co.) were used in three cats. Antipyrine and benzocaine (Pharco Co., Alexandria, Egypt) were used in two cats. Ciprofloxacin hydrochloride (Cid Co., Cairo, Egypt) was used in two cats. Diazinon (AVZ Co., Moscow, Russia) was used in three cats. Cats showed mild improvement with decreased itching and pruritus for about one week and then all signs reoccurred.

Alopecia, pruritus and marked pain during palpation of the affected ear were recorded in all cats. Bloody aural discharges were seen in eight cats; while, purulent discharges were noticed in two cases. Marked para-aural swelling extended to the vertical ramus of the mandible was noticed in three cats.

Visual examination of the affected ear revealed firm pinkish masses of various sizes occupied the external ear canal. This mass was easily visualized protruded from the external auditory meatus in eight cats; while, two cats had a pinkish swelling within the vertical ear canal.

Ultrasonographic findings. Ultrasonographic evaluation of both affected and contralateral ear was conducted. The apparent healthy ear canal appeared hyper-echoic with distal reverberations. Ultrasound of the affected ear canal revealed a circumscribed hypo-echoic masses of various sizes (0.80 - 2.00 cm) and shapes (round, oval, lobulated and irregular) originating from the wall of the external ear canal (Fig. 1). Round anechoic structures within the vicinity of the ear canal mass were imaged in three cats with ceruminous gland adeno-carcinoma (Fig. 1). Ceruminous gland adeno-carcinoma showed irregular and lobulated masses with heterogeneous echogenicity; while, ceruminous gland adenoma revealed a regular homogenously hypo-echoic single mass in the ear canal wall. Ultrasonographic characteristics of the ceruminous gland adenoma and adenocarcinoma were collected (Table 1). Ultra-sonographic examination of the parotid gland revealed enlarged hypo-echoic mass with hyper-echoic internal septa and capsule in only 3 cats with ceruminous adenocarcinoma. It also appeared continuous with the ear canal mass in these cases.

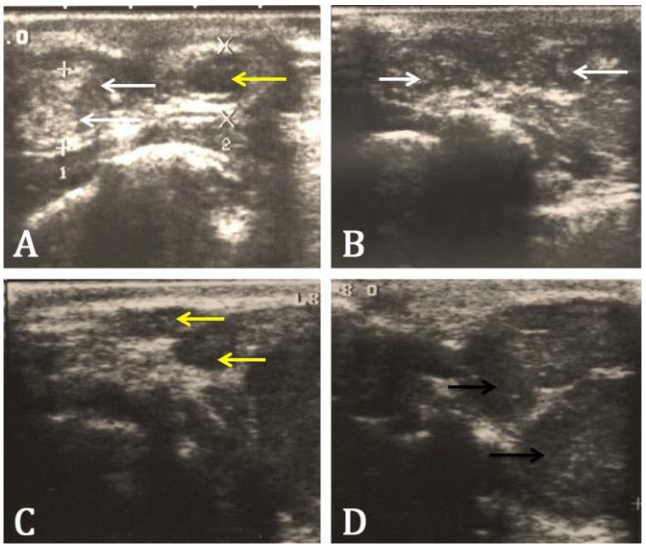

Fig. 1. Longitudinal (A, C and D) and transverse (B) scans of external ear canal with ceruminous gland adenocarcinoma showing hypo-echoic lobulated mass with heterogeneous echo texture (white arrows) and anechoic spaces within the vicinity of the tumor mass (yellow arrows). Longitudinal scan (D) shows enlarged hypo-echoic mass appeared continuous with the ear canal mass representing the enlarged parotid gland (black arrows).

Table 1. The ultrasonographic characteristics of ceruminous gland adenoma and ceruminous gland adenocarcinoma.

Ultrasonographic characteristics	Ceruminous gland adenoma	Ceruminous gland adenocarcinoma
Margin and shape	Regular margin Oval in two cats Round in one cat	Irregular in four cats Lobulated in two cats Round in one cat
Echo texture	Homogeneous	Heterogeneous
Echogenicity	Hypo-echoic	Hypo-echoic in three cats Hypo- with hyper-echoic septa within the tumor mass in four cats
Cystic spaces	Absent	Present only in three cats

Histopathological findings. Based on histopathological examinations, the ceruminous ear gland tumors were classified into ceruminous gland adenoma (n = 3) and ceruminous gland adenocarcinoma (n = 7) with marked lymphatic metastasis in three cats. Ceruminous gland adenoma was characterized microscopically by adenomatous proliferation of ceruminous glands with formation of cystic lesions. The tumor mass was supported by well-developed stroma. The neoplastic cells forming papillary projections were cuboidal having eosinophilic granular cytoplasm with round vacuoles in apical part. The nuclei were round to oval containing prominent nucleoli and few mitotic figures were seen. Cystic dilated glands contained eosinophilic material (cerumen), desquamated epithelium and degenerated neutrophils (Fig. 2). Two stages of ceruminous gland adenocarcinoma differentiation were recognized. The first stage was differentiated adenocarcinoma in which the tumor mass revealed large non-capsulated, highly cellular and infiltrative growth pattern associated with ulceration of upper epidermal layers of the ear canal. There were massive necrosis and inflammatory reaction mainly neutrophils infiltrating the tumor mass. The tumor was composed of tubular arranged neo-plastic cells with intraluminal papillary projections supported by scant fibrovascular stroma. The neoplastic cells were cuboidal to round with eosinophilic and foamy cytoplasm containing vesicular active dividing nuclei containing prominent nucleoli with several mitotic figures. The neoplastic cells showed anisocytosis and anisokaryosis (Fig. 3).

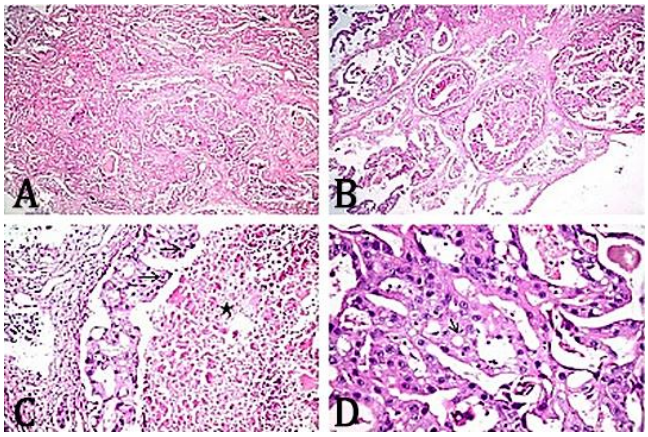

Fig. 2. Photomicrographs of ceruminous gland adenoma stained with Hematoxylin and Eosin showing **A)** adenomatous growth of ceruminous acini supported by well-developed stroma (100×). **B)** Cyst formation with papillary projections of the acinar lining epithelium (100×). **C)** Presence of clear vacuoles in the cytoplasm of the tumor cells (arrow) and distension of cyst with necrotic tissue, cerumen and inflammatory cells (asterisk; 200×). **D)** The neoplastic cells are cuboidal with ill-defined cell borders with clear vacuoles (arrow) and round nuclei containing prominent nucleoli (400×).

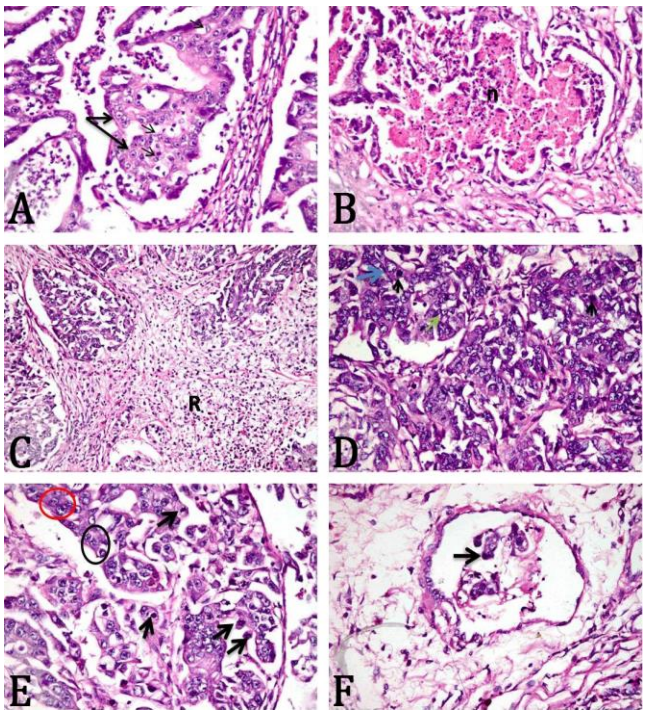

Fig. 3. Photomicrographs of ceruminous adenocarcinoma stained with Hematoxylin and Eosin showing **(A)** nest aggregation of neoplastic cells with mild anisokaryosis (thick arrow for large nuclei and smaller ones for smaller nuclei; 400×). **B)** Intraluminal aggregation of secretions mixed with necrotic cell debris and degenerated and fragmented neutrophils (n; 400×). **C)** Infiltrative growth pattern of neoplastic cells associated with marked necrotic and inflammatory reaction (R) mainly neutrophils infiltration (200×). **D)** Disarranged non-acinar cluster aggregation of neoplastic cells with mitosis (black arrows), anisocytosis and anisokaryosis being indicated by blue arrow for larger cell having larger nucleus and green arrow for smaller ones with smaller nuclei (400×). **E)** Pleomorphism, karyomegalic nuclei containing prominent nucleoli (red circle), smaller neoplastic cells with smaller nuclei (black circle) and numerous mitotic figures (arrows); note the fine fibrovascular stroma separating the neoplastic cells (400×). **F)** Lymphatic metastasis of the carcinoma neoplastic cells (black arrow; 400×).

Eosinophilic secretions mixed with necrotic debris, desquamated epithelium and degenerated fragmented neutrophils were observed in tubular lumen. The underlying muscular layer showed intense necrosis and myocytolysis with massive living and dead neutrophil infiltration. The second stage was undifferentiated grade in which the tumor mass revealed non-capsulated infiltrative cellular mass of neoplastic cells associated with severe necrotic and inflammatory reactions. The neoplastic cells showed pleomorphism and disarranged growth pattern with no recognizable acinar pattern. The cells had eosinophilic cytoplasm, large pleomorphic vesicular nuclei containing prominent nucleoli and numerous mitotic figures. The neoplastic cells were separated by fine ill-developed stroma (Fig. 3).

Discussion

Ceruminous gland adenoma and adenocarcinoma were recorded in ten cats with clinical signs of otitis. Clinical, ultrasonographic and histopathological findings of these neoplasms were recorded.

In the present study, the mean age of cats with ceruminous gland tumors was ten years suggesting increased tumor incidence in older ages. Similar findings were reported in previous studies.[2,16] Ceruminous gland adenocarcinoma was the most prevalent type (70.00%) of ear canal tumors similar to previous records.[2,5,17]

History of aural discharge and continuous scratching for more than two months with severe inflammatory reaction and fibroplasia in histopathological examinations support that long-term inflammation (chronic otitis) may predispose to the development of ceruminous gland neoplasia.[2,6,18,19]

Vestibular ataxia is a common sign associated with ceruminous gland neoplasia and chronic ear infection.[20] In the present study, vestibular system causing ataxia and head tilting with incoordination were manifested in three cats.

The present study demonstrated a novel investigation for ultrasonographic evaluation of ceruminous gland tumor in cats. The use of 8.00 MHz linear transducer was optimal for imaging the external ear canal tumors. Ultrasonographic procedures were safe and well-tolerated without moaning or resistance and did not necessitate the use of anesthesia.

The normal ear canal appeared hyper-echoic with distal reverberations hindering the passage of the ultrasound beam to image the inner wall of the external ear canal.[8] The presence of aural discharges and tumor masses within the ear canal enhanced the passage of the ultrasound beam and acted as an acoustic window for visualizing the external ear canal structures.

The histopathological findings of benign versus malignant neoplasms reflected in the ultrasonographic findings.[21,22] In the present study, heterogeneous echogenicity of the ceruminous adenocarcinoma could be explained by the undifferentiated nature of the neoplastic cells from less to undifferentiated affecting beam transmission resulting in heterogeneous echogenicity. On contrary, the homogenous hypo-echoic pattern of the ceruminous adenomas reflected the well-differentiated nature of neoplastic cells, where the cells appeared completely resemble their tissue of origin.[21] During ultrasonographic examination, the irregular and lobulated masses of ceruminous gland adenocarcinoma with parotid gland involvement had indicated the invasiveness and infiltrative nature of neoplastic cells into the surrounding tissue; while, in ceruminous gland adenoma, the regular single mass within the ear canal was concurrent with the capsulated regular acinar arrangement of benign neoplastic cells. These ultrasonographic findings were confirmed by the results of our histopathological examinations and previous records.[16]

The presence of anechoic structure in the vicinity of the malignant tumor mass could be attributed to the extensive liquefactive necrosis and myocytolysis within the tumor mass as previously explained.[22]

Ultrasonographic examination was superior in detection of the local invasion of ceruminous adeno-carcinoma into the parotid gland, where it appeared as enlarged, round hypo-echoic structure connected with the ear canal mass similar to previous reports.[2,23] It has been reported that it is difficult to differentiate between anaplastic ceruminous tumor and parotid gland carcinoma during histopathological examination.[24]

The main limitation of the present study was the relatively small number of cats reflecting the low incidence of cerminous gland tumors.[2,3,19]

In conclusion, the present study highlighted the role of ultrasonography as a rapid, non-invasive tool in diagnosis and prediction of ceruminous ear gland tumors in cats. The irregularity, lobularity and the hetero-geneous echogenicity of the malignant ceruminous tumors versus the regularity and the homogenous echogenicity of benign ones should be considered. Histopathological examination remains the gold standard for ceruminous gland neoplasia confirmation.

Acknowledgments

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Conflict of interest

The authors declare that they have no competing interests.

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