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Case Report

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Pilomatrixoma in a Maltese Dog

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A 12-year-old female Maltese dog brought to a local veterinary clinic with two nodules in the subcutis of left shoulder. The nodules were grown gradually from 2 years ago. The nodules were removed surgically under anesthesia and examined histopathologically. They were 15×26 mm in diameter (oval form) and 12×15 mm in diameter (round form), respectively. Histopathologically, the lesions consisted of multi-layered basaloid cells in the peripheral of the mass and ghost cells in the central region. Typical findings of these two nodules were gradually keratinized basaloid cell toward central area result in forming anuclear ghost cells. These microscopic features of cutaneous nodules were diagnosed as pilomatrixoma and the identified findings were similar to fully developed stage of human pilomatrixoma. This report may assist in the categorizing of canine pilomatrixoma using histopathological features.

Key words: Pilomatrixoma, pilomatricoma, skin tumor, dog

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Pilomatrixoma is an uncommon follicular skin tumor originated from matrix cells of hair bulb described in dogs, cats, and human beings (Gross *et al.*, 1992; Du Vivier and McKee, 1993; McKee, 1999). Canine pilomatrixomas account for about 1% of all cutaneous neoplasms, 3% of all epithelial skin tumors, and 13-19% of all follicular tumors (Theilen and Medewell, 1987; Danny and Wayne, 1991; Goldshmidt and Shofer, 1992). The term 'Pilomatrixoma' was first denominated by Forbis and Helwig for the human case involving dermis and subcutis (Forbis and Helwig, 1961). The mass was firm and dome-shaped solitary lesion with 0.5-5 cm in diameter. The lesion consisted of basaloid cells and ghost cells encapsulated with connective tissue.

Generally, pilomatrixoma occurs in the head, neck, legs, and shoulder in a dog. Most cases reveal firm to hard intradermal or subcutaneous solitary tumor. Histopathologically, pilomatrixoma consist of basaloid cells and ghost cells (shadow cells). Some cases showed inflammatory reaction, keratinization, and ossification. Treatment of pilomatrixoma is surgical excision and cryotherapy in most cases. However, spontaneous involution of these lesions may occur, and there is occasionally recurred after excision (Goldshmidt, 1992; Gross, 1992).

A 12-year-old female Maltese dog brought to local veterinary clinic with two nodules in the subcutis of the left shoulder. The nodules were gradually grown from 2 years ago. General laboratory findings revealed no significant change in the complete blood counts and serum biochemical results. No abnormal finding was detected in thoracic radiography. The nodules were excised surgically under general anesthesia. They were 15×26 mm in diameter (oval form) and 12×15 mm in diameter (round form), respectively. The lesion was firm and solitary showing slight alopecia (Figure 1A). The masses were well circumscribed and creamy-white to yellow colored homogeneous materials filled on their cut sections (Figure 1B). The specimens were fixed in 10% neutral buffered formalin and paraffin-embedded for general tissue processing procedures. Sections were stained with hematoxylin and eosin for histopathological examination.

Histopathologically, the subcutaneous lesion showed enlarged luminal cysts rimed by basophilic cells similar with irregular arrangement. These cells were similar with normal hair matrical cells. The wall of cyst, multi-layered basaloid

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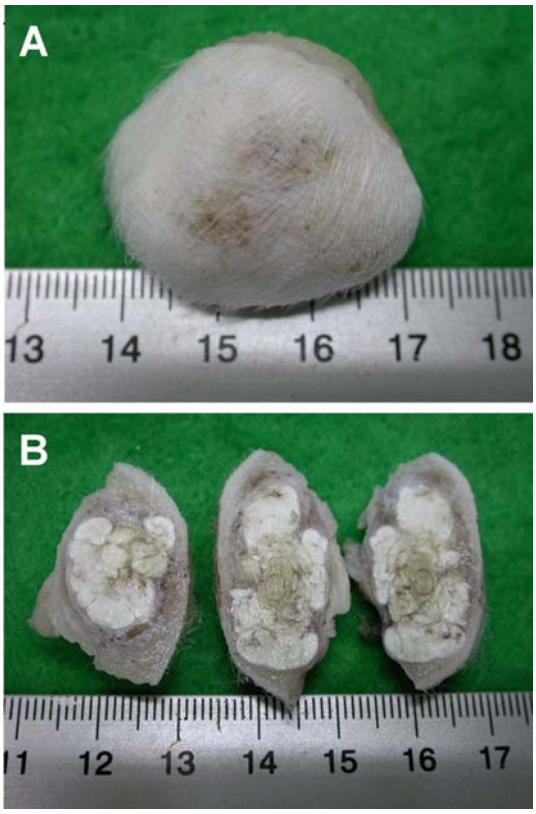

Figure 1. A: Dome-shaped surface with mild pigmentation and alopecia. B: Creamy-white to yellowish color, firm, well-lobulated and solitary appearance on the cut sections.

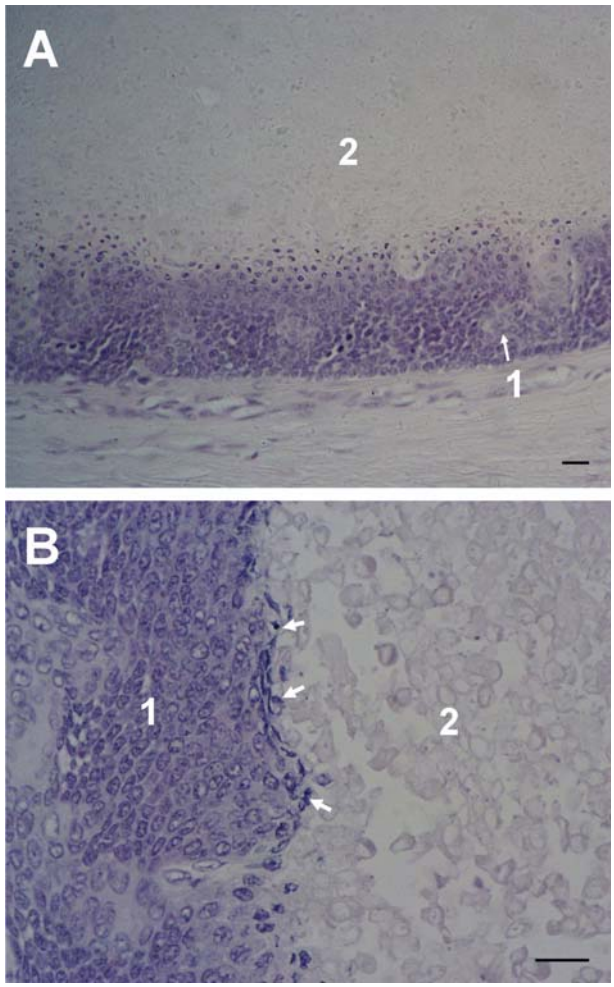

Figure 2. A: The subcutaneous cyst showed enlarged lumen and irregularly shaped and densely packed basaloid cells (1) in the rim. Gradually degenerated cells, ghost cells (2), were in central lesion. B: In the larger magnification of A, basophilic basaloid cells (1) showed nuclear mitosis (arrow) in the junction of degenerated cells. Ghost cell (shadow cells) (2) were disappeared nuclei and poorly stained but maintaining their outline. H&E stain. Scale bar=150 μm.

cells, revealed gradual degeneration toward central region of the cyst. Gradual degeneration resulted in anuclear and pale stained cells referred as ghost cells and/or shadow cells (Figure 2). Multifocal mineralizations were also observed in the central region of the cysts (Figure 3). Cytological atypia (large nuclei and clumpy chromatin) and mitotic figure were seen. No inflammatory reaction was found in this case. In general, the other significant features were not detected in the present specimens. There are all normal adnexa except dilation of apocrine glands.

Pilomatrixoma can be found in head, legs, and shoulders of most canine cases. The age of onset may be as young as 1-year, with an average onset of 6.5 years in dogs. Our case showed older age (12-year-old) than the average development of pilomatrixoma in dogs. The tumor of this report was existed in shoulder which was agreed with previous reports. In human, over 50% of lesions were on the head and neck region, 25-30% in the upper limbs, and the remainder in the trunk and lower extremities (Moehlenbeck, 1973; MacKie, 1998; Hashimoto and Lever, 1999).

The diagnosis of pilomatrixoma is usually made by histopathological examination, which is identified basaloid cells, squamous ghost cells, calcium deposit, and giant cells (MacKie, 1998). Especially, basophilic basaloid cells and ghost cells are two key components of pilomatrixoma (Wang *et al.*, 2002). Basophilic basaloid cells are resembled hair matrix cells and predominated round or oval nuclei. Shadow cells, so called ghost cells, had decreased nuclear staining and shows eosinophilic cytoplasms. Basophilic basaloid cells are gradually losing their nuclei then forming eosinophilic ghost cell. Ghost cells are founded towards the central areas of the cell masses.

Pilomatrixoma microscopically resembles trichoepithelioma but is often more heavily mineralized and consists of fewer, larger cysts than dose trichoepithelioma. Trichoepithelioma

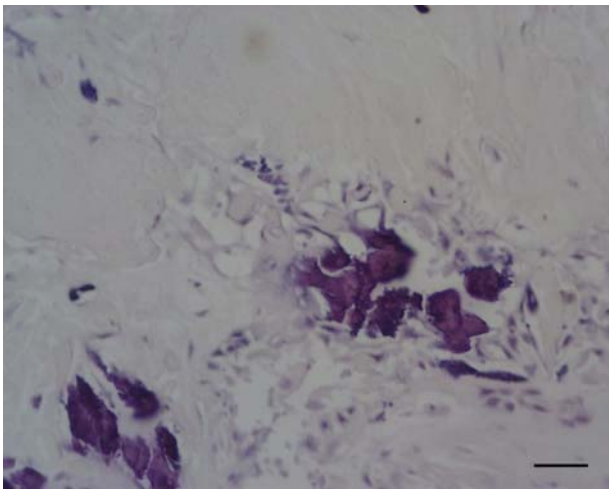

Figure 3. Multifocal mineralization was observed in the central region of the cyst. H&E stain. Scale bar=300 μm.

is characterized by the abrupt central keratinization and the follicle like basal cell nests. And pilomatrixoma is distinguished from trichoepithelioma by two types of cells, the more immature basaloid cells and the more mature shadow cells (Goldshmidt and Shofer, 1992).

Pilomatrixoma categorized into four distinct and chronological stages: early, fully developed, early regressive, and late regressive lesion. Early lesions are small cystic structures lined by squamoid and basaloid epithelium containing keratin filaments and faulty hair matrix materials composed of shadow cells. Fully developed lesions are large neoplasms lined by basaloid epithelium at their periphery, and within, composed of irregularly shaped, densely packed zones of cornified masses containing shadow cells. Early regressive lesions have no apparent epithelial lining but did have basaloid cell foci at the periphery; within, they were composed of pink hair matrix materials with shadow cells surrounded by granulation tissue with inflammatory infiltrates and multinucleated histiocytic giant cells. The last, late regressive lesions have no epithelial component and were composed of irregularly shaped, partially confluent masses of faulty hair materials, and calcified shadow cells embedded in a desmoplastic stroma, with little or no inflammatory infiltrates (Kaddu, 1996).

Pilomatrixoma showed stromal calcification in 75% of cases and ossification in 15~20% of cases, especially in aged tumors. Treatment of pilomatrixoma is surgical excision and cryotherapy in most cases. However, the mass were spontaneously reduced or disappeared in some cases. Occasionally, melanin pigments, trichohyaline granules, and often foreign body giant cells are accompanied (Kaddu *et al*., 1997; MacKie, 1998; Hashimoto and Lever, 1999; Walsh and Fairley, 1999).

A rare variant, which typically grows rapidly, has been described as proliferating pilomatrixoma (Kaddu *et al*., 1996). These mistaken for malignant lesions due to brisk mitotic activity but lack other histological features of malignancy (infiltrative growth pattern, tumor necrosis without formation of ghost cells, vascular invasion, and overt cytological atypia) (Grabczynska *et al*., 2002).

In human, local recurrence after excision of benign pilomatrixoma has been reported to occur in 2-3% of cases. Malignant transformation of pilomatrixoma is rare although invasive recurrence of previously benign lesions in few reports (Grabczynska *et al*., 2002).

Pilomatrixoma is truly often observed in the veterinary medicine showing variable occurred ages in dogs. In most cases, however, it was not significantly considered due to spontaneous involution and good prognosis. Thus there is no minute histopathological findings and categorized lesion. In this report, we observed irregular shaped and densely packed basaloid cells, masses of ghost cells, multifocal mineralization, and no inflammatory reaction in the subcutaneous solitary mass. This skin tumor was diagnosed pilomatrixoma and the identified histopathological findings were similar to previously mentioned fully developed stage of human pilomatrixoma. At this writing, the patient had no evidence of recurrence or metastasis. This report may assist in the categorizing of canine pilomatrixoma using histopathological features. However, greater follow-up of larger numbers of cases are required elucidate the relationship between pilomatrixoma and the other hair matrical cell tumors in dogs and humans.

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