WEDNESDAY SLIDE CONFERENCE 2008-2009

Conference 15

28 January 2009

Conference Moderator:

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CASE I – T8944-07 (AFIP 3102252)

Signalment: 2-year-old female neutered Siamese cat, feline, (*Felis catus*)

History: The cat was presented to the clinician with a 9 month history of prednisolone treatment due to a diagnosis of food hypersensitivity. The skin of the dorsum resembled wet tissue paper and was sensitive to touch. From the left and right thigh, blood vessels were directed towards the lesion (figures). The practitioner excised a 13 x 4 x 0.3 cm skin sample, which showed several tears and detachment of the dermis from the panniculus **(Fig. 1-1)**. The sample was fixed in formalin and routinely processed for histopathological evaluation.

Gross Pathology: None

Laboratory Results: None

Histopathologic Description: Haired skin: The main lesion is a complete lack of subcutaneous adipose tissue which is replaced by a large clear cleft, extending throughout the whole tissue sample and leading to dermo-hypodermal separation. Collagen fibres in this area have a torn and stretched appearance. The epidermis consists of only one or two layers of partly flattened keratinocytes, interpreted as severe epidermal atrophy **(Fig. 1-2)**, and is covered by a layer of lamellar eosinophilic material (lamellar orthokeratotic hyperkeratosis). Superficial and periadnexal dermis show a perivascular to interstitial infiltrate composed of moderate numbers of lymphocytes, less macrophages, neutrophils and mast cells, and a few eosinophils and plasma cells. Around vessels of the superficial vascular plexus there are moderate numbers of extravasated erythrocytes (haemorrhage). Dermal collagen is extremely attenuated and shows a pale staining in H&E stained sections. Adnexal structures demonstrate a complete lack of anagen hair follicles, and the perifollicular fibrous sheaths of many telogen follicles are thickened. Sebaceous glands are decreased in size and number, interpreted as atrophy. Follicular infundibula are extended and filled with large amounts of an eosinophilic lamellar material (infundibular hyperkeratosis).

Contributor's Morphologic Diagnosis:
1. Skin and subcutis: Severe atrophy of epidermis and the subcutaneous panniculus with cleft formation, consistent with feline acquired skin fragility syndrome, Siamese cat, feline
2. Skin: Subacute suppurative dermatitis, superficial and perivascular, mild

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1-1 Haired skin, cat. There are multifocal tears which extend through the diffusely thin epidermis and dermis to the level of the panniculus with minimal associated hemorrhage. Photograph courtesy of Institut fuer Veterinaer-Pathologie, Universitaet Giessen, Giessen, Germany.

Contributor's Comment: Different disease entities are described in man and animal species with an obvious fragility of the skin. Ehlers-Danlos syndrome (syn. collagen dysplasia, dermatosparaxia, cutaneous asthenia, cutis hyperelastica) as a congenital disease with abnormal collagen synthesis has been described in man, cattle, sheep, dogs, cats, mink and rabbits.[4] In man, six main types of the disease are defined due to biochemical, clinical and molecular studies.[7] In addition to skin lesions abnormal collagen synthesis leads to alterations in ligaments, joints, blood vessels and cardiac valves. In cats with Ehlers-Danlos syndrome skin lesions occur predominantly as cutaneous asthenia or dermatosparaxia. In contrast to other species a remarkable joint laxity is not typical in cats.[4]

Recently in man the usage of the term "dermatoporosis" has been presumed for skin lesions in aged people. In this syndrome an increased fragility of the skin is attributed to age-related alterations of the extracellular matrix metabolism.[6] A primary form due to aging or unprotected sun exposure and an iatrogenic form (after corticosteroid administration) are distinguished.

An ectodermal dysplasia with a congenital skin fragility syndrome due to a mutation in the desmosomal protein plakophilin 1 has been reported in man.[2]

Feline acquired skin fragility syndrome is a rare disease with marked skin lesions of multiple etiologies but without a genetic background. The syndrome has been reported only in cats. It has been noted in combination with several other diseases, such as diabetes mellitus, cholangiocarcinoma or hepatic lipidosis, and administration of different drugs.[4,5,8] Most commonly the syndrome is associated with iatrogenic or naturally occurring hyperglucocorticism.[5] There is one report of acquired skin fragility syndrome associated with phenytoin treatment. Since phenytoin inhibits collagen synthesis in vitro the authors assume that cats could acquire collagen disorders during treatment with phenytoin.[1]
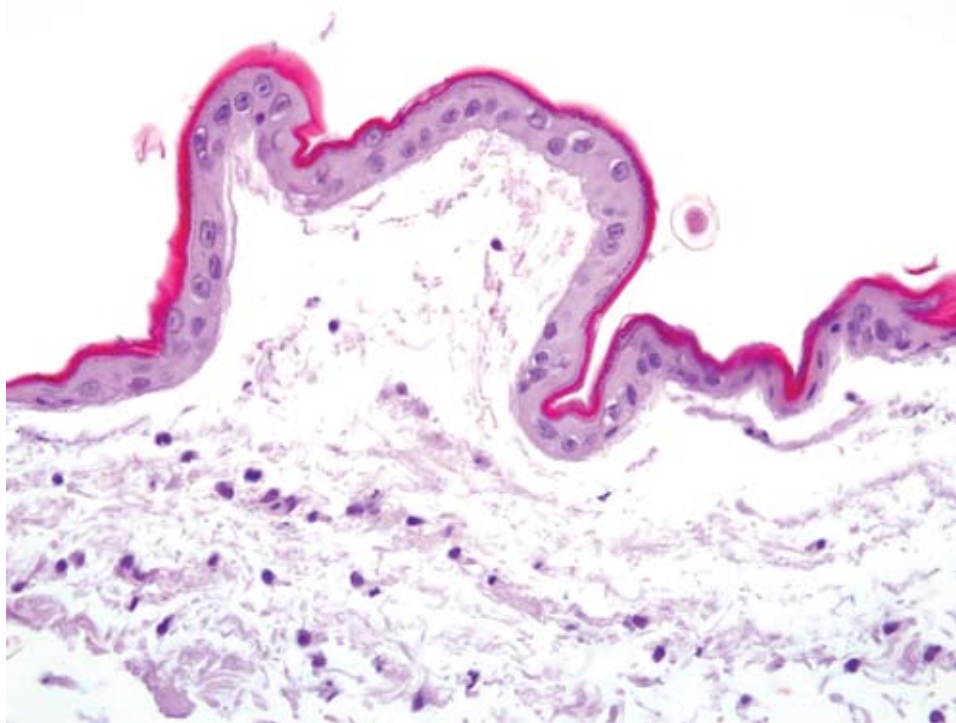
1-2 Haired skin, cat. The markedly thin epidermis in some areas is only one cell layer thick. There is a paucity of dermal adnexa and collagen, and existing collagen fibers vary greatly in thickness. (HE 400X)

Clinical features of acquired skin fragility syndrome are striking. Affected cats show markedly thin skin which tears with minor trauma and commonly leaves great flaps of loose skin. The lesions are most commonly seen at the back. Partial alopecia occurs in most affected regions.[5]

Differential diagnosis is not problematic since the lesions are typical. The patients normally are middle-aged or older and compared to Ehlers-Danlos syndrome the skin is abnormally thin but without evidence of hyperextensibility.[5] Histologically the lesions in Ehlers-Danlos syndrome and feline acquired skin fragility syndrome are similar or indistinguishable.[4]

To confirm the histopathologic diagnosis, Masson's trichrome stain was performed due to described staining abnormalities (abnormal collagen fibers, presence of segmental red staining defects, birefringence of polarized light).[3] Unfortunately fiber abnormalities are not limited to acquired skin fragility syndrome. Similar alterations can also be seen in cutaneous asthenia.[3] In our case no staining abnormalities were detectable.

AFIP Diagnosis: Skin: Epidermal and dermal atrophy, diffuse, marked with follicular atrophy and loss, dermal clefting, and mild subacute dermatitis

Conference Comment: Dr. Goldschmidt concentrated on the gross and histologic features of this disease during the discussion and described ways to differentiate feline acquired skin fragility syndrome from Ehlers-Danlos syndrome (EDS) both grossly and via histologic evaluation.

Cats with feline acquired skin fragility syndrome have extremely thin skin resembling tissue paper that tears very easily and is not hyperextensible. In contrast to feline acquired skin fragility syndrome, EDS is characterized clinically by the ability to stretch the skin to great lengths without tearing. The skin does not appear to be attached to the underlying subcutis. EDS is also a heritable disease, whereas feline acquired skin fragility syndrome is normally secondary to endocrine disorders, neoplasia, or improper drug administration.[5]

As the contributor stated these two entities are histologically similar. However, Dr. Goldschmidt pointed out features that allow them to be differentiated histologically in most cases. In feline acquired skin fragility syndrome, the epidermis is thin and there is also severe dermal atrophy with marked thinning of collagen fibers. Adnexal structures may also be atrophic. In contrast, the epidermis in EDS is generally unaffected, and the dermis may be of normal thickness or partially reduced in total thickness. The dermal collagen is abnormally arranged with affected fibers having red cores when stained with Masson's trichrome stain.[5]

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CASE II – 05-3388 (AFIP 3103426)

Signalment: 6-year-old male Basset hound

History: There was a 3.5 x 3.5 x 1cm raised, red, ulcerated subcutaneous nodule on the right dorsal elbow. The lesion had been present for months, and was removed because it limited the range of motion of the elbow.

Gross Pathology: None

Laboratory Results: None

Histopathologic Description: The superficial and deep dermis contains multiple cystic structures that occasionally compress or displace adnexal structures. The cysts are lined by a stratified squamous epithelium. The basal layer of the epithelium frequently forms short rete pegs that extend into the surrounding dermal collagen **(Fig. 2-1).** There is extensive luminal acantholysis of the stratum spinosum, with frequent cleft formation. There are dyskeratotic/apoptotic keratinocytes within the stratum spinosum and acantholytic cells within the clefts or within the cyst lumen, which also contains abundant keratin **(Fig. 2-2)**. Some cysts contain large numbers of neutrophils and there are multiple foci of mineralization of the luminal debris. Cysts are surrounded by varying degrees of dermal fibrosis. Moderate numbers of lymphocytes, plasma cells and histiocytes surround some of the cysts, as well as surround blood vessels in the deep dermis.

In some sections there is rupture of the cyst wall with release of acantholytic cells and keratin debris into the dermis. A mild infiltrate of neutrophils and epitheloid macrophages surround these areas.

Contributor's Morphologic Diagnosis: Skin: Warty dyskeratoma

Contributor's Comment: Warty dyskeratomas were first described and named in humans. The first and only report in the veterinary literature is of warty dyskeratomas arising in 2 dogs.[1] There are not enough reports to comment on age, breed or location predispositions. In our database from 2004 to present, there are three warty dyskeratomas (including the present case). Two of these tumors were in Bassett hounds and one was in a Yorkshire terrier. Dogs ranged in age from 8 months to 14 years. The case described here was on the right elbow, while the other two cases arose on the right hip or thigh. Lesions ranged in size from 3 to 13cm.
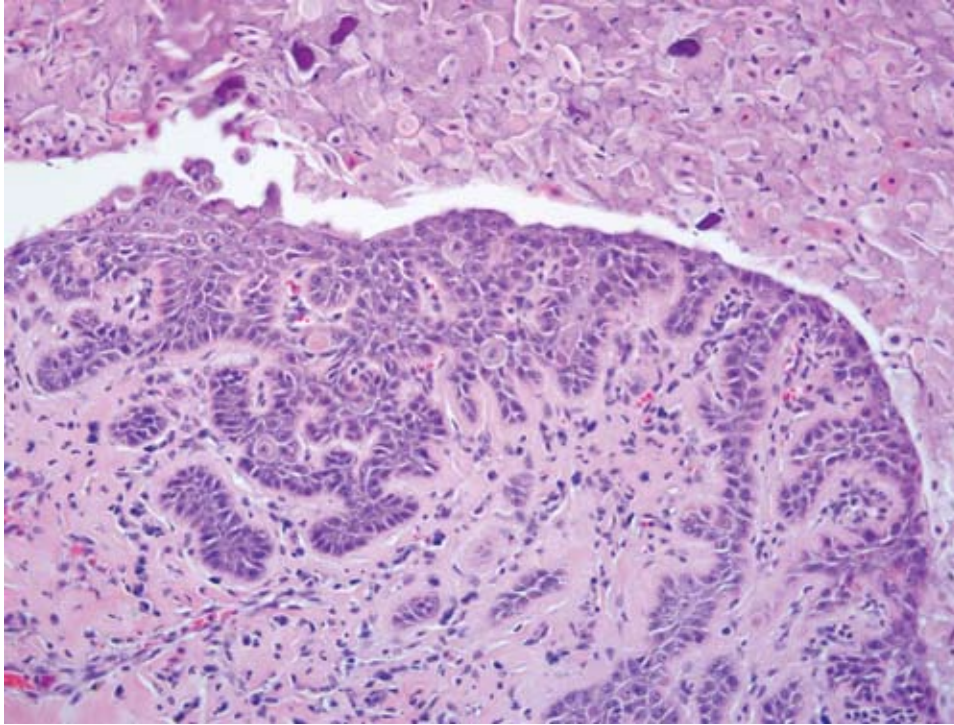
2-1. Haired skin, dog. Warty dyskeratoma. Basal cells thrown into convoluted folds and projections. There is multifocal dyskeratosis within the suprabasilar strata, with occasional suprabasilar clefting. Scattered acantholytic keratinocytes are mineralized. (HE 400X)
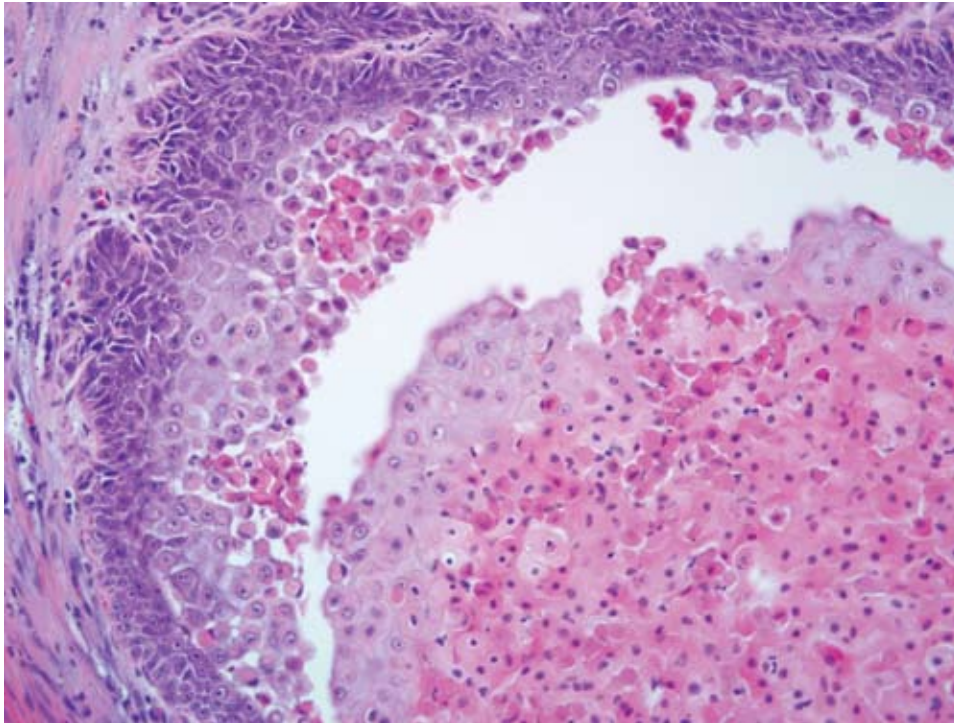
2-2. Haired skin, dog. Warty dyskeratoma. The cyst lumina are filled with parakeratotic debris, acantholytic keratinocytes, and sloughed apoptotic cells with condensed cytoplasm and nuclei. (HE 400X)

Warty dyskeratomas are rare benign tumors that are believed to arise from hair follicles. Histologically there are single to multiple cystic structures in the dermis that are lined by a stratified squamous epithelium that is hyperplastic and forms rete pegs that extend into the surrounding dermis. There is acantholysis of the stratum spinosum which can result in separation of the superficial layers of epithelium from the basal layers. There is frequent keratinocyte apoptosis or dyskeratosis. The cyst lumen is usually filled with keratin debris and acantholytic cells. Secondary inflammation from release of cyst contents into the surrounding dermis is common.[2]

AFIP Diagnosis: Haired skin: Warty dyskeratoma

Conference Comment: Dr. Goldschmidt stated he has seen just a few of these over the last twenty years at the University of Pennsylvania, and this entity seems to be very rare in domestic animals.

Warty dyskeratomas in animals can be confused with an acantholytic variant of squamous cell carcinoma originating from the hair follicle. Squamous cell carcinomas often have extensive apoptosis as a distinguishing feature. Warty dyskeratomas are benign tumors and do not infiltrate through the basement membrane.[1]

In humans, warty dykeratomas are solitary verrucous epidermal neoplasms with marked acantholysis and dyskeratosis of proliferating neoplastic cells.[3] In humans, these tumors generally are found on sun-exposed body parts, and these lesions usually involve hair follicles with some reported cases of oral involvement. Tumors appear as single, raised nodules with umbilicated centers and are usually benign tumors. Histologically, these masses are endophytic with densely packed keratin and suprabasilar clefts with marked acantholysis. Acantholytic cells are described as either "corps ronds," which are suprabasilarly located, large, eosinophilic, rounded cells with perinuclear halos, or "corps grains," which are small intensely eosinophilic, ovoid cells with pyknotic flattened nuclei. These two types of cells are often adjacent to an acantholytic stratum granulosum and parakeratotic stratum corneum.[3]

Contributing Institution:
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CASE III – E28794 2 (AFIP 3103391)

Signalment: 17-year-old, spayed female, domestic-mixed, cat, (*Felis silvestris catus*)

History: The cat was presented for a solitary cutaneous mass in the right thoracic area **(Fig. 3-1)**. At clinical examination, a solitary disc-shaped, well-circumscribed nodule was observed. No other nodular lesion was seen. Cutaneous mass and superficial cervical lymph node were resected surgically. Five months later, the cat died, but necropsy was not performed.

Gross Pathology: The disc-shaped nodule was 30 x 30 x 5 mm in size. A part of overlying skin was ulcered. The cut surface was solid and white in color.

Laboratory Results: None

Histopathologic Description: The mass consisted mainly of round tumor cells infiltrated throughout dermis and deep subcutaneous tissue near the cutaneous muscle layer **(Fig. 3-2)**. The tumor cells proliferated in superficial layer to deep dermis, but did not invaded into epidermal layer of the skin and hair follicles. The proliferating pattern of tumor cells was solid but also trabecular or cord-like in some area **(Fig. 3-3)**. The size of the tumor cells varied considerably from small cells resembling mature lymphocyte to large cells with polygonal nucleus up to 3 times of small one. The cytoplasm of many tumor cells is scanty but small amount of cytoplasmic rims were also visible in many cells. Many nuclei contained fine granular chromatin and multiple small nucleoli. Mitotic figures and apoptotic cells were frequent. Necrotic area was frequent in the tumor mass and a large necrotic area extended from just beneath the epidermis to deep dermis in some. Occasionally, tumor cells are arranged in cords- or gland-like structures with rare intracytoplasmic cysts. Metastasis to lymph node was also seen.

Grimelius reaction for argyrophilic granules was positive in tumor cells, because they often showed small dark granules

3-1. Haired skin, cat. Merkel cell carcinoma. Solitary well-circumscribed disc-shaped, ulcerated neoplasm. Photograph courtesy of the Faculty of Pharmaceutical Science, Setsunan University, Osaka, Japan.

in cytoplasm. Immunohistochemically, almost all tumor cells were positive for cytokeratin 20 and synaptophysin. The positivity for cytokeratin 20 has a perinuclear dot-like structure **(Fig. 3-4)**. Tumor cells have shown focal reactivity for chromogranin A and PGP9.5. However, no positive reaction was observed for cytokeratin 8/18, AE1/AE3, S100, CD3, CD20, and vimentin.

Contributor's Morphologic Diagnosis: Skin: Merkel cell carcinoma

Contributor's Comment: The light and immunohistochemical findings in this tumor supported the diagnosis of Merkel cell carcinoma. The differential diagnosis included lymphoma, trichoblastoma, sweat gland tumor and metastatic neuroendocrine tumor. Contrary to the round nuclei with dense chromatin and distinct large nucleoli, and scanty cytoplasm of the tumor cells in malignant lymphoma, the tumor cells in the present case was characterized by scanty but constantly visible cytoplasm, and round nuclei with small multiple nucleoli and fine granular chromatin taking a dusty appearance. Tumor cells often formed trabecular or cord-like structure, suggesting the epithelial origin in some area. Immunohistochemically negative staining for CD3 and CD20 is most definitive evidence to distinguish from malignant lymphoma.

Trichoblastoma and sweat gland tumor was most difficult to differentiate from Merkel cell carcinoma. In our case, gland-like structure and intracytoplasmic cyst suggested sweat gland origin of tumor cells. However, morphologic pattern of immunohistochemical positivity for cytokeratin 20 was very characteristic and suggestive of Merkel cell tumor. Recently, it was reported that immunohistochemical examination using cytokeratin 20 is extremely useful in distinguishing Merkel cell tumor from trichoblastoma and sweat gland tumor.[3] According to this report, Merkel cell tumor was characterized by perinuclear dot-like structure (keratin button) for cytokeratin 20 like those in the present
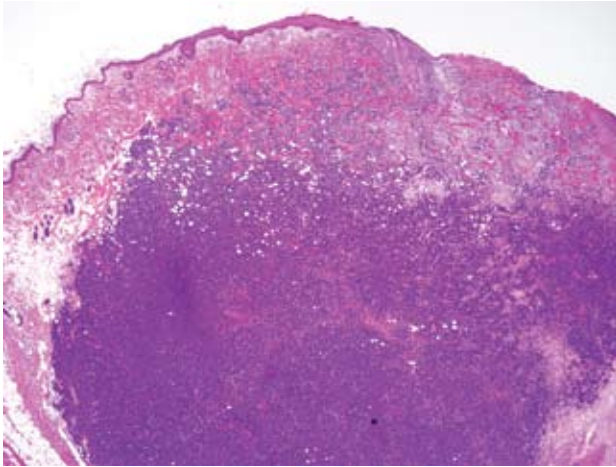
3-2. Haired skin, cat. Expanding the dermis, elevated the overlying ulcerated epidermis, infiltrating subcutaneous adipose tissue, and effacing adnexa, is an unencapsulated, poorly circumscribed, densely cellular neoplasm. There are multifocal areas of necrosis within and surrounding the neoplasm. (HE 20X)
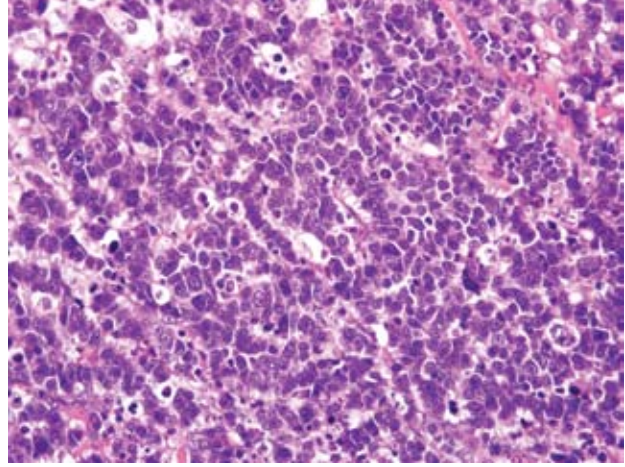
3-3. Haired skin, cat. The neoplasm consists of sheets, solid nests, and vague cords of round cells surrounded by a fine fibrovascular stroma. (HE 400X)

case. In addition, negative staining for cytokeratin 8/18 was able to deny sweat gland differentiation. Trichoblastoma often included focal positivity for synaptophysin and chromogranin A, indicating neuroendocrine differentiation. However, in our case, many tumor cells were positive for synaptophysin and focal positivity for PGP9.5 was seen. Therefore, our case was derived from neuroendocrine cells.

In humans, small cell carcinoma of lung often metastasizes to the skin. The growth pattern of that tumor resembles Merkel cell tumor. Cytokeratin 20 was usually negative in small cell carcinoma, but there was no report in animals.[3] In our case, as necropsy was not performed, metastatic tumor could not be completely denied. However, positivity for cytokeratin 20 strongly suggested Merkel cell origin.

Only two cases of Merkel cell carcinoma of cats have been reported.[1,4] One case was a relapse and pulmonary metastasis, but another case showed no relapse and metastasis. In our case, lymph node metastasis and multiple mitotic figures indicated malignant behavior of this tumor. In dogs, Merkel cell tumor was benign, but in humans it was malignant.[2] Therefore, clinical behavior of cats was similar to that of humans.

AFIP Diagnosis: Haired skin: Merkel cell carcinoma

Conference Comment: Merkel cells are located in the stratum basale of the epidermis and are mechanoreceptors responsible for tactile sensing. These cells are numerous in the rostal nasal planum of pigs, the nasal planum of carnivores, and the external root sheath of tactile hairs in most species. They are normally flat cells with intracytoplasmic, light staining, dense core granules. These cells also have numerous desmosomes.[2]

Debate over the origin of Merkel cells continues, and it is now commonly thought that these cells arise from the neural crest. Immunhistochemical staining helps support this theory because Merkel cells stain for neuron-specific enolase, chromogranin A, and synaptophysin. As the contributor mentioned, Merkel cells are also positive for CK 20, and they are negative for CD45 and CD18 ruling out a leukocyte origin. Rare cases of Merkel cell tumors have been reported in dogs, and this is only the third reported case in a cat. Merkel cell tumors are normally intradermal, unencapsulated tumors composed of solid, dense nests and packets separated and supported by a fine fibrovascular stroma. There is normally little cellular atypia, and mitotic figures are rare. Ultrastructurally, Merkel cells have characteristic membrane-bound dense core granules and rudimentary desmosomal structures.[3]

Dr. Goldschmidt pointed out an area adjacent to the neoplasm of abrupt transition from normal epidermis to an area of flat raised acanthotic epidermis (not evident in all sections) strongly suggestive of viral plaque. Pathologists in the AFIP Department of Soft Tissue Pathology reviewed this case and concurred with the diagnosis of Merkel cell carcinoma.
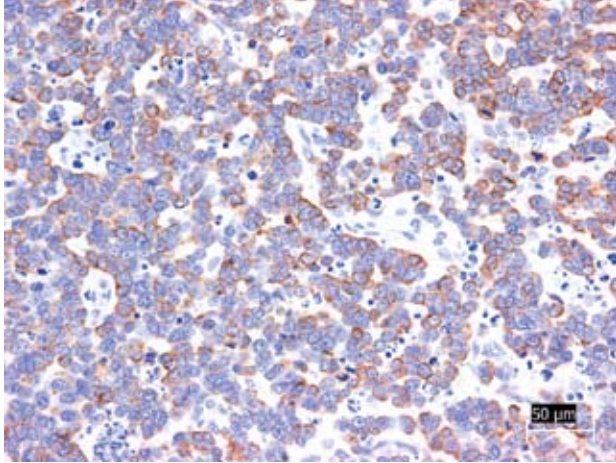
3-4. Haired skin, cat. Diffusely, neoplastic cells show cytoplasmic immunopositivity for cytokeratin 20. Photomicrograph courtesy of the Faculty of Pharmaceutical Science, Setsunan University, Osaka, Japan.

Contributing Institution: Department of Pathology, Faculty of Pharmaceutical Science, Setsunan University, 45-1 Nagaotohge-cho, Hirakata, Osaka 573-0101, JAPA, narama@pharm.setsunan. ac.jp

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CASE IV – H07-0778 (AFIP 3102248)

Signalment: Adult male southern brown bandicoot (*Isoodon obesulus*)

History: A southern brown bandicoot (*Isoodon obesulus*) was found at Lesmurdie, Western Australia (32° 00'S, 116° 02'E) showing lethargy, weight loss, and abnormal diurnal behaviour during April 2007. It was taken to Kanyana Wildlife Rehabilitation Centre and then Wattle Grove Veterinary Hospital for veterinary attention. During initial examination, multifocal to coalescing irregular, raised, alopecic and erythematous plaques were observed over the skin of the flanks, face and limbs. Routine skin scraping was performed, but no ectoparasites or fungal pathogens were identified. The prescribed treatments included weekly ivermectin 200 µg/kg PO and weekly Malaseb baths. During this treatment, the bandicoot's weight and level of activity increased and behaviour normalized. General improvement of the skin condition was noted at a follow-up veterinary examination, but the raised plaques persisted. The southern brown bandicoot was referred to the Murdoch University School of Veterinary and Biomedical Sciences for further diagnostic investigation.

Gross Pathology: Clinical examination revealed numerous multifocal to coalescing flat and slightly raised, red-black, alopecic skin plaques involving approximately 10-15% of the total skin surface area. These lesions were evident on the fore- and hindpaws, fore- and hindlegs, thorax, flanks, lips, chin and face. The claw of the left lateral digit was overgrown and deformed medially across the palmar aspect of the left forepaw.

Laboratory Results:
Blood smear: Rare extracellular *Hepatozoon* sp. gamonts were observed.
Microbiology: Negative for fungal growth
PCR: Total DNA extracted from the papillomas was positive using FAP59/64 degenerate primers for amplifying sequences within the L1 ORF of papillomaviruses.(1)
In situ hybridizations: All DNA in situ hybridization (ISH) probes designed to anneal with BPCV1 DNA sequences failed to stain papillomas from the southern brown bandicoot.(2) All DNA ISH probes designed to anneal with BPCV2 DNA sequences (within the L1, L2 and small t antigen ORFs as well as a BPCV2 genomic DNA probe) stained the nuclei of many keratinocytes within the affected epidermis and root sheath.[3]

Histopathologic Description: Histopathology demonstrated moderate to marked, multifocal, irregular
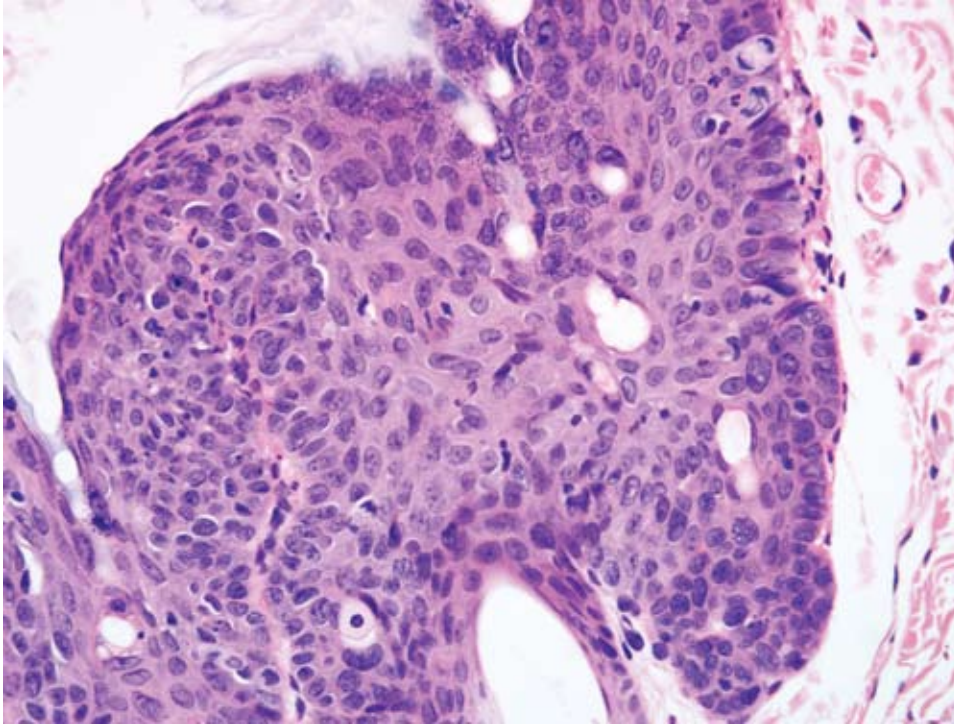
4-1. Haired skin, bandicoot. Irregular hyperplasia and dysplasia of follicular and surface epithelium with altered polarity of keratinocyte differentiation, dyskeratosis, and suprabasilar mitoses. (HE 400X)

hyperplasia and hyperkeratosis of the outer root sheath of hair follicles and to a lesser extent the overlying epidermis. The hyperplastic changes involved mainly the stratum spinosum and granulosum. Keratinocyte proliferation and differentiation was often disorderly **(Fig. 4-1)**. There were scattered suprabasilar mitotic figures and basilar and suprabasilar apoptotic keratinocytes. Keratinocytes in both the hyperplastic outer root sheath and epidermis demonstrated mild to moderate anisocytosis and anisokaryosis. The cytoplasm of occasional spinous layer keratinocytes appeared vacuolated (koilocytosis). There were mild multifocal infiltrates of mixed inflammatory cells (predominantly neutrophils, but also some lymphocytes and plasma cells) in the superficial dermis, epidermis and surrounding some hair follicles in some sections, with concurrent mild dermal oedema. Some sections also contained serocellular crusts on the skin surface, which consisted of cellular debris and degenerate neutrophils, set in an amorphous eosinophilic (proteinaceous) background.

Contributor's Morphologic Diagnosis: Haired Skin: 1. Moderate, multifocal to coalescing, chronic, irregular, follicular and epidermal hyperplasia, hyperkeratosis and dysplasia with occasional koilocytosis 2. Mild, multifocal, subacute, neutrophilic and lymphoplasmacytic superficial and exudative dermatitis

Contributor's Comment: No parasitic, bacterial or fungal organisms were demonstrable using haematoxylin and eosin, Gram Twort or periodic acid Schiff's (PAS) staining techinques. No papillomavirus capsid proteins were detected with indirect immunohistochemistry (using a rabbit polyclonal anti-bovine papillomavirus type 1 antibody [Dako-Cytomation]), though the positive control tissue section from a canine oral papillomavirus-infected tissue sample stained strongly positive. No virions were visualized in the skin fragments processed for transmission electron microscopy, though intranuclear inclusions were not identified by light microscopy of histology sections either.

Multiply primed rolling circle amplification [4] successfully amplified a circular double-stranded DNA genome, which upon restriction enzyme digestion (*Eco*RI, *Bam*HI, *Sal*I, *Bgl*II, *Hin*dIII, *Kpn*I) was ~7.3 kilobase pairs (kb). PCR results indicated the presence of papillomavirus-like L1 and L2 ORFs and polyomavirus-like T antigen ORFs1,3,5. DNA sequencing of the amplicons generated through PCR confirmed these findings.[2] The PCR and restriction enzyme digestion results indicated that the current isolate was similar but not identical to bandicoot papillomatosis carcinomatosis virus type 1 (BPCV1).[7,10] This was later confirmed by complete genomic sequencing of the current virus isolate (GenBank# EU277647), which was consequently named bandicoot papillomatosis carcinomatosis virus type 2 (BPCV2).[2]

In situ hybridization results demonstrated that both the papillomavirus-like and polyomavirus-like parts of the BPCV2 genome could be found within the nuclei of keratinocytes of cutaneous papillomatous lesions of the affected southern brown bandicoot.[7]

Bandicoot papillomatosis carcinomatosis virus type 1 was recently discovered in western barred bandicoots (*Perameles bougainville*) in association with papillomatous and carcinomatous epithelial lesions grossly similar to the lesions evident on the southern brown bandicoot.[1,2,10,11] The BPCVs have certain genomic characteristics typical of *Papillomaviridae* and other genomic features classically associated with *Polyomaviridae*[5]. Their ~7.3 kb double-stranded, circular DNA genomes are similar in size to known papillomaviruses, and they encode structural proteins similar to the L1 and L2 capsid proteins of established papillomavirus types.[2,10] The transforming protein-encoding ORFs, most similar to large T antigen and small t antigen, occur on the opposite DNA strand to the structural protein-encoding ORFs: features characteristic of viruses classified within the *Polyomaviridae*.[2,10]

Mitochondrial DNA evidence suggests the two extant genera, within the family Peramelidae, *Isoodon* and *Perameles*, diverged from a common bandicoot ancestor approximately 10 million years ago.[2,5] The divergence of the host genera from a common ancestor appears to approximately coincide with the divergence of the BPCVs affecting them.[2] This observation is supportive of the concept of virus-host co-speciation in which both modern day hosts and viruses arose from common ancestors.[6,8]

As it stands, the current virus taxonomic paradigm does not comfortably accommodate the BPCVs whose genomic features are intermediate between *Papillomaviridae* and *Polyomaviridae*.[2,10] It is clear the BPCVs are demonstrably and distinctly different to both polyomaviruses and papillomaviruses and as such, their taxonomic position is presently undefined.

The presence of *Hepatozoon* sp. gamonts in blood smears was considered an incidental finding. The prevalence of *Hepatozoon* sp. infection in *I. obesulus* from Perth, Western Australia was 48% by examination of stained blood smears and 58% by PCR of DNA extracted from blood in a recent survey.[9]

AFIP Diagnosis: Skin: Follicular and epidermal hyperplasia and dysplasia, focally extensive, marked with hypergranulosis

Conference Comment: The contributor provided an excellent summary of this condition in bandicoots.

Koilocytes were not seen in the sections reviewed in conference.

Papilloma viruses, of the *Papoviridae* family, are double stranded DNA viruses that form paracrystalline arrays. Cutaneous papillomas of viral origin are quite common in domestic animals. Papillomas can either be viral induced or an idiopathic proliferation of the epidermis. With the exception of bovine papilloma viruses, papilloma viruses are normally site and species specific. Bovine papilloma viruses have been linked to feline cutaneous fibropapillomas and equine sarcoids. There are two general categories of viral induced papillomas, the squamous papilloma and the fibropapilloma.[4]

Squamous papillomas are filiform, exophytic, wart-like masses with marked epidermal hyperplasia and either orthokeratotic or parakeratotic hyperkeratosis with support provided by a thin dermal stalk. The stratum spinosum is markedly acanthotic, and the cytoplasm of virally infected cells may exhibit ballooning degeneration with eccentrically placed nuclei. These cells are known as koilocytes and are a helpful histologic feature. There is also hypergranularity of the stratum granulosum characterized by large, abnormally shaped eosinophilic granules within the cytoplasm. Eosinophilic, intracytoplasmic inclusions represent aggregates of keratin in dying keratinocytes and should not be confused with pox inclusions. Small, rare, basophilic intranuclear inclusions can also occur.[4]

Fibropapillomas, represented by equine sarcoids and feline fibropapillomas, are nodular lesions covered by a hyperkeratotic and hyperplastic epidermis with rete ridge formation. The predominant feature of these lesions is the marked expansion of the dermis by proliferating fibroblasts arranged in haphazard whorls.[4]

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