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Histopathological Features of Cutaneous Squamous Cell Carcinoma in a Dog: A Case Report

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Abstract: This case presents the microscopic features of cutaneous squamous cell carcinoma (SCC) located on the femur of a 7-year-old mixed-breed dog, diagnosed through histopathological examination. A 0.5 cm fragment was sampled from an ulcerated mass and prepared for microscopic evaluation. The tissue fragments were dehydrated in absolute alcohol, embedded in paraffin blocks, sectioned, and stained using the hematoxylin–eosin–methylene blue trichrome technique (H.E.A). Histopathological examination revealed a malignant cellular proliferation arranged in cords, encapsulated by a well-represented fibrovascular stroma. The neoplastic cells exhibited eosinophilic cytoplasm, nuclear pleomorphism, and moderate mitotic activity. Mild keratinization was expressed by the presence of numerous keratin pearls and parakeratotic pearls at various stages of formation, as well as areas of individual cellular keratinization. Based on these histomorphological features, a diagnosis of cutaneous squamous cell carcinoma was established, with well-differentiated margins and a moderate degree of keratinization. The diagnosis was based exclusively on classical histopathological criteria, without performing immunohistochemical examination, as the morphological features were considered characteristic and sufficient for confirmation. This case highlights the importance of histopathological examination and routine staining techniques in the identification of cutaneous tumors in dogs, with the morphological characteristics of squamous cell carcinoma enabling a rapid diagnosis with minimal resources and costs.

Keywords: Squamous cell carcinoma; dog; histopathology; keratin pearls; cutaneous tumor.

• Introduction

Alongside corneocytes, fatty acids, ceramides, and cholesterol, keratin represents the fundamental matrix of the stratum corneum of the skin. When the genetically programmed death of keratinocytes is delayed, their uncontrolled proliferation may lead to the development of squamous cell carcinoma (SCC). Cutaneous squamous cell carcinoma is a malignant neoplasm originating from keratinocytes, characterized by a predominantly locally invasive biological behavior with variable metastatic potential. Cutaneous neoplasms, regardless of the causative factors involved (genetic, environmental, dietary, etc.), account for approximately 30% of all neoplastic processes in dogs [Schneider et al., 2021].

Squamous cell carcinoma represents approximately 5% of all canine skin cancers, with no evident sex predisposition, although a higher frequency has been reported in large, dark-coated breeds such as Rottweilers, Beagles, Giant Schnauzers, Bull Terriers, Standard Poodles, Dachshunds, Dalmatians, Boxers, and Basset Hounds [Jiménez-Alonso AA et al., 2025; Belluco S et al., 2013]. Some studies have also identified dogs with poorly pigmented skin as having an increased susceptibility to the development of this neoplasm. SCC is primarily a tumor of middle-aged to older dogs, being most commonly diagnosed between 7 and 10 years of age. Predisposing factors include ultraviolet radiation, immunosuppression, chronic dermatological diseases, and viral agents such as Papillomavirus. Prolonged exposure to UV radiation induces cellular DNA damage and promotes the development of mutations within epidermal keratinocytes. In addition, alterations in cell adhesion molecules have been associated with tumor progression and invasiveness [Belluco S et al., 2013; Schneider et al., 2021; Łojszczyk A et al., 2021].SCC may occur in a wide range of anatomical locations, from depigmented areas of the head and neck to the abdomen, flanks, and limbs, with a higher frequency reported in the forelimbs. Subungual localization is associated with an increased risk of recurrence in adjacent digits, even following surgical treatment [Belluco S et al., 2013; Łojszczyk A et al., 2021]. The tumor may also develop in the nasal planum, interdigital region, or scrotal area, with anatomical location significantly influencing prognosis and clinical evolution. Although pulmonary metastases have occasionally been reported, recent histopathological studies have demonstrated the absence of a clear morphological correlation between cutaneous SCC and pulmonary tumor lesions. Distant metastases, as well as metastases involving osseous structures, are considered uncommon [Łojszczyk A et al., 2021]. Nevertheless, more recent studies have documented metastatic spread of flank SCC to regional lymph nodes [Seok J et al., 2024].

The diagnosis of squamous cell carcinoma is primarily based on histopathological examination, with the evaluation of tumor differentiation, keratinization, mitotic activity, and local invasion being essential for both prognostic assessment and definitive diagnosis [Jiménez-Alonso AA et al., 2025].

• Material and method

Following surgical excision, a 0.5 cm tissue fragment was collected from a 7-year-old mixed-breed dog presenting an approximately 4 cm ulcerated tumoral mass located at the thigh level.Two tissue fragments measuring approximately 0.2 cm were processed using the conventional histological technique. The samples were dehydrated through successive baths of absolute alcohol, embedded in paraffin blocks, sectioned using a microtome at a thickness of 5 µm, and stained using the hematoxylin–eosin–methylene blue trichrome (H.E.A.) technique. Microscopic examination was performed using an Olympus CX23 binocular microscope equipped with 4×, 10×, and 40× objectives.The microscopic evaluation focused on the assessment of tumor architecture, degree of differentiation, presence of keratinization, stromal characteristics, and mitotic activity.

• Results and discussions

Histopathological examination revealed a malignant cellular proliferation predominantly arranged in cellular cords, delineated by a well-developed fibrovascular stroma (Fig.1). The neoplastic cells exhibited eosinophilic cytoplasm, pleomorphic nuclei, and moderate mitotic activity. Tumoral keratinization ranged from mild to moderate and was evidenced by the presence of numerous keratin pearls and parakeratotic pearls at various stages of development, as well as foci of individual cellular keratinization. (Fig.3). The margins of the neoplastic proliferation displayed a good degree of cellular differentiation, supported by the relatively organized arrangement of the neoplastic cells and their keratin-producing capacity.

The parakeratotic pearls consisted of concentric structures composed of lamellarly arranged keratinocytes, highlighting an incomplete keratinization process characterized by the persistence of nuclei within the central keratinized masses (Fig.2,4). These formations were observed at different stages of development, ranging from compact cellular aggregates to structures with intensely eosinophilic centers, suggesting partial preservation of the squamous differentiation capacity of the neoplastic cells. The predominantly superficial localization of the parakeratotic pearls, in close proximity to the squamous layer, suggests the preservation of a relatively good degree of cellular differentiation and a moderately infiltrative character of the neoplastic proliferation.

The findings obtained in the present case are consistent with the data reported by Schneider et al. (2021), Belluco et al. (2013), and Łojszczyk et al. (2021) regarding the histopathological characteristics of well-differentiated cutaneous squamous cell carcinoma in dogs. Similar to the descriptions provided by Belluco et al. (2013), the neoplastic proliferation observed in the present study was predominantly arranged in cellular cords delineated by a well-developed fibrovascular stroma and associated with evident tumoral keratinization structures. The presence of keratin pearls and parakeratotic pearls identified in the examined sections supports the good degree of cellular differentiation, a feature also described by Schneider et al. (2021) in well-differentiated forms of cutaneous squamous cell carcinoma. The persistence of the keratinization capacity of the neoplastic cells and their relatively organized arrangement represent important histopathological criteria for confirming squamous tumoral differentiation.

The moderate mitotic activity and the presence of foci of individual cellular keratinization observed in the present case are in agreement with the observations reported by Łojszczyk et al. (2021), who demonstrated that well- and moderately differentiated SCCs retain their keratin-producing capacity and exhibit a less infiltrative behavior compared with poorly differentiated forms. Furthermore, the predominantly superficial localization of the parakeratotic pearls, in close proximity to the squamous layer, suggests the preservation of a relatively good degree of cellular differentiation and a moderately infiltrative character of the neoplastic proliferation, findings that are consistent with the histopathological descriptions reported by Belluco et al. (2013) and Schneider et al. (2021).The absence of severe anaplasia, evident lymphovascular invasion, and the preservation of tumoral keratinization distinguish the present case from the poorly differentiated forms described by Łojszczyk et al. (2021), which are characterized by loss of squamous differentiation, deep tissue invasion, and a marked reduction in keratin production.

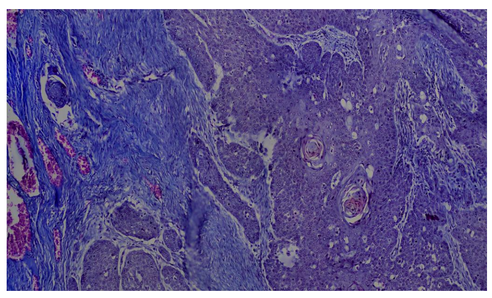

Fig.1. Canine SCC – well-developed fibrovascular stroma H.E.A x10

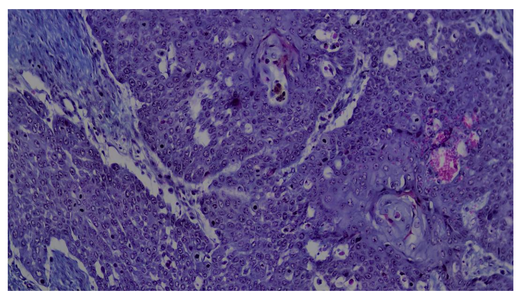

Fig.2. Parakeratotic pearls in different stages of formation. H.E.A stain stain x20

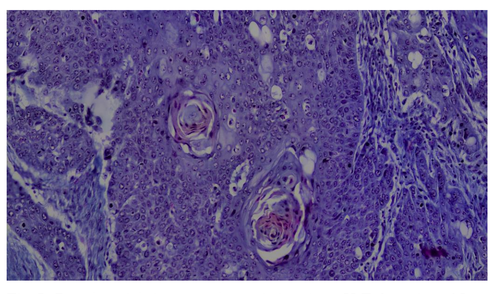

Fig.3. Pearls with intense keratinization. H.E.A stain x40

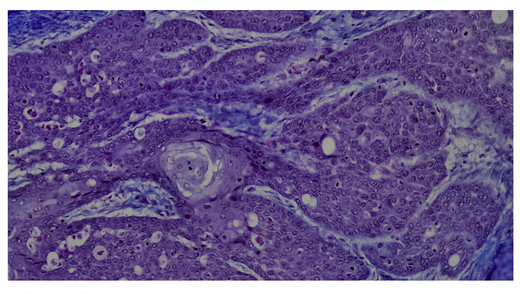

Fig.4. Basophilic concentric structures suggestive of early squamous differentiation. H.E.A stain x40

•Conclusions

Histopathological examination revealed a well-differentiated cutaneous squamous cell carcinoma, characterized by a neoplastic proliferation arranged in cellular cords, with a well-developed fibrovascular stroma and moderate tumor keratinization.

The presence of keratin pearls and parakeratotic pearls, associated with foci of individual keratinization, supported the maintenance of squamous differentiation and a moderately infiltrative tumor behavior. The predominantly superficial localization of parakeratotic pearls, in close proximity to the squamous layer, suggests reduced local invasiveness and a potentially more favorable clinical course compared to poorly differentiated forms.

The diagnosis was established exclusively on the basis of classical histopathological criteria, without the use of immunohistochemical analysis, as the morphological features were considered sufficient to confirm cutaneous squamous cell carcinoma.

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