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Epidemiological and clinicopathological aspects of neoplasms in pigs in the hinterland of Paraíba

Aspectos epidemiológicos e clinicopatológicos das neoplasias em suínos no Sertão da Paraíba

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Highlights

In the hinterland of Paraíba, skin tumors are the most frequent neoplasms in pigs.
Chronic and ulcerative skin lesions are indicative of neoplasia in pigs.
Neoplasms in pigs are rarely considered a reason for euthanasia.
Tumors in pigs are occasionally considered incidental findings at slaughter.

Abstract

Neoplasms in pigs are rare and are occasionally associated with clinical signs and reasons for euthanasia in Brazil. This study describes the epidemiological, clinical, and anatomopathological aspects of neoplasms in pigs in the hinterland of Paraíba, Brazil. A retrospective investigation was conducted from biopsy and necropsy reports of pigs diagnosed with neoplasms at the Animal Pathology Laboratory of the Federal University of Campina Grande from 2003 to 2022. Seven neoplasms were diagnosed, namely: squamous cell carcinoma (SCC), melanoma, nephroblastoma, and hemangiosarcoma. Squamous cell carcinoma was diagnosed in three adult females housed in pens with access to sunlight; in only one case was it considered a reason for euthanasia. Macroscopically, the ulcerative and crusted lesions were located in various locations on the backs of the animals. Melanoma was identified in two

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cases, both approximately one year old, presenting as multifocal, solitary, soft, and blackened masses. Hemangiosarcoma was diagnosed in a one-year-old male with ulcerative, multilobular, and soft nodular lesions. Nephroblastoma was considered an incidental finding during inspection at the slaughterhouse in one case. Macroscopically, it was characterized by a multilobular, firm, yellowish-white tumor mass measuring 8 cm in diameter, attached to the renal capsule and extending into the medullary region upon sectioning. The neoplasms were considered uncommon. However, skin tumors were the most frequently observed, with lesions persisting for up to one year. This location is associated with prolonged exposure to ultraviolet light, a triggering factor for skin neoplasms. Young animals were commonly affected, highlighting an important epidemiological characteristic of these pathologies in the species. The diagnosis of proliferative lesions in these animals is important for differentiating them from non-neoplastic conditions, especially in slaughterhouse environments.
Key words: Squamous cell carcinoma. Swine diseases. Melanoma. Neoplasia.

Resumo

As neoplasias na espécie suína são raras, sendo ocasionalmente descritas associadas a sinais clínicos e motivos para eutanásia no Brasil. Descrevem-se os aspectos epidemiológicos, clínicos e anatomopatológicos dos neoplasmas em suínos no Sertão da Paraíba. Foi realizado um estudo retrospectivo dos laudos de biópsia e necropsias de suínos diagnosticados com neoplasias no Laboratório de Patologia Animal da Universidade Federal de Campina Grande durante os anos 2003 a 2022. Foram diagnosticadas sete neoplasias, sendo: carcinoma de células escamosas (CCE), melanoma, nefroblastoma e o hemangiossarcoma. O CCE foi diagnosticado em três fêmeas adultas que ficavam alojados em baias com acesso ao sol, em apenas um caso o foi considerado como motivo de eutanásia. Macroscopicamente as lesões ulcerativas e crostosas possuíam diferentes localizações no dorso dos animais. O melanoma foi identificado em dois casos, ambos com idade aproximada de um ano apresentando-se como massas multifocais, solitárias, macias e enegrecidas. O hemangiossarcoma foi diagnosticado em um macho de um ano de idade com lesões nodulares ulcerativas, multilobuladas e macias. O nefroblastoma foi considerado como um achado incidental durante a inspeção no abatedouro em um caso, macroscopicamente caracterizou-se por massa tumoral multilobulada, firme, branco-amarelada, medindo 8 cm de diâmetro, aderida a cápsula renal que ao corte estendia-se até a região medular. Os neoplasmas foram considerados pouco frequentes. Contudo, os tumores mais frequentes estavam acometendo a pele com evolução das lesões de até um ano. Essa localização possibilita a associação com exposição prolongada à luz ultravioleta, fator desencadeante de neoplasias cutâneas. O acometimento de animais jovens foi comum, evidenciando uma característica epidemiológica importante dessas patologias na espécie. A realização do diagnóstico de lesões proliferativas nesses animais é importante como diferencial de condições não neoplásicas principalmente em abatedouros.
Palavras-chave: Carcinoma de células escamosas. Doenças de suíno. Melanoma. Neoplasia.

Introduction

In domestic pigs (Sus scrofa domesticus), neoplastic changes are considered rare (Brum et al., 2013). This rarity is partly attributed to the commercial practice of slaughtering pigs before they reach full maturity, thus reducing the likelihood of neoplasia development. However, the most commonly described tumors in the species occur in younger animals and include lymphoma (Ogihara et al., 2012), nephroblastoma (Grieco et al., 2006), and melanoma (Teixeira et al., 2013). These tumors are rarely associated with clinical signs or metastasis.

Neoplastic lesions can exhibit nonspecific characteristics that may be mistaken for non-neoplastic proliferative changes or inflammatory/infectious conditions, such as fungal or bacterial granulomas. Therefore, despite their low economic impact, the anatomopathological characterization of neoplasms in pigs is critical for determining the appropriate management of carcasses on slaughter lines and/or for the prognosis of affected animals (Morey-Matamalas et al., 2021).

Tumors in pigs are occasionally reported in Brazil through individual case reports (Resende et al., 2015; Santos et al., 2016; Pereira et al., 2018) or retrospective studies (Ramos et al., 2008; Brum et al., 2015). Thus, the aim of this study is to describe the neoplasms diagnosed in pigs at the Animal Pathology Laboratory of the Federal University of Campina Grande, Patos campus, Paraíba, Brazil. This research outlines the primary epidemiological, clinical, and anatomopathological features of these tumors, providing essential insights to assist veterinarians, pathologists, and slaughterhouse inspectors in recognizing and diagnosing these conditions.

Material and Methods

We reviewed necropsy and biopsy reports from pigs at the Animal Pathology Laboratory (LPA) at the University Veterinary Hospital (HVU) of the Federal University of Campina Grande (UFCG) covering the period from January 2003 to December 2022 to identify cases of neoplasia.

From the records that documented a diagnosis of neoplasia, we extracted epidemiological data (sex, breed, age, farming system, and origin), along with clinical signs and anatomopathological findings. For the microscopic analysis, we reexamined histological slides from the cases and prepared new slides from tissue samples archived in paraffin blocks. All tissue sections were routinely processed and stained with hematoxylin and eosin (H&E).

Results and Discussion

During the study period, 155 necropsies and 38 biopsies were performed on domestic pigs (Sus scrofa domesticus). Of these, one case (1/155; [0.6%]) was diagnosed with neoplasia at necropsy, and six cases (6/38; [15.7%]) were diagnosed through biopsy material. All affected animals originated from subsistence farms in the state of Paraíba and were of mixed breed (5/7). Table 1 presents the main epidemiological and clinical data of the affected pigs.

Table 1
Epidemiological and clinical data of pigs diagnosed with neoplasia at LPA/UFCG from January 2003 to December 2022

Case	Diagnosis	Sex	Breed	Age	Location	Evolution	Clinical signs
1	SCC	Female	Mixed	3 years	Skin	5 months	Multifocal, proliferative, ulcerative, and crusted lesions.
2	SCC	Female	Mixed	4 years	Skin	2 months	Diffuse ulcerative lesions in the back region.
3	SCC	Female	Mixed	3 years	Skin	1 year	Multifocal ulcerative lesions in the ear and right dorsal flank.
4	Melanoma	Male	Mixed	> 1 year	Skin	1 month	Firm, blackened, and painless proliferative mass measuring 2 cm in diameter in the lateral medial third of the left hind limb.
5	Melanoma	Female	Mixed	1 year	Skin	3 months	Blackened nodule, 5 cm in diameter, in the frontal region; excisional biopsy performed.
6	Hemangiosarcoma	Male	Large White	1 year	Skin	4 months	Proliferative and ulcerated masses that bleed easily, located in the scrotum and right axillary region.
7	Nephroblastoma	-	-	-	Kidney	-	Asymptomatic.

Neoplasms in pigs are rarely encountered in the diagnostic routine at LPA/UFCG, a finding that aligns with similar studies from the southern region of the country, where a low incidence of tumors has been observed compared to other domestic species (Ramos et al., 2008; Brum et al., 2013, 2015). This low occurrence is likely due to the economic practices involving these animals, where pigs are typically slaughtered at the end of the finishing stage, around 10 months of age.

The types of neoplasms identified included squamous cell carcinoma (SCC) (3/7), melanoma (2/7), nephroblastoma (1/7), and hemangiosarcoma (1/7). Six of these cases involved the skin, and one involved the kidney, the latter detected during an inspection at a local slaughterhouse. Skin tumors are relatively rare in pigs, but there are documented instances of hemangioma, papilloma, and mastocytoma in the literature (Pereira et al., 2020; Rasche et al., 2022).

Over the 20-year survey period, SCC was the most frequently diagnosed tumor, identified in three mixed-breed adult females intended for breeding. These animals are known to be replaced at an older age during breeding cycles. While SCC can affect younger animals, its incidence increases with age (Santos et al., 2016; Ramos et al., 2008). Information available in the literature on SCC in pigs is scarce, especially in Brazil, with only a few isolated cases described (Brum et al., 2015).

The affected animals were housed in pens with access to sunlight and had histories of non-healing skin lesions ranging from two months to one year of evolution. In one instance, SCC was deemed a sufficient cause for euthanasia. Several risk factors have been linked to the development of these neoplasms, including prolonged exposure to ultraviolet (UV) light, particularly in animals with depigmented skin (Kleinschmidt et al., 2006; Barbosa et al., 2009; Reis et al., 2016).

Squamous cell carcinoma was characterized by lesions located variably across the backs of the animals, sometimes appearing diffusely. Macroscopically, the SCC lesions presented as ulcerative and crusted with irregular edges, ranging from round to oval and varying in size (Figure 1A). Upon sectioning, they revealed an irregular, whitish surface interspersed with reddish multifocal areas and occasional well-defined yellowish punctate areas (Figure 1B).

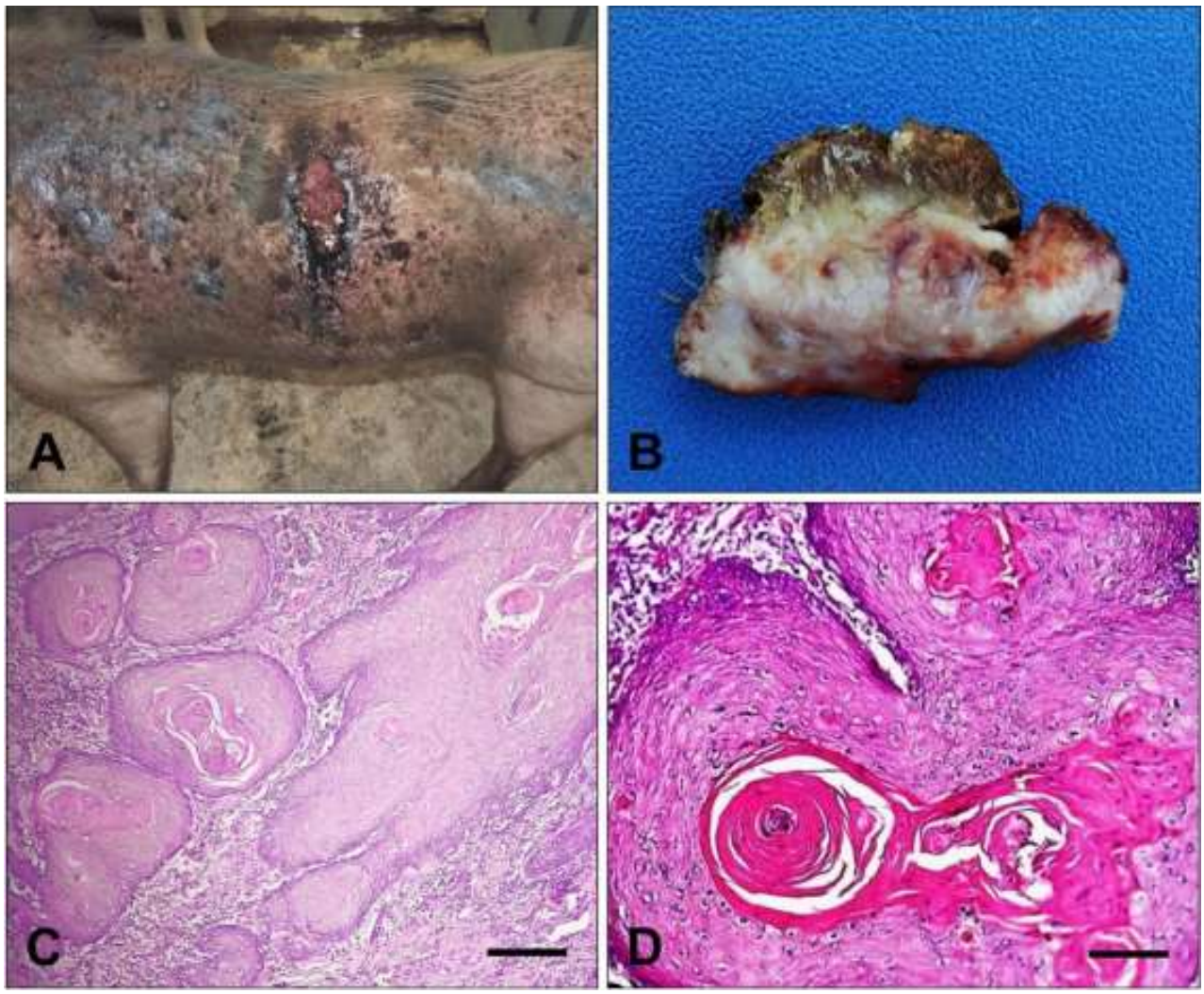

Figure 1. Squamous cell carcinoma in pigs.
(A) Dorsal view of skin showing multifocal round to oval ulcerated areas with varying sizes and irregular borders. **(B)** Skin: a cutaneous nodule with an irregular, poorly delimited, and infiltrative sectioned surface, displaying multifocal reddish areas and occasional yellowish punctiform areas. **(C)** Skin: proliferation of epithelial cells arranged in nests in the dermis; HE, 10x magnification. **(D)** Skin: in the center of some nests, the formation of concentric lamellae of keratin (horny pearls) is visible; HE, 20x magnification.

Microscopically, all cases showed a non-encapsulated, ulcerated, and infiltrative tumor mass, composed of epithelial cells arranged in nests and papillary projections supported by a moderate fibrous stroma, extending from the epidermis to the dermis (Figure 1C). The neoplastic cells varied from polygonal to oval, featuring abundant, eosinophilic, and well-defined cytoplasm. These cells also displayed large, rounded nuclei with loose chromatin and one or more prominent nucleoli. Observations included mild anisocytosis and anisokaryosis, with no mitoses noted. In the center of some nests, eosinophilic material was distributed in a lamellar arrangement, indicative of horny pearls. Moderate individual keratinization of keratinocytes was also evident (Figure 1D).

Melanoma was the second most commonly diagnosed skin tumor, found in two mixed-breed animals. High frequencies of melanomas and melanocytomas are described in breeds such as Sinclair, Duroc, Hormel, Hampshire, and Iberian (Misdorp, 2003; Perez et al., 2002). In surveys of melanocytic lesions in pigs slaughtered for consumption, melanoma has been reported as the predominant malignant cutaneous tumor in the species (Teixeira et al., 2013).

Several studies suggest that melanomas often have a congenital and/or hereditary origin, appearing within the first weeks of a pig's life (Smith et al., 2002; Jagdale et al., 2019; Apiou et al., 2022). This is corroborated by our findings, where in the first case, the diagnosis was made when the pig was 42 days old. The lesion had been noted for approximately one month, and in the second case, a history of similar lesions was also found in the parent of the animal.

Macroscopically, melanomas were characterized by masses that were either multifocal or solitary, with irregular edges and a uniformly blackened surface, occasionally displaying multifocal ulcerations. Upon sectioning, these masses appeared soft, irregular, and diffusely blackened. Microscopically, melanomas consisted of densely cellular, poorly delimited, and infiltrative neoformations within the dermis, composed of malignant mesenchymal cells arranged in mantle-like patterns and supported by a moderate fibrovascular stroma (Figure 2A). Neoplastic cells ranged from spindle-shaped to rounded, with well-defined cytoplasm containing a large amount of brownish granular pigment (melanin). The nuclei were round, with moderately condensed chromatin and barely visible nucleoli (Figure 2B). Nuclear atypia and frequent mitotic figures were observed, with 3 to 8 per field at the highest magnification (400x). The neoplastic cells extended beyond the surgical margins.

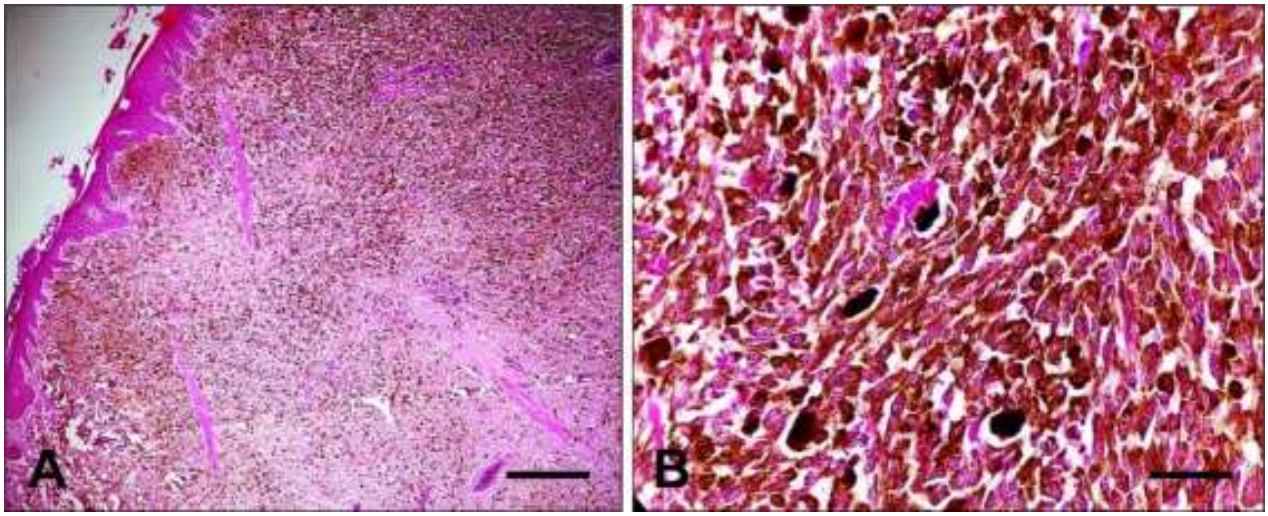

Figure 2. Melanoma in pigs.
(A) Skin: proliferation of melanocytic cells arranged in a mantle infiltrating the dermis; HE, 10x magnification. **(B)** Skin: slightly elongated to rounded neoplastic cells rich in melanin within the cytoplasm; HE, 40x magnification.

Hemangiosarcoma was identified in an animal with multifocal skin lesions. While hemangiosarcoma and hemangioma in pigs have been noted in various organs such as the skin, liver, spleen, meninges, and in a diffuse form (Spitzbarth et al., 2011; Kessler et al., 2019), the observed tumors were macroscopically characterized by ulcerated, multilobular, and soft nodular lesions with sometimes depressed surfaces, measuring up to 2 cm in diameter (Figure 3A). The cut surface appeared reddish and poorly defined (Figure 3B). Similar characteristics were recently described in a case of hemangiosarcoma in the scrotum of a pig (Silveira et al., 2021).

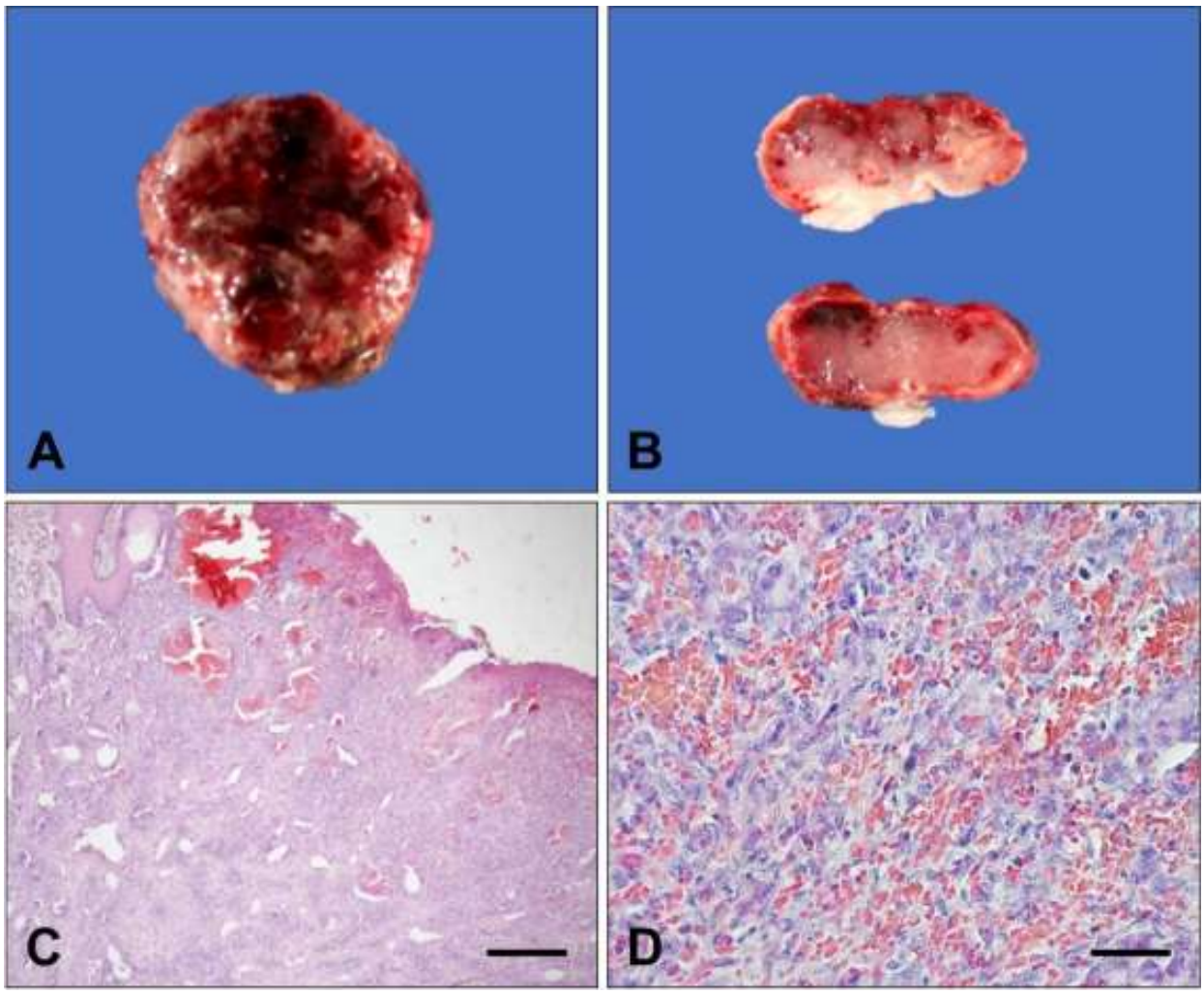

Figure 3. Hemangiosarcoma in pigs.
(**A** and **B**) Skin: cutaneous nodule with a multilobular, ulcerated tumor mass exhibiting a diffusely reddish and poorly delimited sectioned surface. (**C**) Skin: ulcerated and infiltrative tumor mass composed of vascular channels of various calibers filled with blood within the dermis; HE, 10x magnification. (**D**) Skin: vascular channels lined by elongated to polygonal cells with abundant and poorly delimited eosinophilic cytoplasm, and oval nuclei with loose chromatin and evident nucleoli; HE, 40x magnification.

Microscopically, the hemangiosarcomas presented as non-encapsulated, ulcerated, infiltrative, and poorly delimited masses composed of spindle cells arranged in vascular patterns filled with blood and supported by scant fibrovascular stroma (Figure 3C). The vascular channels were lined by elongated to polygonal cells with abundant, poorly defined eosinophilic cytoplasm. Nuclei varied from round to oval, featuring loose chromatin and evident nucleoli. Pleomorphism was pronounced and characterized by anisocytosis and anisokaryosis (Figure 4D).

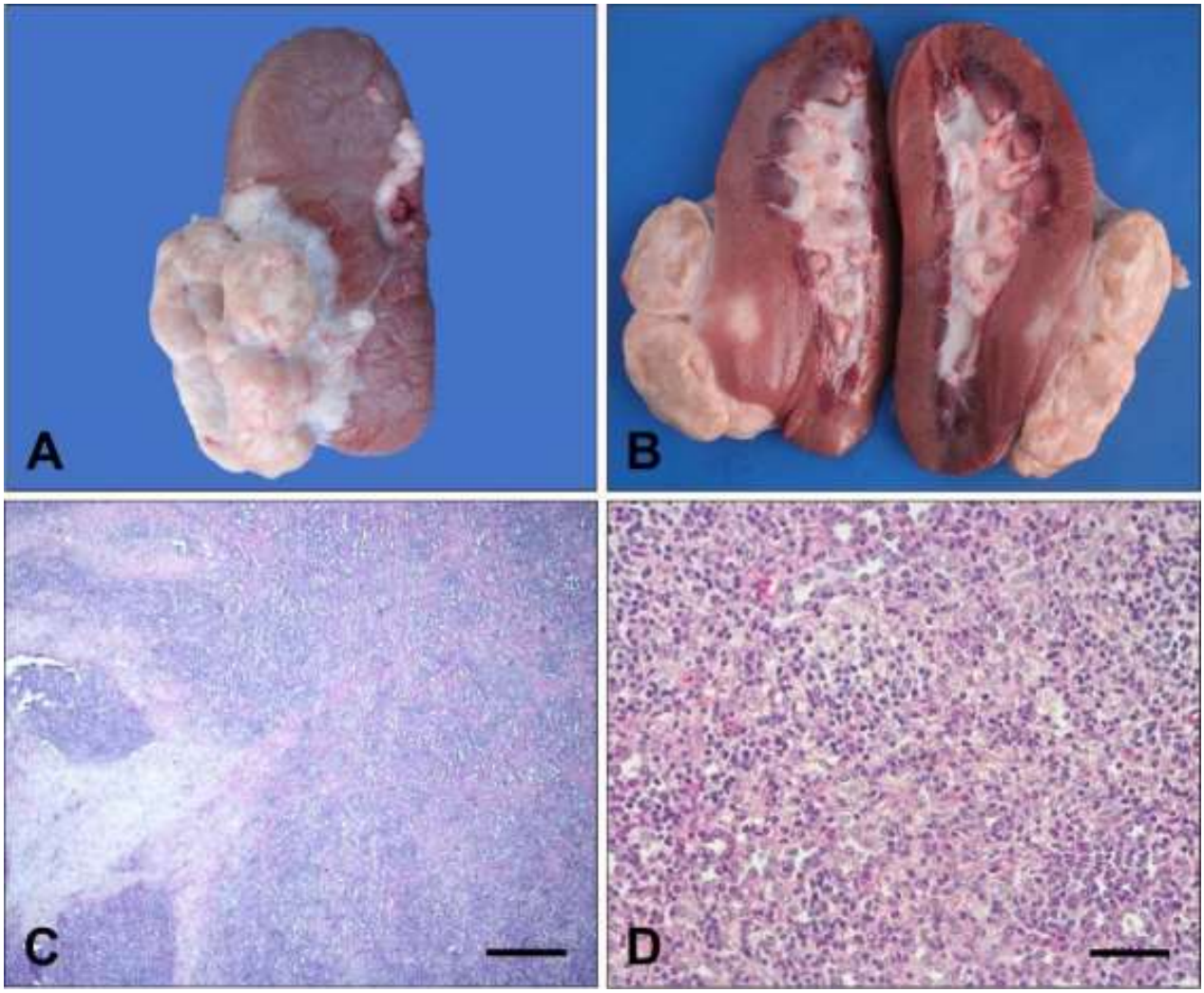

Figure 4. Nephroblastoma in pigs.
(**A** and **B**) Kidney: multilobular, elevated, yellowish-white mass partially adhered to the renal capsule. The sectioned surface is whitish and multilobular, extending to the medullary region with moderate compression of the renal pelvis. (**C**) Kidney: densely cellular tumor mass composed of epithelial cells arranged in irregular tubules and in tufted projections into the lumen (primitive glomeruli) and mesenchymal cells in collagenous stroma (embryonic mesenchyme); HE, 10x magnification. (**D**) Kidney: epithelial cells from cuboidal to elongated with scant and indistinct cytoplasm. The nuclei are round with loose chromatin and, occasionally, evident nucleoli; HE, 20x magnification.

Nephroblastoma was diagnosed in one case and was considered an incidental finding during inspection at the slaughterhouse. Generally, these tumors do not exhibit clinical signs and are most often diagnosed only at the time of slaughter (Grieco et al., 2006; Morey-Matamalas et al., 2021). However, there have been instances where nephroblastoma was cited as the cause of death in a pig, with metastases observed in the lymph nodes, lung, internal chest wall, liver, and uterus (Brum et al., 2015).

The occurrence of nephroblastoma in this study was lower than in similar studies conducted in Brazil, where it is identified as the second most frequently found tumor during slaughterhouse inspections of this species (Grieco et al., 2006). This discrepancy is likely due to the infrequent practice among local veterinarians of sending lesions found during slaughter to diagnostic laboratories.

Macroscopically, the tumor presented as a multilobular, firm, yellowish-white mass measuring 8 cm in diameter, attached to the renal capsule (Figure 4A). Upon sectioning, the mass extended from the cortical to the medullary region associated with moderate compression of the renal pelvis (Figure 4B). Given the macroscopic characteristics and the involvement of the renal parenchyma, a differential diagnosis with lymphoma is necessary due to its high frequency in pigs (Brum et al., 2015).

The tumor mass was densely cellular, expansive, and encapsulated, comprising two distinct groups of cells: epithelial cells arranged in irregular tubules and tufted projections into the lumen (interpreted as primitive glomeruli), and mesenchymal cells embedded in collagenous stroma (representing embryonic mesenchyme) (Figure 4C). The mass was encapsulated by fibrocollagenous intralobular stroma. The epithelial cells ranged from cuboidal to elongated with scant, poorly defined cytoplasm. Nuclei were round with loose chromatin and, occasionally, prominent nucleoli. Pleomorphism was mild, characterized by anisokaryosis without mitotic activity (Figure 4D). The mesenchymal cells ranged from spindle-shaped to oval with discrete, eosinophilic, and poorly defined cytoplasm. The nuclei were oval with reticulated chromatin, and pleomorphism was mild, again noted by anisokaryosis without mitoses.

Conclusions

Neoplasms in pigs are rare in the hinterland of Paraíba, with euthanasia being justified in only one reported case. Skin neoplasms were the most frequent and may be linked to ultraviolet light exposure and hereditary factors. Occurrence in young animals was common, highlighting an important epidemiological characteristic of these pathologies in the species. Although typically considered an incidental finding at slaughter, nephroblastoma should be included as a differential diagnosis when assessing other neoplasms such as lymphoma. Diagnosis and characterization of proliferative lesions in pigs are important for establishing differential diagnoses from non-neoplastic conditions within the species.

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