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Throughout Pathological Study on Skin, Subcutaneous and Mucosal Neoplasia of the Dromedary Camel

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Abstract

The aim of this study was to record, classify and describe some external tumors of single-humped camels as well as their diagnosis after surgical excision and to determine the link between occurrence of tumors and breed, sex, age, coat color, and tumor location. Clinical cases of tumors ($n = 26$) were presented for surgical treatment. Camels were subjected to detailed study including breed, age, sex, and coat color of the animal, case history, gross and microscopic appearance of the tumor, surgical treatment, and postoperative care. This study showed that tumors were seen in three local breeds: Maghateer ($n=13$), Majaheem ($n=12$), and Sofr ($n=1$). Four different types of tumors were diagnosed in camels, namely, squamous cell carcinoma (SCC), fibroma, lipoma and fibromyxosarcoma. The most common type of tumor in Maghateer breed which have white colored coat was SCC (69.2%), while in Majaheem breed which have dark brown to black coat was fibroma (66.7%). Incidence of neoplasia was significantly higher in females than males. The age of the animals had no significant effect either on the site or type of tumor.

Key words: neoplasia, description, epidemiology, single humped camel

Introduction

Neoplasms of the skin and subcutaneous tissues are the most frequently recognized neoplastic disorders in domestic animals (8,10,28). Skin neoplasms have been reported as solitary cases in camels. A case report of squamous cell carcinomas (21, 25) and basal cell carcinoma (1) has been described in camels. On the other hand, cases of internal neoplasia such as renal cell carcinoma (30), bronchoalveolar adenocarcinoma (7), salivary fibro-adenocarcinoma (18), rhabdomyosarcoma (32), and seminoma with cholangiocarcinoma (4) have also been reported in camels.

Spontaneously or naturally occurring tumors in domestic animals are of particular interest for comparative studies. Prolonged and continuous exposure to sunlight is the best known etiologic factor, and a sunlight-induced-skin cancer relationship has been established in several

domestic species (29). Ultraviolet radiation (UV) is the major etiologic agent in skin cancer development (24), especially squamous cell carcinoma in cows, goats, sheep, cats and dogs (16).

The aim of this study was to record, classify and describe some external neoplasms of single-humped camels as well as their histopathological diagnosis after surgical excision, and to determine the link between occurrence of tumors and breed, sex, age, coat color, and tumor location.

Materials and methods:

Animals

The present study was carried out on 26 clinical cases of camels with tumors that were presented to the Veterinary Teaching Hospital, College of Agriculture and Veterinary Medicine, Qassim University, Saudi Arabia from

September, 2007 to June, 2010. Qassim's weather (latitude 26°-20° N, longitude 43°-47° E, altitude 640 m) is sunny most of the year. Annual range of minimum temperature is 8-28°C and that maximum temperature is 21-45°C. Annual air humidity range is 18-59%.

Camels with tumors were subjected to detailed study, recording breed, age, sex, and coat color of the animal, history of each case, and gross and microscopic appearance of the tumors.

Surgical treatment

Routine surgical procedures concerning previous fasting, anesthetics and surgery proper, either with or without cauterization, were used to remove the neoplasms. The excised masses had surrounding normal tissue to ensure the existence of free tumor borders. Each animal was given postoperative antibiotics therapy. For small tumors the skin and subcutaneous tissue were sutured whereas for the large tumors the wound was allowed to second intention healing.

Histopathology

Specimens from the surgically-excised tumors were fixed in 10% buffered formalin and embedded in paraffin by routine methods. Sections, 4 µm thick, were stained with hematoxylin and eosin (HE) (2). Mitotic index was determined by counting mitotic figures in 30 random high power fields (1 hpf = 0.159 mm²) in HE stained sections of tumors according to the method described by Yu et al. (31). Areas of tumor sections having highly cellular activity were selected to count mitotic figures.

Statistical analysis

The data were expressed in percentages. Differences in percentages were evaluated by the χ^2 -test. SPSS program for Windows (version 18, 2008) was used for data analysis. The level of significance was set at $P < 0.05$.

Results:

Incidence of neoplasia was significantly higher in females (24/26, 92.3%) than males (2/26, 7.7%) ($P < 0.0001$). This study showed that tumors were seen in three local breeds: Maghateer ($n=13$), Majaheem ($n=12$), and Sofr ($n=1$) (Table 1). The age of the animals had no significant effect either on the site ($P < 0.06$) or type ($P < 0.2$) of tumors. History of the cases indicated that the tumors were noticed between 4 months and 2 years before presentation to the hospital but the majority occurred between 1 and 1.5 years. The color of the coat of the affected camels was white (Maghateer), dark brown to black (Majaheem), or light brown (Sofr).

Tumors were seen intraoral on the gum, tongue, cheek and lips ($n=3/26$, 11.6%), neck ($n=3/26$, 11.6%), soft palate (dulaa) ($n=1/26$, 3.9%), on the sacrum ($n=3$, 11.6%), on the abdominal wall ($n=7/26$, 26.9%), and on the hind limbs ($n=9/26$, 34.6%). Tumors were noticed more commonly in the hind limbs and abdominal wall compared to mouth, sacrum, neck or dulaa ($P < 0.05$).

According to histopathological analysis, neoplasms were categorized into 4 different types; squamous cell carcinomas (SCC) ($n=13$, 50%), fibroma ($n=10$, 38.6%), lipoma ($n=1$, 3.8%) and fibromyxosarcoma ($n=2$, 7.6%). Both SCC and fibroma were more common than fibrosarcoma and lipoma ($P < 0.001$).

The more common type of tumor in Maghateer camels was SCC (9/13, 69.2%). Fibroma (2/13, 15.4%) and fibrosarcoma (2/13, 15.4%) occurred in less frequencies. The common type of tumor in Majaheem camels was fibroma (8/12, 66.7%). SCC (3/12, 25%), lipoma (1/12, 8.3%) were observed in less frequencies. Only squamous cell carcinoma was observed in Sofr breed.

Gross appearance of tumors:

Squamous cell carcinoma varied in shape from oval to round and sometimes irregular with variable sizes according to its developmental age. Oval and irregular SCC measured from 10x15 cm. However, rounded SCCs were up to 25 cm in diameter. The tumor mass appeared soft to firm, multilobular, rough-surfaced and occasionally bled. Exudation and fetid odor were also noticed in some cases of SCC. SCCs were seen on the ventrolateral or ventral abdominal wall ($n=7$) (Fig. 1A), lateral aspect of the thigh ($n=1$) (Fig. 1B), sacrum ($n=3$) (Fig. 1C), gum ($n=1$) and dulaa ($n=1$) (Fig. 1D).

Fibromas appeared as conical to ball-like swellings with variable sizes. The base of the swelling was usually wide. They were recorded on the neck ($n=3$), caudal aspect of the thigh ($n=6$), and on the lateral aspect of the fetlock joint ($n=1$) (Fig. 2A-C). While, lipomas were seen as rounded to oval swellings with rough surfaces and attached to the dorsal aspect of the hock joint with a broad fold of skin (Fig. 2D). Fibromyxosarcomas were recorded as intraoral tumors of the gum, tongue, cheek, and lips. They were diagnosed in Maghateer she-camels. They appeared as multiple, multilobular swellings of variable sizes and rough surfaces. The size ranged from few millimeters to few centimeters (Fig. 2E,F).

Histopathology

Two different types of SCC were observed; ten cases were of well differentiated type and three of poorly differentiated type. Well differentiated SCCs were characterized by irregular masses of epidermal cells that proliferated downward into the dermis. The invading masses composed of concentric layers of squamous cells showing gradually increasing keratinization toward the

center in the form of horn pearls (Fig. 3A). The centers showed either incomplete or complete keratinization (Fig. 3B). In poorly differentiated SCCs, no horn pearls could be observed. The cell masses were surrounded by pale staining connective tissue stroma (Fig. 3C). Keratinization occurred only in small cell groups (Fig. 3D). The

neoplastic cells were atypical with pleomorphic nuclei, and prominent nucleoli (Fig. 3E). Other characteristics included high mitotic activity. The mitotic index was 2.17 ± 0.13 . and frequent mitotic atypia was detected (Fig. 3F).

Table 1. Breed and sex distribution of tumors in camels ($n=26$).

Tumor	Breed						Total
	Maghateer		Majaheem		Sofr		
	Male	Female	Male	Female	Male	Female	
Squamous Cell Carcinoma	0	9	1	2	0	1	13
Fibroma	0	2	1	7	0	0	10
Lipoma	0	0	0	1	0	0	1
Fibromyxosarcoma	0	2	0	0	0	0	2
Total	0	13	2	12	0	1	26

Lipoma was encapsulated by a connective tissue capsule which sent trabeculae into the tumor mass dividing the neoplasm into lobules. The tumor was composed of differentiated fat cells of irregular size and shape (Fig. 4A).

Fibroma consisted of fibroblast cells running in different directions. Their nuclei were long, narrow and densely stained with scanty cytoplasm. Bundles of collagen separated the cells (Fig. 4B). Fibromyxosarcoma consisted of irregular cells with irregular large nuclei. Numerous mitotic figures could be seen (Fig. 4C). The mitotic index was 1.48 ± 0.14 . Within the tumor, myxomatous elements were observed, which consisted of spindle shaped and stellate shaped fibroblasts, with long branching fibrils suspended in an abundance of intercellular matrix (Fig. 4D).

Discussion

Camel neoplasms were categorized in 4 different types arranged according to frequency; SCCs, fibromas, fibromyxosarcomas, and lipomas. Incidence of neoplasia was significantly higher in females than males ($P < 0.0001$). SCC was the most common tumor in the Maghateer breed ($P < 0.05$). Fibroma was the most common tumor in the Majaheem breed ($P < 0.05$).

In comparison to other tumors, skin tumors, especially benign ones, have been cited to occur more frequently and are more often removed surgically (11,28). A number of benign and malignant tumors have been previously reported in the skin and subcutaneous tissues of one-humped camels. The most common examples include papillomas, squamous cell carcinomas, myxomas, fibromas and fibrosarcomas (6, 19, 21, 25).

Cutaneous SCCs were seen in an increased frequency in camels especially on the Maghateer breed of

the white colored coat ($n = 9, 69.2\%$). SCC has been described on parts of the body poorly covered by hair or wool (14, 26, 28). Both ultraviolet light exposure (13, 22, 28) and exposure to photosensitizing plants are proposed etiologic factors. Goats with white- or gray-haired areas also appear to be predisposed to cutaneous SCC (28). The geographical region of the present study with prolonged exposure to sunlight per day may increase exposure to ultraviolet radiation. The white colored coat increased the sensitivity to such radiation with subsequent occurrence of SCC. The sunlight-associated neoplasms in animals include SCC of the pinnae and external nares in white cats (27), SCC of the eye and periocular structures in white-faced cattle (28), carcinomas of the vulva in sheep and cattle (28), the perineum in goats (3), the ear and other areas poorly covered by wool in sheep (12,14), and carcinoma of the non-pigmented glabrous skin of the ventral abdomen in dogs (10). The vast majority of SCC in camels of the present study was recorded on the abdominal wall ($n = 7$).

Frequently, tumors are associated with scar tissue around identification ear tags or punch holes (14). There were no history of wounds in camels of the present study; however, wounds due to wire fences, rough rocky ground might be predisposing factors for camel tumors.

Camel neoplasia of the present study was more frequent in females ($n = 24, 92.3\%$). This might be explained because of slaughtering of males for meat consumption. Thus, we may infer that females may be overrepresented. Similar results have been already reported (20). Moreover, skin neoplasms have been observed in domestic animals more commonly in females (56.5%) than males (43.5%) (11). Although in the present study tumors were diagnosed in adult camels, there was no particular age that predisposed to carcinogenesis.

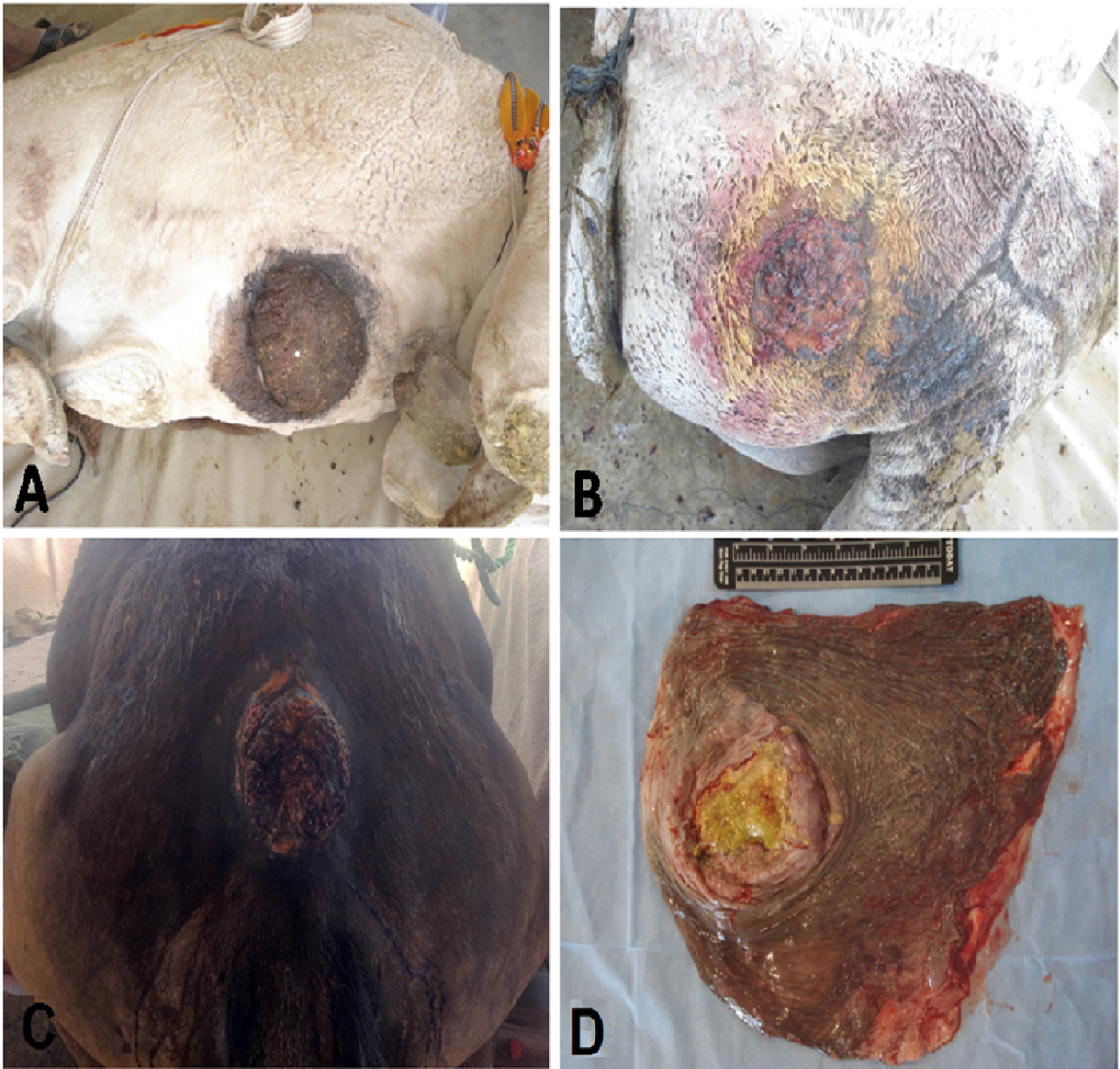


Figure 1. Squamous cell carcinoma on the ventral aspect of the abdominal wall of a Maghateer female camel (A), on the lateral aspect of the thigh in a Maghateer female camel (B), on the sacral area of a Majaheem female camel (C), and in a surgically excised dulaa of a male Majaheem camel (D).

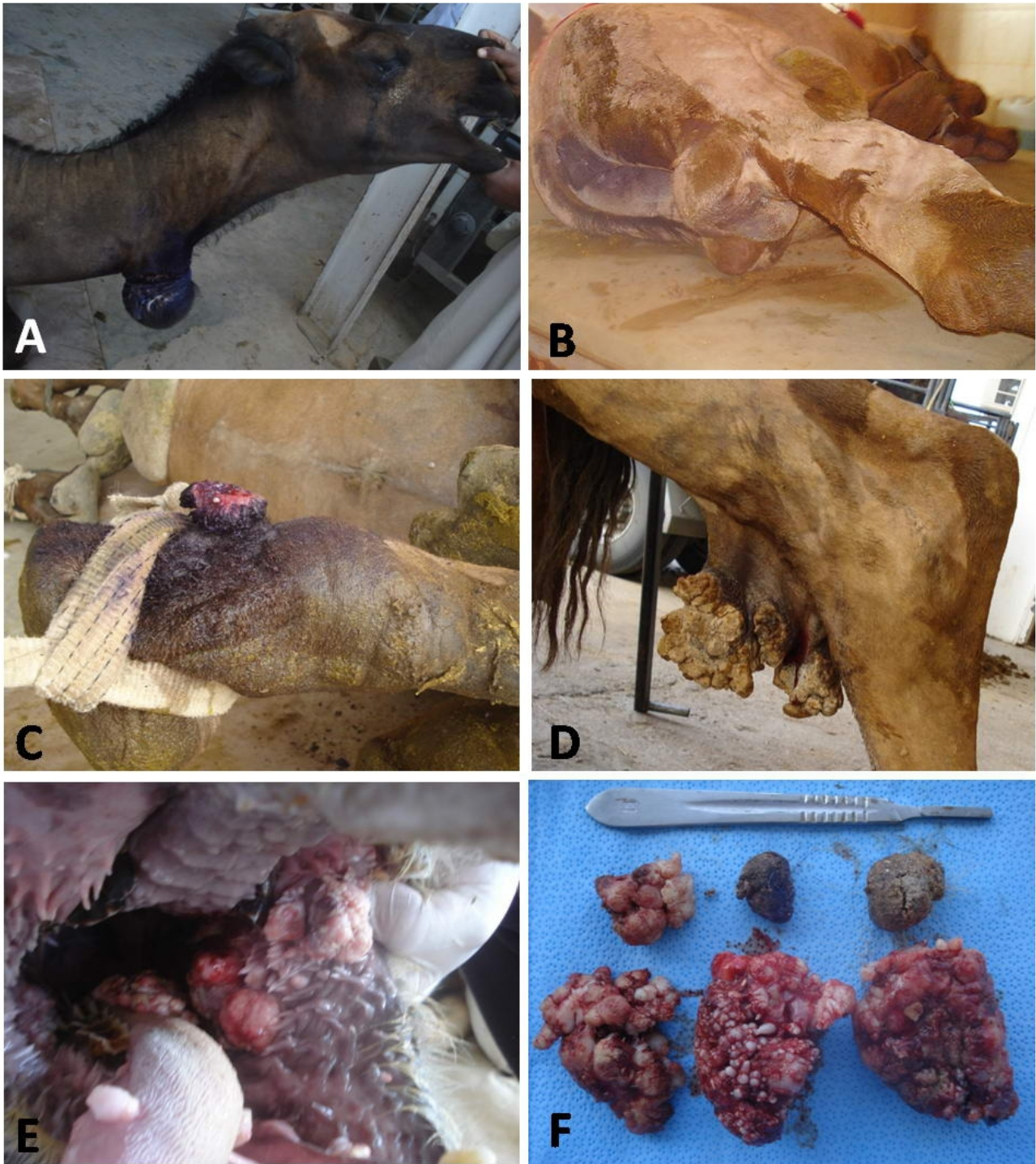


Figure 2. Fibroma on the ventral aspect of the neck in a Majaheem female-camel (A), on the caudal aspect of the thigh in a Maghteer female-camel (B), and on the lateral aspect of the fetlock region in a Majaheem female-camel (C). Lipoma on the dorsal aspect of the fetlock joint of a Majaheem female-camel (D). Intraoral fibromyxosarcomas in Maghteer female camel (E) and after their surgical excision (F).

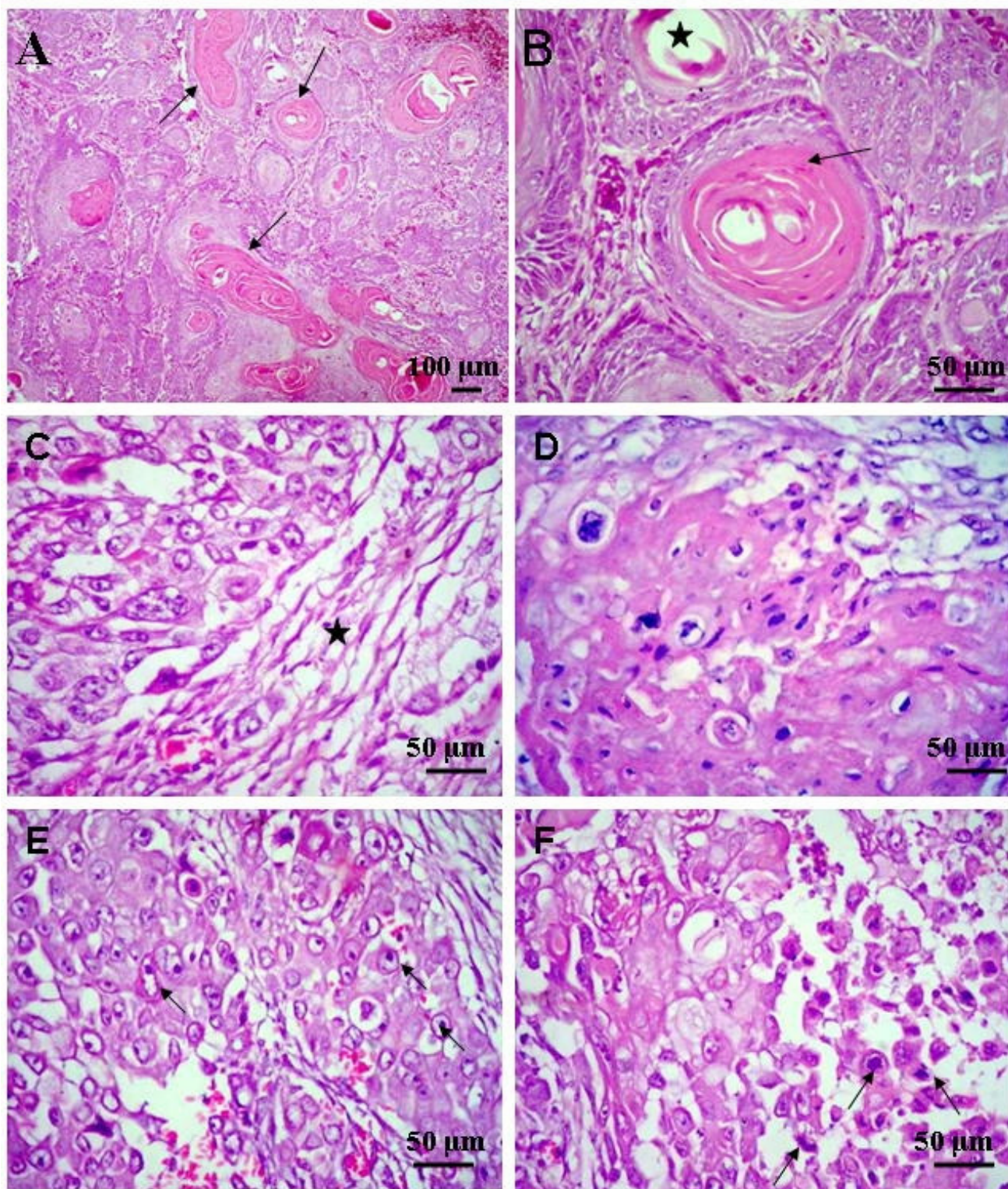


Figure 3. Well differentiated SCC (A) with horn pearls (arrows). Well differentiated SCC (B), note areas of complete keratinization (arrow) and areas of incomplete keratinization (star). Poorly differentiated SCC (C), note the absence of horn pearls. The cell masses are surrounded with connective tissue stroma (star). Poorly differentiated SCC (D), note that keratinization is seen in small group of cells. Poorly differentiated SCC (E), note the atypical neoplastic cells with pleomorphic nuclei, and prominent nucleoli (arrows). Poorly differentiated SCC (F) with high mitotic activity and frequent mitotic atypia (arrows). HE.

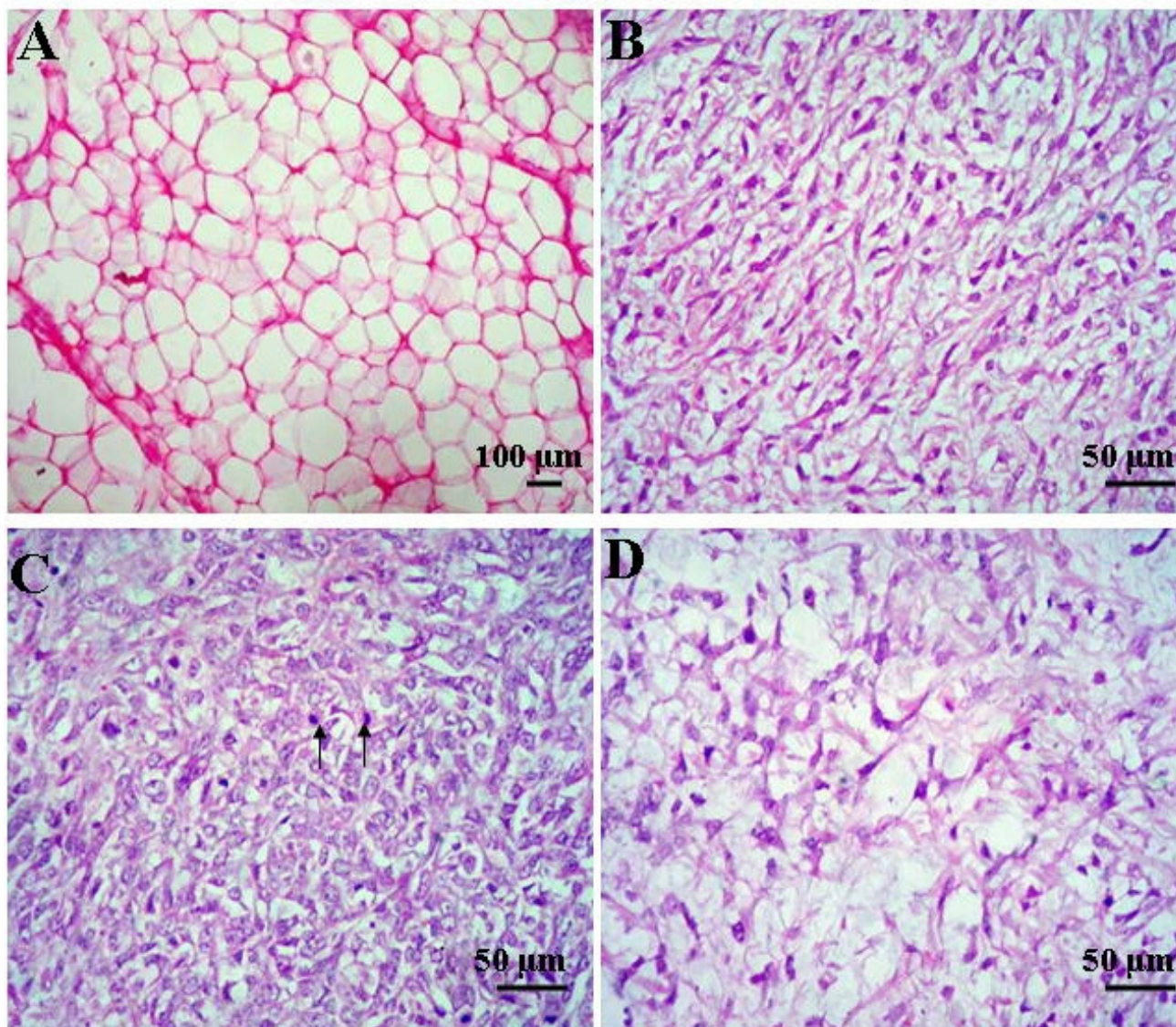


Figure 4. Lipoma (A); differentiated fat cells of irregular size and shape. Fibroma (B); bundles of fibroblast cells running in different directions. Fibromyxosarcoma (C); irregular cells with irregular, large nuclei. Numerous mitotic figures (arrows). Fibromyxosarcoma (D); myxomatous elements consisted of spindle shaped and stellate shaped fibroblast cells, with long branching fibrils suspended in an abundance of intercellular matrix. HE.

SCC has been reported to be the second most common skin tumor in almost all farm animals (28). The description of the SCC in camels of the present study was similar to that of cattle (17) but the location has been cited to occur at the mucocutaneous junction in cattle (26, 28).

Fibroma was diagnosed as a single large mass in each camel of the present study. It has been cited that fibromas usually occur as single masses and vary in consistency from fleshy to fatty to myxoid, depending on the tumor cell type (28). Fibromyxosarcoma were noticed as multiple intraoral lesions in camels of the current study. It has been reported that these soft tissue tumors occur

rarely in cattle, sheep, goats, and pigs (28) and occur as intraoral lesion in older dogs (5, 9). Moreover, it has been reported that recurrence is likely after surgical excision but metastases are rare (5, 9).

In this study, lipoma was diagnosed in one animal. Subcutaneous lipomas have been reported to occur occasionally in cattle and are rare in sheep, goats, and pigs (28).

Thin paraffin sections stained with HE have been, in most cases, sufficient for diagnosis. Careful description of the macroscopic appearance of the lesion has also been of great help. In contrast, needle biopsies have been

reported to be less suitable and can easily lead to a wrong diagnosis (8). Diagnosis of tumors in the present study depended mainly on macroscopic description as well as microscopic interpretation of HE-stained representative specimens after surgical excision.

All tumors of the present study were treated by surgical excision. Surgery has been reported as a radical treatment of tumors (15, 20, 23). Although, surgery was effective in excising neoplasms like SCCs, fibromas, fibromyxosarcoma and lipoma of the present study, it was not possible to evaluate the result of treatment since many of the animals were neither followed-up closely nor for long enough.

In conclusion, camel neoplasms were categorized in 4 different types; SCCs, fibromas, fibromyxosarcomas, and lipomas. Incidence of neoplasia was higher in females. SCC was the commonest neoplasm in the Maghateer breed. Fibromas were the commonest type of tumors in the Majaheem breed. To the best of our knowledge this study was the first to report fibromyxosarcomas as intra-oral lesions in camels. There is no link between camel age and carcinogenesis.

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