

# TUMOURS IN DROMEDARY CAMELS: PREVALENCE, TYPES AND LOCATIONS

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## ABSTRACT

The incidence, types and locations of tumours in 9576 dromedary camels were determined at the Veterinary Teaching Hospital of Qassim University. Grossly, tumour like growth was seen in 75 cases but histopathological examination confirmed the tumour in 59 cases (incidence 59/9576, 0.006%). Types of the tumours diagnosed were squamous cell carcinoma ( $n=22$ ), fibroma ( $n=13$ ), adenocarcinoma ( $n=13$ ), fibromyxosarcoma ( $n=2$ ), leiomyoma ( $n=2$ ), angiosarcoma ( $n=1$ ), schwannoma ( $n=1$ ), lipoma ( $n=1$ ), microcystic adnexal carcinoma ( $n=1$ ), renal cell carcinoma ( $n=1$ ), sertoli-leydig cell tumour ( $n=1$ ) and granulosa cell tumour ( $n=1$ ). These tumours were located at the limbs ( $n=14$ ), vagina ( $n=9$ ), abdominal wall ( $n=8$ ), head ( $n=7$ ), sacrum ( $n=4$ ), neck ( $n=4$ ), intraoral ( $n=3$ ), cervix ( $n=2$ ), ovary ( $n=2$ ), rectum ( $n=2$ ), uterus ( $n=1$ ), soft palate ( $n=1$ ), kidney ( $n=1$ ) and compartment 3 ( $n=1$ ). Females were more affected than males (54 vs 5). Age of the affected animals ranged between 4 months to 18 years. In conclusion, squamous cell carcinoma, fibroma and adenocarcinoma are the common types of tumours occurring in camel.

**Key words:** Adenocarcinoma, dromedary camels, fibroma, squamous cell carcinoma, tumours

The incidence of tumours reported in slaughter houses surveys indicates that tumours are most common in cattle (0.23%) and are uncommon in sheep (0.002%), goats (0.009%) and pigs (0.004%) (Valentine, 2004). Several studies have been done to determine the common types of tumours in sheep, goats, cattle and horses in Saudi Arabia (Al-Sobayil *et al*, 1993; Al-Sobayil *et al*, 2004a,b; Al-Sobayil *et al*, 2005; Ahmed 2011; Ahmed and Hassanein, 2012).

Neoplasms of the skin and subcutaneous tissues are the most frequently recognised neoplastic disorders in domestic animals (Hargis *et al*, 1977; Valentine, 2004; Ginn *et al*, 2007). Case reports of squamous cell carcinomas (Ramadan and Elhassan, 1989; Tageldin and Omar, 1986) and basal cell carcinoma (Al-Hizab *et al*, 2007; Fowler, 2010) have been described in camels. On the other hand, cases of internal neoplasia such as renal cell carcinoma (Vitovec, 1982), bronchoalveolar adenocarcinoma (Gameel *et al*, 1998), salivary fibro-adenocarcinoma (Ramadan *et al*, 2001), rhabdomyosarcoma (Zakia-Mohammed *et al*, 2007), seminoma with cholangiocarcinoma (Birincioglu *et al*, 2008; Ali *et al*, 2013a) and granulosa cell tumour (Ali *et al*, 2013b) have also been reported in camels.

Immunohistochemistry adds more depth for diagnosis of tumours. In addition, it has advantage of detecting status of important genes which have pivotal role for neoplasm pathogenesis irrespective of mechanism of gene activation or inactivation. Therefore, it provides broad information than would be obtained by any single genetic analysis alone (Fricke *et al*, 2003; Khodeir, 2005). Fortunately, all these valuable data can be demonstrated by reliable, easily performed techniques on paraffin embedded tumour specimens (Khodeir, 2005). The final goal is to cure the disease or considerably prolong life while improving the patient's quality of life. Immunohistochemical diagnosis of camel tumours has also been reported (Weiss and Walz, 2009; Khodakaram and Khordadmehr, 2011).

The objective of the present study was to determine the incidence, their common types and locations of tumours in camels of Kingdom of Saudi Arabia.

## Materials and Methods

A total of 9576 dromedary camels were examined at the Veterinary Teaching Hospital of Qassim University in the Kingdom of Saudi Arabia for the occurrence of external or internal tumours.

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Biopsy from the suspected tumours was taken for histopathological and immunohistochemical examination. Histopathological examination was performed by hematoxylin and eosin (H&E) stain and diagnosis was done.

Immunostaining was performed using the avidin-biotin- peroxidase complex (ABC) method. Sections were then rinsed and incubated with primary antibodies cytokeratins (CK5/6) and Pan cytokeratin for squamous cell carcinoma cases. Adenocarcinoma cases were incubated with primary antibodies EMA, CEA. The immunostaining was performed on an automated immunostainer with appropriate positive and negative controls. DAB was used as a chromogen (3-3\ diaminobenzidine tetrahydrochloride) and Mayer's hematoxylin as a counter stain.

### Results

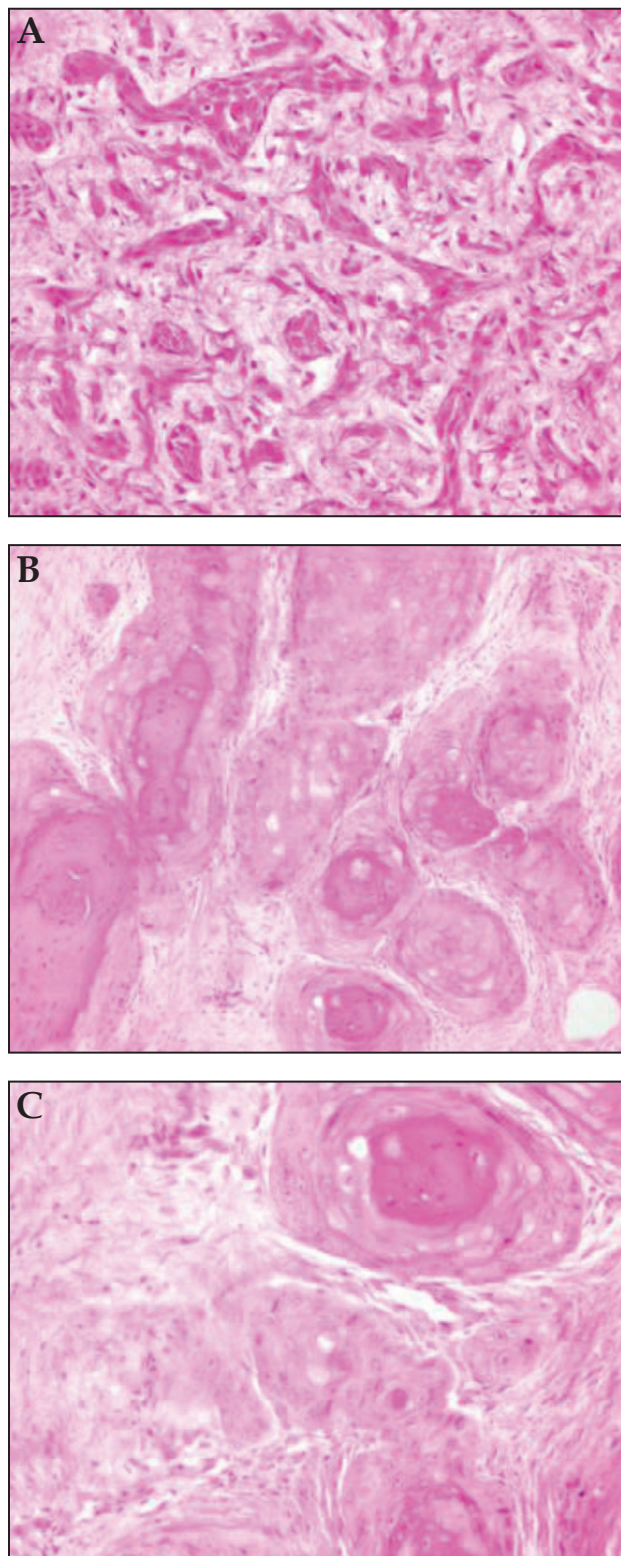
Grossly, tumours like growths were diagnosed in 75 cases. However, after histopathological microscopic examination, 59 cases were confirmed to be tumours (incidence 59/9576, 0.006%). Types of the tumours were listed in Table (1) and illustrated in Figs (1-5). Squamous cell carcinoma, adenocarcinoma and fibroma were the common types of tumours occurring in camel.

**Table 1.** Types of tumours in dromedary camels.

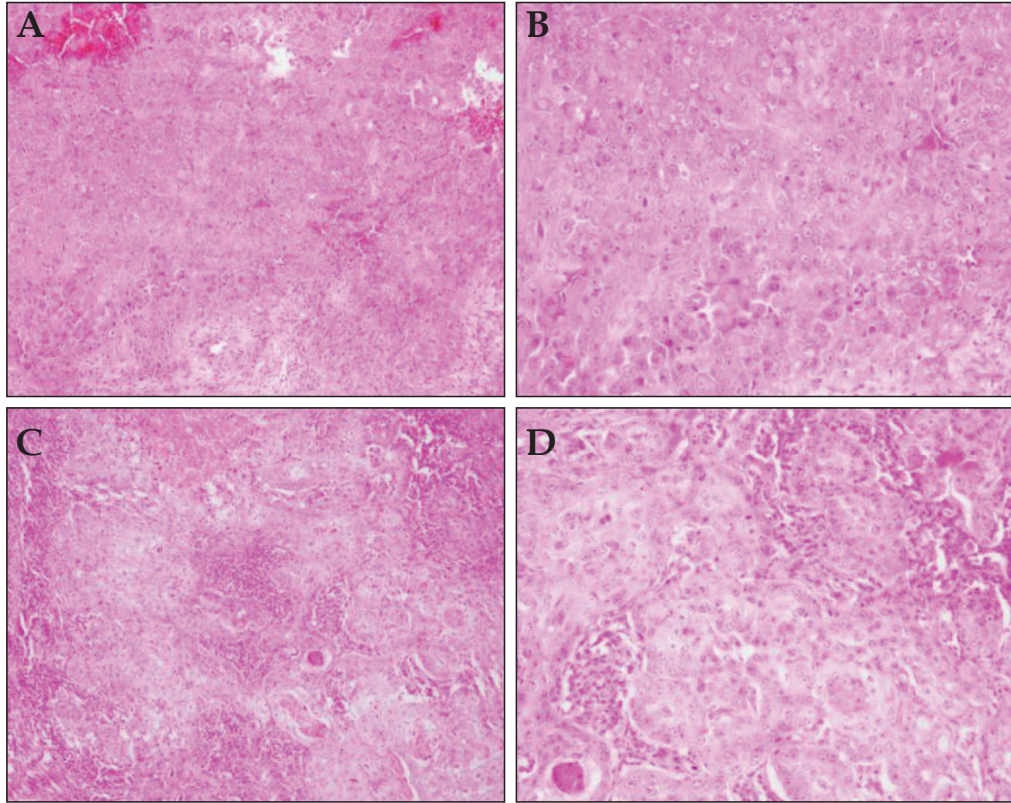
Type of tumour	Number of cases	Incidence (Per cent)
Squamous cell carcinoma	22	37.3
Adenocarcinoma	13	22
Fibroma	13	22
Fibromyxosarcoma	2	3.4
Leiomyoma	2	3.4
Angiosarcoma	1	1.7
Schwannoma	1	1.7
Lipoma	1	1.7
Microcystic adnexal carcinoma	1	1.7
Renal cell carcinoma	1	1.7
Sertoli-Leydig cell tumour	1	1.7
Granulosa cell tumour	1	1.7
Total	59	100

Cases of adenocarcinoma showed diffuse expression of EMA (Fig 6) and CEA (Fig 7), while cases of squamous cell carcinoma showing diffuse strong expression of pancytokeratin (Fig 8) and cytokeratin5/6 (Fig 9).

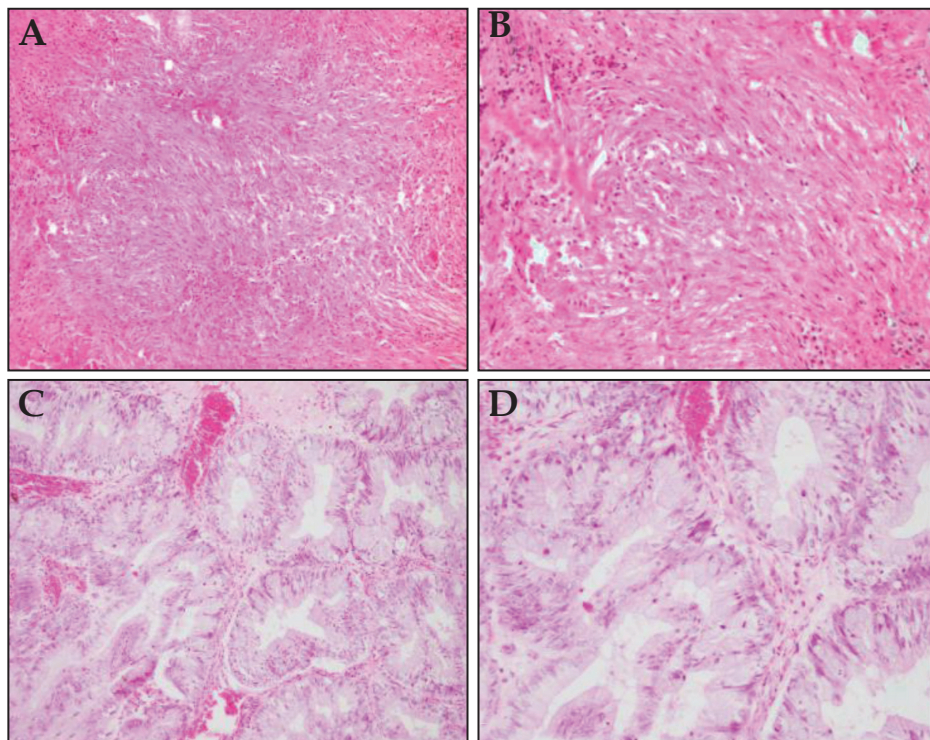
The camel tumours were located at different parts and organs of the camel body (Table 2, Figs



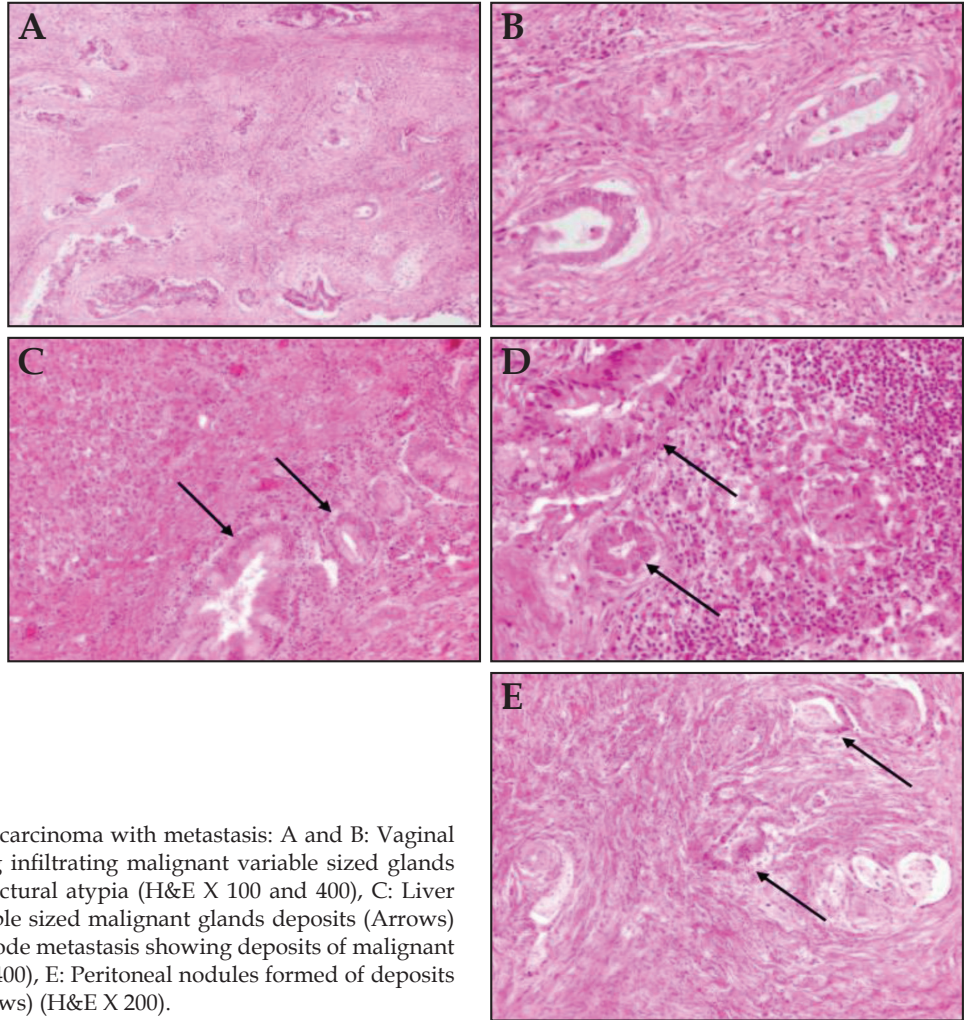
**Fig 1.** Histopathology of camel tumours: A: Sections in left side head tumour showing microcystic adnexal carcinoma with cords and nests of bland keratinocytes and ductal differentiation (H&E stain X 200), B and C: Abdominal tumour showing well differentiated keratinising squamous cell carcinoma multiple cell nests and keratin pearl formation (H&E X 200 and 400).



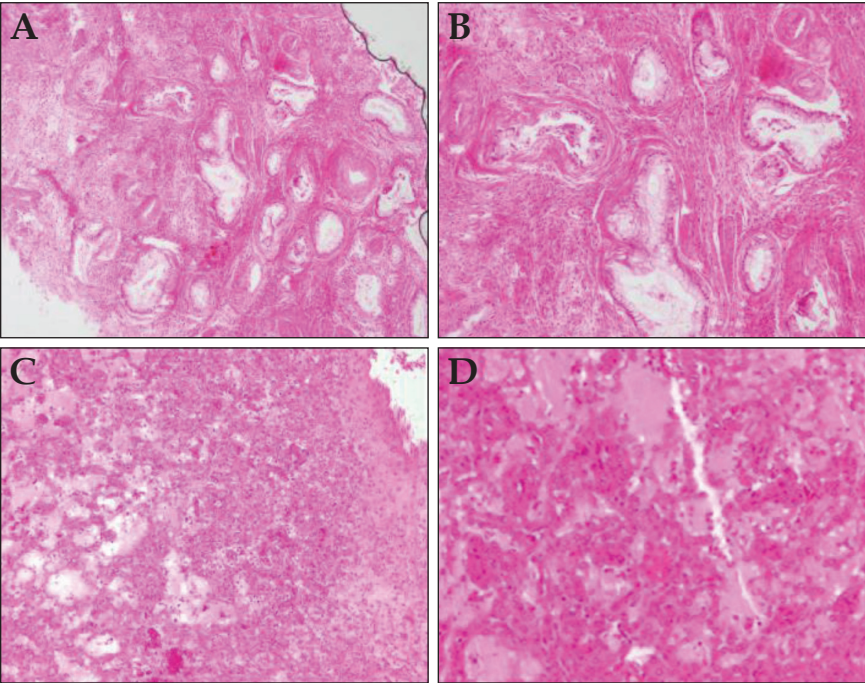
**Fig 2.** Histopathology of camel tumours: Different cases of moderately differentiated squamous cell carcinoma showing malignant epithelial cells with hyperchromasia and pleomorphism. A and B: non keratinising sheets of cells (H&E X 200 and 400), C and D: nests of malignant epithelial cells with focal keratinisation (H&E X 200 and 400).



**Fig 3.** Histopathology of different cases of camel vaginal tumours: A and B: Leiomyoma showing interlacing bundles of bland looking smooth muscles with rod shaped nuclei (H&E X 200 and 400), C and D: well differentiated adenocarcinoma showing variable sized infiltrating mucin secreting malignant glands showing cellular and architectural atypia lined by columnar cells (H&E X 200 and 400).



**Fig 4.** The case of vaginal adenocarcinoma with metastasis: A and B: Vaginal Adenocarcinoma showing infiltrating malignant variable sized glands showing cellular and structural atypia (H&E X 100 and 400), C: Liver metastasis showing variable sized malignant glands deposits (Arrows) (H&E X 400), D: Lymph node metastasis showing deposits of malignant glands (Arrows) (H&E X 400), E: Peritoneal nodules formed of deposits of malignant glands (Arrows) (H&E X 200).



**Fig 5.** A and B: Well differentiated cervical adenocarcinoma showing infiltrating variable sized glands lined by malignant columnar epithelial cells with mucin secretion (H&E X 100 and 200), C and D: Renal cell carcinoma showing well differentiated tubules separated by cellular stroma (H&E X 100 and 400).

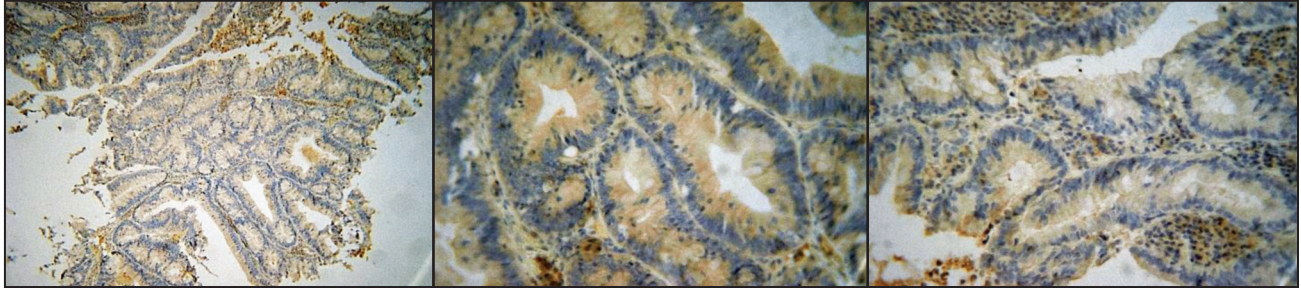


Fig 6. Photomicrographs of cases of adenocarcinoma showing diffuse expression of EMA (DAB Chromogen, Hx&E counter stain).

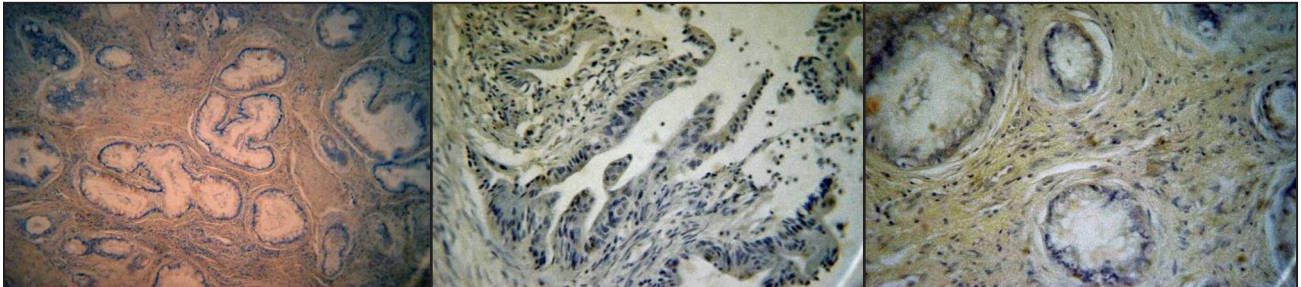


Fig 7. Photomicrographs of cases of adenocarcinoma showing expression of CEA (DAB Chromogen, Hx&E counter stain).

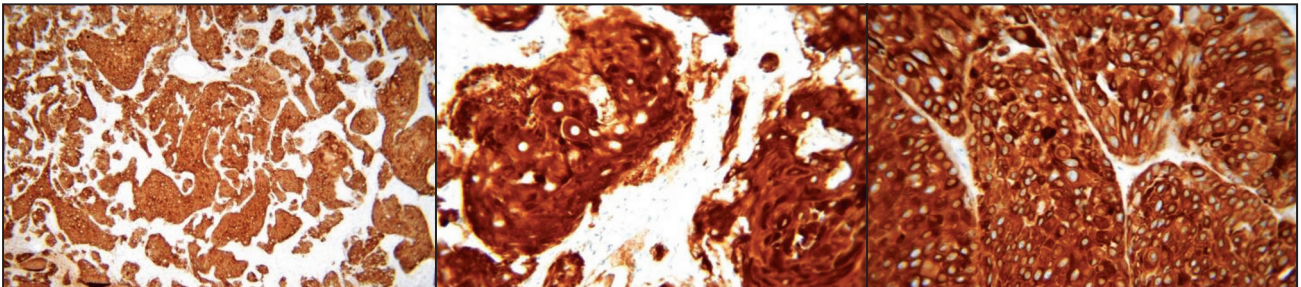


Fig 8. Photomicrographs of different cases of squamous cell carcinoma showing diffuse strong expression Pancytokeratin (DAB Chromogen, Hx&E counter stain x).

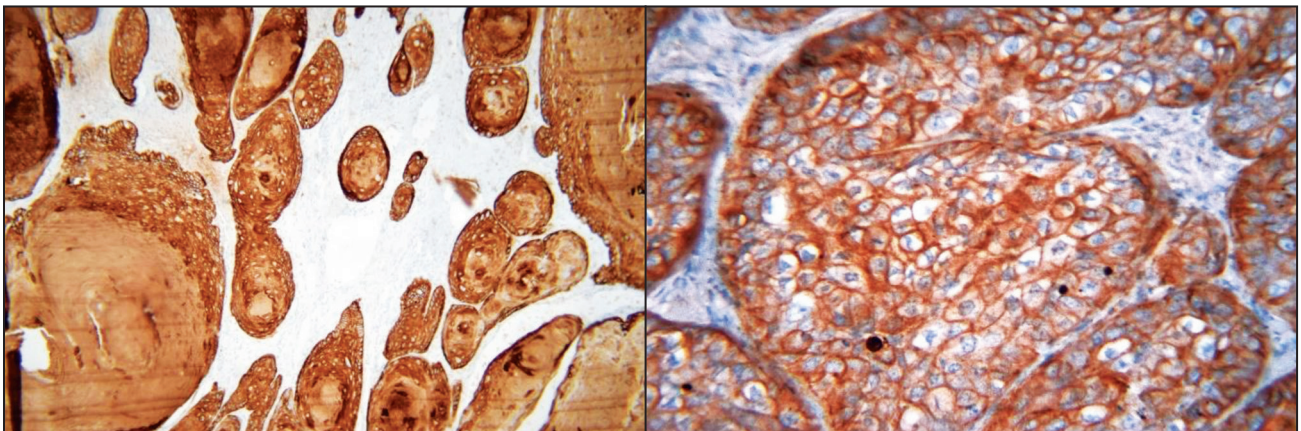


Fig 9. Photomicrographs of different cases of squamous cell carcinoma showing diffuse strong expression of cytokeratin 5/6 ((DAB Chromogen, Hx & E counter stain x).

10, 11). Only one case of metastasis was observed. Adenocarcinoma was observed firstly in the vagina. After postmortem examination, metastasis was observed in the regional and mesenteric lymph nodes

(LN) and in the liver (Fig 11, H, I). Female camels showed tumours more frequently than males (54 vs. 5). Age of the affected animals ranged between 4 months to 18 years.

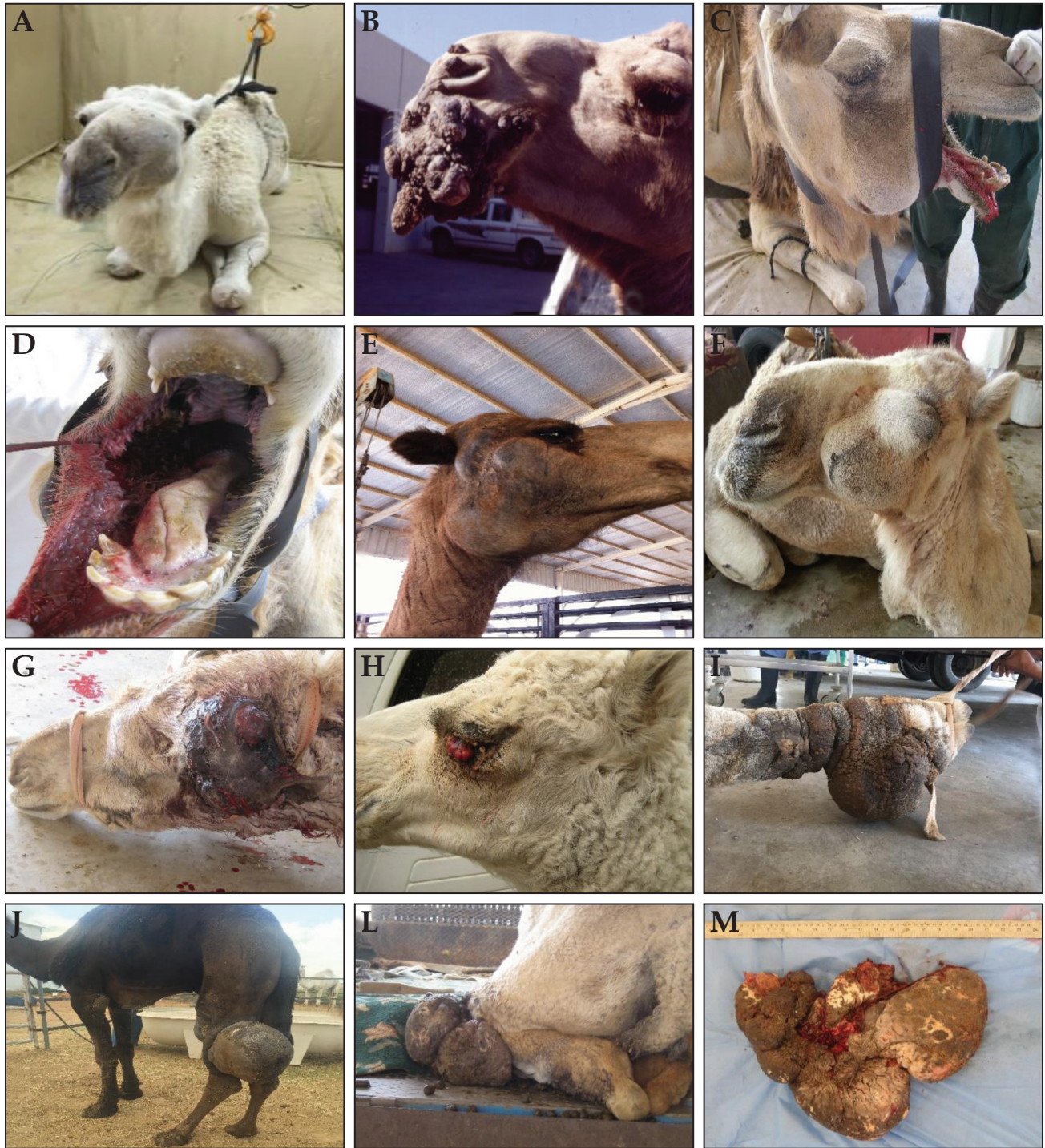
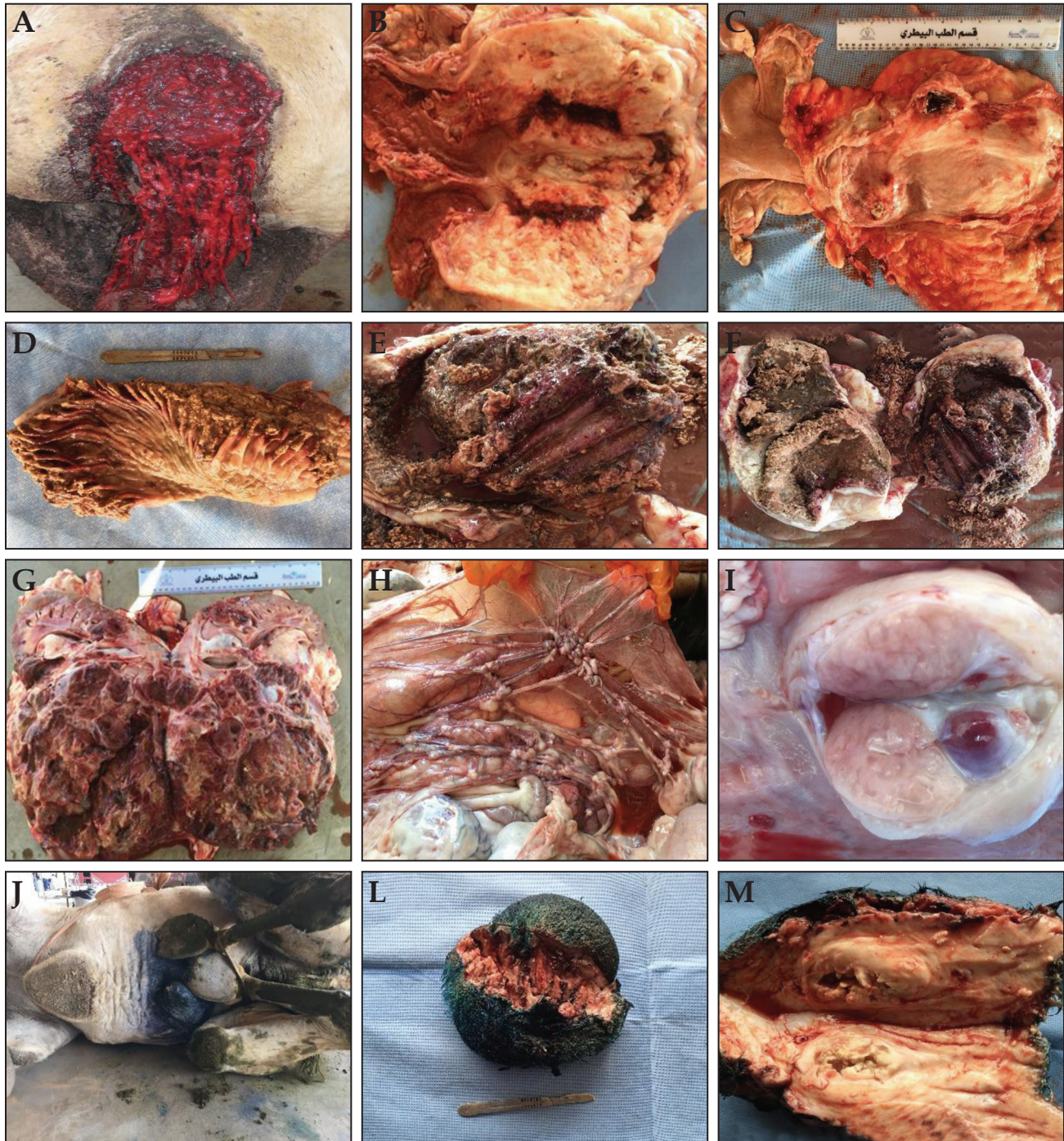


Fig 10. Location of camel tumours at the head (A-G), eye (H) and leg (I-M).

### Discussion

The prevalence of camel tumours as reported in this study (0.006%) is extremely lower than that reported in cattle (0.23%), but nearly similar to that reported in sheep (0.002%), goats (0.009%) and pigs (0.004%) (Valentine, 2004). It was universally known that cattle are the most animal species affected with tumours.

Based on the present results, squamous cell carcinoma, fibroma and adenocarcinoma are the common types of camel tumours and the limbs, vagina, abdominal wall and head were the most affected organs. Neoplasms of the skin and subcutaneous tissues have been reported as the most frequently recognised neoplastic disorders



**Fig 11.** Location of camel tumours in the rectum (A), vagina and cervix (B, C), omasum and abomasum (D, E, F), kidney (G), mesenteric and regional LNs (H, I) and at the abdominal wall (L, M).

in domestic animals (Hargis *et al*, 1977; Valentine, 2004; Ginn *et al*, 2007). Case reports of squamous cell carcinomas (Ramadan and Elhassan, 1989; Tageldin and Omar, 1986) and basal cell carcinoma (Al-Hizab *et al*, 2007; Fowler, 2010) have been described in camels. On the other hand, cases of internal neoplasia such as renal cell carcinoma

(Vitovec, 1982), bronchoalveolar adenocarcinoma (Gameel *et al*, 1998), salivary fibro-adenocarcinoma (Ramadan *et al*, 2001), rhabdomyosarcoma (Zakia-Mohammed *et al*, 2007), seminoma with cholangiocarcinoma (Birincioglu *et al*, 2008, Ali *et al*, 2013a) and granulosa cell tumour (Ali *et al*, 2013b) have also been reported in camels.

**Table 2.** Location of the tumours in dromedary camels.

Location	Number of camels	Incidence (Per cent)
Limbs	14	23.7
Vagina	9	15.2
Abdominal wall	8	13.6
Head	7	11.9
Sacrum	4	6.8
Neck	4	6.8
Intraoral	3	5.1
Cervix	2	3.4
Ovary	2	3.4
Rectum	2	3.4
Soft palate	1	1.7
Kidney	1	1.7
Uterus	1	1.7
Omasum and abomasum	1	1.7
Total	59	100

According to a recent report 4 different types of tumours were diagnosed in camels, which were SCC, fibroma, lipoma and fibromyxosarcoma. The most common type of tumour in Maghateer (white coloured coat) and Majaheem (dark brown to black coat) breeds were SCC and fibroma, respectively. In our study, cancer was common in white camels (n=33). A case of lipoma in the left ischioanal fossa has been reported in camel (Kaswan *et al*, 2013).

Spontaneously or naturally occurring tumours 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 (Valentine, 2006). Ultraviolet radiation (UV) is the major etiologic agent in skin cancer development (Storm and Yamamura, 1997), especially squamous cell carcinoma in cows, goats, sheep, cats and dogs (Nicola *et al*, 1992). However, other causes of cancers have been reported such as sex hormones, environmental pollution, radiation and viruses like papilloma virus.

According to the present results, age of the affected animals ranged between 4 months to 18 but most occurred during adulthood or old age. The overall occurrence of tumours cannot be determined with certainty because food animals are slaughtered for meat production at an early age, before tumours have time to develop. In most reported series of neoplasms there is a peak age of tumour incidence for

each species. The peak age of incidence has not been clearly established in the food animals (Goldschmidt and Hendrick, 2002).

Female camels showed tumours more frequently than males; this might be attributed to slaughtering of male camels at young age for meat production, if compared to the females that are usually reared till old ages. However, other factors such as sex hormonal might have an effect on the higher occurrence of cancer in females than males.

One case of metastasis was observed. Adenocarcinoma was observed firstly in the vagina, after postmortem examination metastasis was observed in the regional and mesenteric lymph nodes and in the liver. To our knowledge this is the first report of spreading of vaginal cancer to other organs in camels.

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