2026 SCIENCELINE

Online Journal of Animal and Feed Research

Volume 16, Issue 3: 132-139; May 30, 2026

ISSN 2228-7701

DOI: https://dx.doi.org/10.51227/ojafr.2026.16

CLINICOPATHOLOGICAL CHARACTERIZATION OF CUTANEOUS PAPILLOMATOSIS IN CATTLE FROM NEW VALLEY GOVERNORATE, EGYPT

Ali Awadh AL GHAYTHAN[1], Mohamed MARZOK[1]✉, Rasha Yassin ELKHIDR[1], Saad SHOUSHA[2], Mahmoud SABER[3], Mohamed EL-SHERIF[3]✉, and Mahmoud HASSAN[3]

[1]*Department of Clinical Studies, College of Veterinary Medicine, King Faisal University, Al-Ahsa 31982, Saudi Arabia*
[2]*Department of Biomedical Sciences, College of Veterinary Medicine, King Faisal University, Al-Ahsa 31982, Saudi Arabia*
[3]*Department of Surgery, Faculty of Veterinary Medicine, New Valley University, Al-Kharga 72511, New Valley, Egypt*

✉Emails: mmarzok@kfu.edu.sa; mohamedelsherif@vet.nvu.edu.eg

Supporting Information

RESEARCH ARTICLE

PII: S222877012600016-16

Received: March 12, 2026

Revised: May 18, 2026

Accepted: May 21, 2026

ABSTRACT: Bovine papillomatosis is a contagious proliferative skin disease of cattle caused by bovine papillomaviruses (BPVs). It is characterized by exophytic, papillary, or cauliflower-like lesions affecting the skin or mucous membranes and occurs worldwide, particularly in young animals. Histopathology remains a reliable confirmatory diagnostic tool in field settings lacking molecular techniques. This descriptive observational field study included 50 cattle with lesions clinically consistent with cutaneous papillomatosis. Animals of both sexes, aged 9 months to 4 years, were evaluated for sex, age, lesion size, multiplicity, and anatomical distribution. Representative lesions were surgically excised, fixed in 10% neutral buffered formalin, processed by routine paraffin embedding, sectioned at 4µm, and stained with hematoxylin and eosin. Data are presented as counts and percentages, and the study followed STROBE guidelines. Most affected cattle were female (76.0%) and aged 9–18 months (74.0%). Lesions smaller than 10 cm^3 predominated (78.0%). Multiple lesions were more common than solitary ones, with three animals presenting up to 20 lesions each. A total of 211 lesion sites were recorded, with the highest frequency in the head and neck region (51.7%), followed by the chest, abdomen, and withers (23.2%). Histopathology revealed epidermal hyperplasia, hyperkeratosis, acanthosis, elongated rete pegs, papillary projections with fibrovascular cores, fibroblastic proliferation, and variable inflammatory infiltration, including occasional vascular thrombosis. This study showed that bovine cutaneous papillomatosis in this setting predominantly affects young cattle and shows a marked predilection for the head and neck. Histopathological features align with classical papillomatous and fibropapillomatous lesions, supporting their value as a practical diagnostic tool in field conditions.

Keywords: Cattle, Molecular typing, Mucous membranes, Papillomatosis, Skin.

INTRODUCTION

Bovine cutaneous papillomatosis is a contagious proliferative skin disease of cattle characterized by exophytic or papillary lesions that may appear as pedunculated, sessile, or cauliflower-like warts. The disease is caused by bovine papillomaviruses (BPVs), a group of small (50–60 nm), non-enveloped, icosahedral double-stranded DNA viruses belonging to the family Papillomaviridae. The clinicopathological spectrum extends from localized epithelial papilloma to fibro papillomatous lesions involving both epithelial and stromal components (Jelínek and Tachezy, 2005; Borzacchiello and Roperto, 2008; Ugochukwu et al., 2019). To date, at least 14 BPV genotypes have been identified, classified into four genera: Deltapapillomavirus (BPV-1,2,13), Xipapillomavirus (BPV-3,4,6,9–12), Epsilonpapillomavirus (BPV-5,8), and one unassigned type (BPV-7) (Gharban et al., 2023; Carvajal-Reina et al., 2025). The clinical and histopathological presentation varies with BPV type: Deltapapillomaviruses cause fibropapillomas characterized by concurrent epithelial and dermal stromal proliferation, Xipapillomaviruses produce pure epithelial papilloma, while Epsilonpapillomaviruses generate intermediate forms involving both components (Jelínek and Tachezy, 2005; Borzacchiello and Roperto, 2008; Khattab et al., 2023).

The disease occurs worldwide and affects cattle of all ages; however, young animals below two years are disproportionately affected (Jelínek and Tachezy, 2005; Sameeh, 2010; Araldi et al., 2017; Al-Salihi et al., 2020). Heifers aged one to two years are considered the most susceptible group, and disease incidence typically declines with age as protective cell-mediated immunity develops following primary BPV exposure. Both sexes are affected, but females, particularly lactating dairy animals, tend to show higher prevalence owing to repeated epithelial trauma through milking procedures, teat cup liner contact, and handling, which create portals of viral entry (Campo, 2002; Sameeh, 2010; Beytut, 2017; Ugochukwu et al., 2019; Bianchi et al., 2020). The disease carries significant economic consequences: teat and udder lesions interfere with milking, reduce milk production, and predispose affected animals to mastitis; generalized cutaneous lesions impair body condition and reduce market value; and severe or complicated lesions may cause

Citation: AL Ghaythan AA, Marzok M, Elkhidr RY, Shousha S, Saber M, El-Sherif M, and Hassan M (2026). Clinicopathological characterization of cutaneous papillomatosis in cattle from new valley governorate, Egypt. *Online J. Anim. Feed Res.*, 16(3): 132-139. DOI: https://dx.doi.org/10.51227/ojafr.2026.16

morbidity sufficient to necessitate culling (Fenner et al., 1987; Campo, 2002; Sameeh, 2010; Gharban et al., 2023). Transmission occurs through direct contact with infected animals and indirectly through contaminated milking equipment, fencing, feeding and watering fixtures, needles, and in young stock through skin abrasions at common contact points; arthropod vectors have also been implicated as mechanical transmitters (Studdert et al., 1988; Fields et al., 2007; Sameeh, 2010; Ugochukwu et al., 2019).

In field settings, the diagnosis of bovine cutaneous papillomatosis is mostly based on clinical inspection of characteristic gross lesion morphology. However, histopathological examination of excised or biopsied tissue remains central to confirmatory diagnosis and to the differentiation of papillomatous lesions from other proliferative skin conditions such as dermatophilosis, squamous cell carcinoma, fibrosarcoma, and equine sarcoid-like lesions in cattle (Somvanshi et al., 1986; Jelínek and Tachezy, 2005; Hesham et al., 2024). Characteristic microscopic features of bovine papillomatous lesions include epidermal hyperplasia, hyperkeratosis, acanthosis, elongated rete pegs, and papillary projections supported by fibrovascular stromal cores; fibro papillomatous lesions additionally show pronounced fibroblastic proliferation and stromal expansion (Jelínek and Tachezy, 2005; Fields et al., 2007; Hesham et al., 2024; Elghmry et al., 2025). In resource-limited field settings where molecular BPV typing by PCR is not routinely accessible, histopathological classification of lesions into fibropapilloma versus epithelial papilloma provides a clinically meaningful approximation of the contributing viral type and informs management and treatment decisions (Salib and Farghali, 2011; Panchal et al., 2024; Usman and Gwadabawa, 2024).

The management includes control communal watering points, shared feeding equipment, and concentration of young stock may favor skin abrasion and horizontal BPV transmission. The present study was conducted to describe the clinicodemographic characteristics (sex, age), lesion burden (size, multiplicity), anatomical distribution, and histopathological features of bovine cutaneous papillomatosis in cattle, with the aim of contributing baseline field data applicable to disease recognition, reporting, and management planning in this setting.

MATERIALS AND METHODS

Study design and animals

This study included 50 cattle presenting with skin lesions clinically consistent with bovine cutaneous papillomatosis. Animals were of both sexes and ranged in age from 9 months to 4 years. Cases were referred to by local farmers or identified during routine veterinary inspections. The study was conducted in accordance with STROBE guidelines for observational research (Cuschieri, 2024).

Clinical data collection

A standardized clinical record was completed for each animal, documenting sex, age (grouped as 9-18 months, 18 months-2.5 years, and >2.5 years), and lesion characteristics following the framework described in horses (Knottenbelt, 2009). Lesion size was estimated by three-dimensional external measurement using a flexible tape measure. The maximum length (L), width (W), and height (H) of each lesion were recorded, and lesion volume was calculated using the prolate ellipsoid formula: $V = (\pi/6) \times L \times W \times H$ Then lesions were grouped into four categories: <10 cm^3, 10–30 cm^3, 30–100 cm^3, and 100-300 cm^3. The 100–300 cm^3 category was pre-specified in the study protocol prior to data collection, based on lesion size ranges reported in the prior literature, and is retained in the classification framework to document the observed absence of intermediate-sized lesions between the 30–100 cm^3 and >300 cm^3 categories in this series.". Lesion multiplicity was recorded as the number of discrete lesion sites per animal. Anatomical location was classified into five body regions: head and neck; forelimb; chest, abdomen, and withers; hind limb; and genital and perineal region. The total number of individual lesion sites across all animals was computed to generate an anatomical distribution map independent of animal count.

Histopathological examination

Representative lesions from each affected animal were surgically excised under the effect of local anesthesia. Tissue samples were immediately fixed in 10% neutral buffered formalin, processed by routine paraffin embedding, sectioned at 4 µm thickness using a rotary microtome, and stained with hematoxylin and eosin (H&E) (Bancroft and Gamble, 2008). Microscopic examination was performed by a single veterinary pathologist using a binocular light microscope. Epidermal and stromal changes were systematically evaluated, with particular attention to epidermal hyperplasia, keratinization pattern (orthokeratotic hyperkeratosis versus parakeratotic hyperkeratosis), degree of acanthosis, elongation of rete pegs, papillary projections, fibrovascular core formation, fibroblastic proliferation, vascular changes, and inflammatory cell infiltration. Photomicrographs were acquired at ×4, ×10, and ×40 objective magnifications. The study is descriptive in design. Results are expressed as counts and proportions (percentages). To examine the association between demographic variables (age group, sex) and lesion characteristics (multiplicity category, lesion size category), the Chi-square test or Fisher's exact test (used when any expected cell count was <5) was applied. All tests were two-tailed with a significance threshold of $P < 0.05$. Statistical analyses were performed using IBM SPSS v.26 software.

RESULTS

Clinicodemographic findings

Clinicodemographic and lesion distribution data are summarized in Tables 1-4. The most notable demographic finding was the predominance of females (76.0%) and of the 9–18 month age group (74.0%), indicating a strong age-related pattern of susceptibility. Among lesion characteristics, most lesions were small (<10 cm^3, 78.0%), and multiple lesions per animal were more common than solitary presentation: only 26.0% of animals had a single lesion, while 6.0% (n = 3) presented with 20 lesions each, representing the most severe end of the distribution. The anatomical distribution showed concentration in the cranial and thoracic regions: the head and neck together with the chest, abdomen, and withers accounted for approximately 75% of all lesion sites.

Table 1 - Sex and age distribution of cattle affected with bovine cutaneous papillomatosis (n = 50).

Age group	Animals (n)	Percent (%)	Males (n)	Females (n)	% of group that are male
9–18 months	37	74.0%	8	29	21.6%
18 months–2.5 years	7	14.0%	2	5	28.6%
>2.5 years	6	12.0%	2	4	33.3%
Total	50	100.0%	12	38	24.0%

Table 2 - Distribution of lesion size categories among affected cattle (n = 50).

Lesion Size Category	Cattle (n)	Percent (%)
<10 cm^3	39	78.0%
10–30 cm^3	5	10.0%
30–100 cm^3	3	6.0%
100–300 cm^3	0	0.0%
>300 cm^3	3	6.0%
Total	50	100.0%

No lesions were recorded in the 100–300 cm^3 range. The category is retained for completeness to confirm the absence of intermediate-sized lesions in this series.

Table 3 - Lesion multiplicity per affected animal, stratified by sex (n = 50).

Lesions per animal	Male (n)	Female (n)	Total (n, %)
1	3	10	13 (26.0%)
2	2	0	2 (4.0%)
3	2	8	10 (20.0%)
4	3	6	9 (18.0%)
5	2	8	10 (20.0%)
6	0	3	3 (6.0%)
20	0	3	3 (6.0%)
Total	12	38	50 (100%)

Table 4 - Anatomical distribution of lesion sites across all affected animals (n = 211 lesion sites, 50 animals).

Anatomical Region	Total sites (n)	Percent of 211 (%)	Male sites (n)	Female sites (n)	% Male	% Female
Head and neck	109	51.7%	12	97	11.0%	89.0%
Chest, abdomen, and withers	49	23.2%	14	35	28.6%	71.4%
Hind limb	22	10.4%	5	17	22.7%	77.3%
Genital and perineal region	17	8.1%	2	15	11.8%	88.2%
Forelimb	14	6.6%	2	12	14.3%	85.7%
Total	211	100.0%	35	176	16.6%	83.4%

Histopathological findings

Hematoxylin and eosin-stained sections of excised papillomatous lesions revealed the following microscopic features: epidermal hyperplasia with marked orthokeratotic hyperkeratosis; acanthosis with elongation and broadening of rete pegs; papillary projections supported by central fibrovascular cores; fibroblastic proliferation within the dermis; focal ulceration of the overlying epidermis in some sections; perivascular and diffuse inflammatory cell infiltration comprising lymphocytes, neutrophils, and eosinophils; vascular thrombosis in some sections; and extension of inflammatory infiltrate to the underlying muscle in sections from severely ulcerated or secondarily infected lesions. Representative histopathological findings are illustrated in Figures 1a–e. Koilocytic changes (perinuclear cytoplasmic vacuolation in superficial keratinocytes, the hallmark cytopathic effect of productive BPV infection) were sought but were not a consistent or prominent feature in the present study.

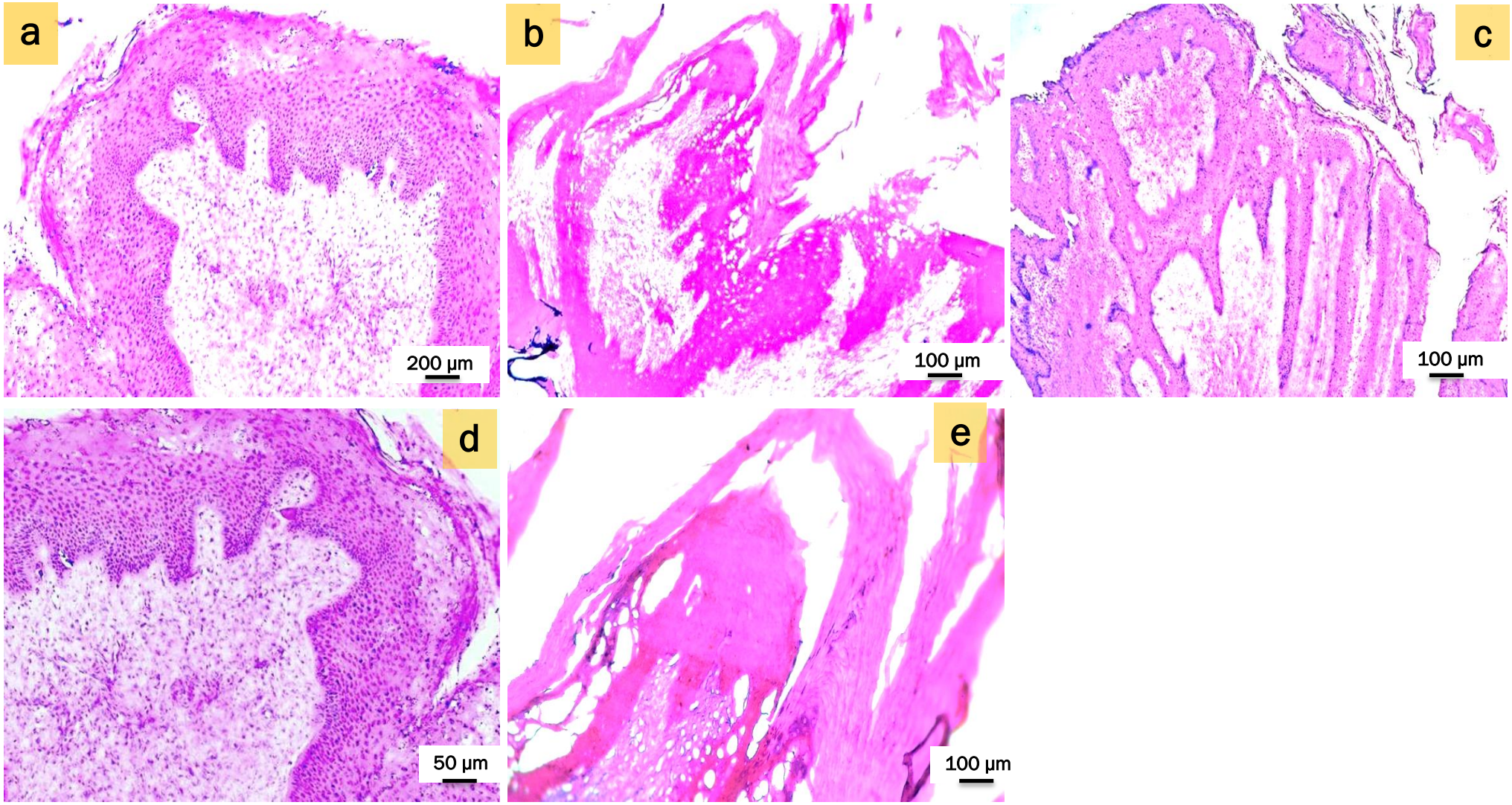

Figure 1 - Histopathological features of bovine cutaneous papillomatosis (HandE stain). (a) Epidermal hyperplasia and orthokeratotic hyperkeratosis. (b) Acanthosis with club-shaped elongation of rete pegs. (c) Papillary projections supported by fibrovascular dermal cores. (d) Mixed inflammatory infiltrate (lymphocytes, neutrophils, and eosinophils) with dermal fibroblastic proliferation. (e) Intraluminal vascular thrombosis and extension of inflammatory infiltrate to the underlying musculature in a severely ulcerated lesion.

Citation: AL Ghaythan AA, Marzok M, Elkhidr RY, Shousha S, Saber M, El-Sherif M, and Hassan M (2026). Clinicopathological characterization of cutaneous papillomatosis in cattle from new valley governorate, Egypt. *Online J. Anim. Feed Res.*, 16(3): 132-139. DOI: https://dx.doi.org/10.51227/ojafr.2026.16

DISCUSSION

The arid environmental conditions of New Valley Governorate, Egypt, are comparable to those of the Saudi Arabian regions where bovine papillomatosis has similarly been reported. The extreme arid conditions of New Valley Governorate like various Saudi areas are characterized by high ambient temperatures often exceeding 40°C during summer months and intense solar ultraviolet (UV) radiation due to the region's low latitude and clear-sky prevalence may exert multiple influences on bovine cutaneous papillomatosis epidemiology. First, chronic UV-B irradiation induces oxidative stress and keratinocyte DNA damage, thereby compromising skin barrier integrity and potentially creating micro abrasions that facilitate BPV entry, particularly in areas of sparse hair coat such as the face, muzzle, and ear pinnae consistent with the head and neck lesion predominance observed here. Second, elevated ambient temperatures accelerate epidermal desquamation and increase skin fold micro-trauma during insect activity peaks, both of which are recognized portals of BPV transmission. Third, BPV virion stability in the environment on fencing, feeding equipment, and pasture soil may be enhanced or reduced by extreme heat and UV exposure; while UV radiation degrades viral DNA, desiccated virions in shaded micro-environments under troughs and shelters may remain infectious for extended periods, sustaining horizontal transmission in concentrated young stock. These environmental factors represent a biologically plausible explanatory layer for the high disease burden in this setting and merit prospective quantification in future studies. The marked predominance of affected animals in the 9-18 month age group (74.0%) is in close agreement with classical descriptions of bovine cutaneous papillomatosis as a disease primarily of young stock. The higher susceptibility of cattle below two years of age has been attributed to relative immunological immaturity: effective BPV-specific cell-mediated immunity, which is the principal mechanism of both wart regression and resistance to reinfection, is not yet fully developed in animals that have not undergone prior antigenic exposure (Jelínek and Tachezy, 2005; Namgyel et al., 2021; Gharban et al., 2023). The observed decline in disease prevalence with age reflects the progressive development of protective adaptive immune responses following primary BPV infection, a pattern that has been documented consistently across geographic and management settings (Sameeh, 2010; Aydin et al., 2020). Comparable field studies in India and Ethiopia have similarly reported that most papillomatosis cases occur in cattle below 18 months. The very low proportion of affected animals older than 2.5 years (12.0%) in the present study is consistent with these observations and suggests that surviving natural exposure in this age group confers at least partial protective immunity.

The female predominance observed in this study (76.0%) warrants specific attention. The higher proportion of affected females is consistent with reports from other field settings (Campo, 2002; Sharma et al., 2020) and is likely to reflect a combination of factors rather than innate sex-linked susceptibility to BPV. In the present study population, females were most of the young stock cohort (29 of 37 animals in the 9-18 month age group), and this demographic imbalance may partially explain the finding. Additionally female cattle are handled more frequently for reproductive examination, vaccination, and milking preparation, creating cutaneous abrasions that serve as viral entry points (Sameeh, 2010). The concentration of lesions in the head and neck and thoracic regions rather than the teat and udder which would be expected to predominate in adult lactating dairy females supports the interpretation that the affected females in this series were predominantly pre-lactating heifers in whom milking-associated teat trauma was not a relevant exposure pathway.

To formally separate biological susceptibility from demographic imbalance, a comparison of sex-specific incidence density (new cases per animal-time at risk, stratified by sex) would be necessary. In the present study, the herd composition data confirm that 78.4% (29/37) of animals in the most affected age cohort (9–18 months) were female, meaning the observed female excess in lesion counts (83.4% of all 211 lesion sites) is substantially and possibly entirely attributable to the sex imbalance in the source population rather than to differential biological susceptibility. This limitation is acknowledged, and future studies should record total herd census data by sex to enable incidence density calculations.

The strong predilection for the head and neck region (51.7% of all lesion sites) in this study is consistent with the known affinity of BPV infection for areas susceptible to contact abrasion in young, group-housed stock. Similar anatomical predominance has been described in comparable field series involving young cattle (Hatama et al., 2018; Babu et al., 2020). In adult dairy herds, teat and udder lesions caused by BPV-1, BPV-5, and BPV-6 often predominate (Campo, 2002; Jelínek and Tachezy, 2005), but in the present study population, which was heavily weighted toward animals aged 9-18 months, teat-associated BPV transmission through milking was not a relevant exposure pathway. Instead, horizontal transmission in this age group is most plausibly facilitated by skin abrasion during social interaction, rubbing against shared fencing, and contact at communal feeding troughs and watering points all of which favor trauma-prone areas of the cranial and thoracic body surface. The chest, abdomen, and withers represented the second most affected region (23.2%), which is consistent with rubbing behavior at horizontal barriers. Lesions of the genital and perineal region (8.1%) were predominantly recorded in females, which may be attributable to BPV-1 or BPV-2 involvement in the perineal and para genital skin in susceptible animals (Borzacchiello and Roperto, 2008; Sameeh, 2010).

A subset of animals (3/50, 6.0%) presented with 20 discrete lesion sites, representing a pattern of extensive disseminated papillomatosis that warrants specific clinical comment. Such severe multifocal disease is generally associated with local or systemic immunosuppression, whether attributable to concurrent endoparasitism, nutritional deficiency, management stress, or primary failure of cell-mediated immune responses against BPV (Sameeh, 2010). In immunocompetent cattle, most papillomatous lesions regress spontaneously within 1–2 years following the development

Citation: AL Ghaythan AA, Marzok M, Elkhidr RY, Shousha S, Saber M, El-Sherif M, and Hassan M (2026). Clinicopathological characterization of cutaneous papillomatosis in cattle from new valley governorate, Egypt. *Online J. Anim. Feed Res.*, 16(3): 132-139. DOI: https://dx.doi.org/10.51227/ojafr.2026.16

of BPV-specific T-lymphocyte-mediated immunity (Nicholls and Stanley, 2000; Elghmry et al., 2025), and persistence or proliferation of lesions should therefore prompt investigation of potential immunosuppressive comorbidities. The BPV genotypes associated with extensive cutaneous dissemination particularly BPV-2 and BPV-3 were not characterized in the present study, as molecular typing was not available. Animals with disseminated papillomatosis present a therapeutic challenge and are at increased risk of secondary bacterial superinfection, body condition loss, and reduced market value (Campo, 2002; Sameeh, 2010; Corteggio et al., 2013).

The histopathological features documented in the present study epidermal hyperplasia, orthokeratotic hyperkeratosis, acanthosis, elongated rete pegs, papillary projections with fibrovascular cores, and dermal fibroblastic proliferation represent the canonical microscopic architecture of bovine papillomatous lesions and are consistent with previously published descriptions (Özsoy et al., 2011; Crossland and Adenomyosis, 2024). The coexistence of fibrovascular stromal cores with fibroblastic dermal proliferation indicates that at least a proportion of the lesions examined were fibropapillomas rather than purely epithelial papilloma, a distinction that is of practical relevance because fibropapillomas are associated with Delta-papillomaviruses (BPV-1, 2, 13) which have broader host tropism and oncogenic potential than the Xipa-pillomaviruses responsible for purely epithelial lesions (Borzacchiello and Roperto, 2008; Yıldırım et al., 2022; Gharban et al., 2023). The vascular thrombosis and deep inflammatory extension to the underlying musculature observed in some sections most likely reflects secondary bacterial superinfection of ulcerated lesions and is consistent with the clinical observation of surface crusting in a proportion of animals. Histopathological examination in this manner provides a reliable field-level confirmatory tool and allows meaningful differentiation of papillomatous lesions from other proliferative skin conditions when molecular typing is unavailable (Somvanshi, 2011; Khattab et al., 2023).

The present study has several limitations that should be acknowledged. First, its cross-sectional descriptive design precludes estimation of incidence rates, assessment of temporal trends, or determination of risk factors for disease acquisition or severity. Second, molecular typing of BPV was not performed; PCR-based genotyping of the BPV strains would substantially strengthen the epidemiological and virological characterization of this disease in the region and is a priority for future investigation. Third, the study was conducted at a single center, which may limit generalizability to other areas. Fourth, systematic data on herd management practices, vaccination history, concurrent disease burden, and nutritional status were not collected, precluding multivariable analysis of potential predictors of lesion multiplicity or distribution. Notwithstanding these limitations, this descriptive series provides the first formal clinicopathological field report of bovine cutaneous papillomatosis and establishes a baseline for future prospective and molecularly informed studies in this region.

CONCLUSIONS

Bovine cutaneous papillomatosis in this observational field series, predominantly affected young cattle (74.0% in the 9–18 month cohort), with a female predominance consistent with demographic and management patterns of the local cattle population. Multiple lesions per animal were more common than solitary presentation, and a subset of severely affected animals exhibited disseminated disease warranting further immunological investigation. Anatomically, lesions showed a strong predilection for the head and neck region, reflecting the likely mode of horizontal transmission through contact abrasion in young, group-managed stock. Histopathological examination confirmed the papillomatous nature of the lesions, documenting the characteristic features of fibro papillomatous and epithelial papillomatous involvement, and provided a reliable basis for confirmatory field-level diagnosis. These findings contribute baseline clinicopathological data for this under-characterized region and provide a foundation for future molecular and epidemiological studies.

DECLARATIONS

Corresponding author

Correspondence and requests for materials should be addressed to Mohamed Marzok, Department of Clinical Studies, College of Veterinary Medicine, King Faisal University, Al-Ahsa, Saudi Arabia (ORCID: https://orcid.org/0000-0002-7961-1247, Email: mmarzok@kfu.edu.sa); Mohamed El-Sherif, Department of Surgery, Faculty of Veterinary Medicine, New Valley University, Al-Kharga 72511, New Valley, Egypt (ORCID: https://orcid.org/0000-0001-6483-6737. Email: mohamedelsherif@vet.nvu.edu.eg)

Acknowledgement

The author's sincere acknowledgment to the Deanship of Scientific Research at King Faisal University for the financial support under the Annual track (Project Number: KFU262035).

Consent to Publish

The current research project was performed with collaboration of junior researcher joint between the faculty departments to research supposed common surgical diseases and disorders in Egypt and Saudi Arabia. All authors read and approved publication.

Ethics committee approval

This research project was conducted through a collaborative effort between the Department of Clinical Studies, Coll. Vet. Med., King Faisal University, and the Department of Surgery, Fac. Vet. Med., New Valley University. The study involved junior researchers from both institutions and aimed to investigate prevalent surgical diseases and disorders of shared clinical significance in Egypt and Saudi Arabia. All experimental procedures were approved by the IACUC of King Faisal University (Ref. No. 19-Ma-2026). The authors complied with the ARRIVE guidelines and or the Interdisciplinary Principles and Guidelines for the Use of Animals in Research, Testing, and Education by the New York Academy of Sciences, Ad Hoc Animal Research Committee.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Funding

This work was supported through the Annual Funding track by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [Protocol Number: KFU262035].

Authors' contributions

M. Marzok and M. El-Sherif conceptualization and supervision. A. AL Ghaythan, M. Saber and M. Hassan study design, methodology, and data acquisition. A. AL Ghaythan, R. Elkhidr, and S. Shousha, manuscript drafting and revision. A. AL Ghaythan, R. Elkhidr, and S. Shousha statistical analysis, manuscript review and editing.

Competing interests

All authors have reviewed the manuscript and approved its final version for publication.

REFERENCES

Al-Salihi KA, Al-Dabhawi AH, Ajeel AA, Erzuki IA, and Ali TAH (2020). Clinico-histopathological and immunohistochemical study of ruminant's cutaneous papillomavirus in Iraq. Veterinary Medicine International, 2020(1):5691974. DOI: https://doi.org/10.1155/2020/5691974

Araldi RP, Assaf SMR, Carvalho RF, Carvalho M, Souza JM, Magnelli RF, et al. (2017). Papillomaviruses: a systematic review. Genetics and Molecular Biology, 40(1):1–21. DOI: https://doi.org/10.1590/1678-4685-gmb-2016-0128

Aydin H, Gelen V, Şengül E, and Yildirim S (2020). Immunological effects of autogenous vaccine administration in cattle with cutaneous papillomatosis. Acta Veterinaria Eurasia, 46:98–103. DOI: https://doi.org/10.5152/actavet.2020.20002

Babu MVS, Veena P, Kumar RVS, Amaravathi P, Vani G, and Reddy KJM (2020). Clinical studies on bovine papillomatosis. International Journal of Livestock Research, 10(7): 98–103. DOI: https://ijlr.org/ojs_journal/index.php/ijlr/article/view/688?articlesBySimilarityPage=1

Bancroft JD and Gamble M (2008). *Theory and practice of histological techniques* (6th ed.). Churchill Livingstone, Elsevier Inc. DOI: https://doi.org/10.1016/B978-0-443-10279-0.50010-5

Beytut E (2017). Pathological and immunohistochemical evaluation of skin and teat papillomas in cattle. Turkish Journal of Veterinary and Animal Sciences, 41(2):204–212. DOI: https://doi.org/10.3906/vet-1609-65

Bianchi RM, Alves CDBT, Schwertz CI, Panziera W, De Lorenzo C, da Silva FS, et al. (2020). Molecular and pathological characterization of teat papillomatosis in dairy cows in southern Brazil. Brazilian Journal of Microbiology, 51(1): 369–375. DOI: https://doi.org/10.1007/s42770-019-00175-2

Borzacchiello G and Roperto F (2008). Bovine papillomaviruses, papillomas and cancer in cattle. Veterinary Research, 39(5):45. DOI: https://doi.org/10.1051/vetres:2008022

Campo MS (2002). Animal models of papillomavirus pathogenesis. Virus Research, 89(2):249–261. DOI: https://doi.org/10.1016/s0168-1702(02)00193-4

Carvajal-Reina DJ, Bedoya-Páez F, Guerrero-Freire MS, Ledesma Y, Vasco-Julio D, de Waard JH, et al. (2025). Bovine papillomavirus genotypic diversity and a putative novel viral type in Ecuador. Veterinary Sciences, 12(7): 672. DOI: https://doi.org/10.3390/vetsci12070672

Corteggio A, Altamura G, Roperto F, and Borzacchiello G (2013). Bovine papillomavirus E5 and E7 oncoproteins in naturally occurring tumors: are two better than one? Infectious Agents and Cancer, 8(1):1. DOI: https://doi.org/10.1186/1750-9378-8-1

Crossland N (2024). Image challenge in veterinary pathology, answers: reproductive tract diseases. Veterinary Pathology, 61(4):679–681. DOI: https://doi.org/10.1177/03009858241244852

Cuschieri S (2024). Conducting an observational epidemiological study: from idea to publication. Routledge. Doi: https://doi.org/10.4324/9781003413721

Elghmry ZM, El Korashy NM, Ghonaim AH, and Li W (2025). Bovine papillomavirus: the silent threat in cattle health. Veterinary Virology of Domestic and Pet Animals, pp. 1–18. DOI: https://doi.org/10.1007/978-3-031-54690-7_53-1

Fenner F, Bachmann P, Gibbs E, Murphy F, Studdert M, and White D (1987). Veterinary virology. Academic Press, Orlando, FL.

Fields BN, Knipe DM, and Howley PM (2007). Fields virology (5th ed.). Lippincott Williams and Wilkins.

Gharban HA, Al-Shaeli SJ, and Hussen TJ (2023). Molecular genotyping, histopathological and immunohistochemical studies of bovine papillomatosis. Open Veterinary Journal, 13(1):26. DOI: https://doi.org/10.5455/ovj.2023.v13.i1.4

Hatama S, Murakami K, Yamamoto S, and Kadota K (2018). Detection of bovine papillomavirus type 2 DNA in calf conjunctival myofibroblastoma. Journal of Veterinary Medical Science, 80(10):1544–1548. DOI: https://doi.org/10.1292/jvms.18-0341

Hesham M, Abdel-Ghaffar SK, and Sadek AA (2024). Pathological, histopathological, and immunohistochemical evaluation of vulvar fibropapilloma in a heifer and its therapeutic trial: a case report. Journal of Advanced Veterinary Research, 14(7):1282–1285. DOI: https://www.advetresearch.com/index.php/AVR/article/view/1986

Jelínek F and Tachezy R (2005). Cutaneous papillomatosis in cattle. Journal of Comparative Pathology, 132(1):70–81. DOI: https://doi.org/10.1016/j.jcpa.2004.07.001

Khattab MS, Ali AM, Osman AH, AbuBakr HO, Azouz RA, Ramadan ES, et al. (2023). Bovine papillomatosis: a serological, hematobiochemical, ultrastructural and immunohistochemical investigation in cattle. Pakistan Veterinary Journal, 43(2): 327-332. DOI: http://pvj.com.pk/pdf-files/22-413.pdf

Knottenbelt DC (2009). Pascoe's principles and practice of equine dermatology. Elsevier Inc.

Namgyel U, Wangdi K, Pem R, and Rinchen S (2021). Effectiveness of different treatment protocols against cutaneous bovine papillomatosis (wart): a clinical trial study. Bhutan Journal of Animal Science, 5(1):95–102. DOI: https://ojs.moal.gov.bt/index.php/bjas/article/view/14

Nicholls PK and Stanley MA (2000). The immunology of animal papillomaviruses. Veterinary Immunology and Immunopathology, 73(2):101–127. DOI: https://doi.org/10.1016/s0165-2427(99)00165-8

Özsoy ŞY, Özyıldız Z, and Güzel M (2011). Clinical, pathological and immunohistochemical findings of bovine cutaneous papillomatosis. Ankara Üniversitesi Veteriner Fakültesi Dergisi, 58(3):161–165. DOI: https://doi.org/10.1501/Vetfak_0000002468

Panchal JH, Bhatt RH, Raval RJ, Kalaria VA, and Vadalia JV (2024). Diagnosis and surgico-therapeutic management of bovine tumours. Indian Journal of Veterinary Sciences and Biotechnology, 20(1): 70-76. https://doi.org/10.48165/ijvsbt.20.1.15

Salib FA and Farghali HA (2011). Clinical, epidemiological and therapeutic studies on bovine papillomatosis in northern oases, Egypt in 2008. Veterinary World, 4(2):53–59. DOI: https://doi.org/10.5455/vetworld.2011.53-59

Sameeh MY (2010). Veterinary medicine: a textbook of the diseases of cattle, horses, sheep, pigs and goats, 10th ed., Elsevier Health Sciences.

Sharma S, Gupta D, and Bansal B (2020). Udder and teat skin lesions in bovines. International Journal of Livestock Research, 10:1–14. DOI: http://ijlr.org/ojs_journal/index.php/ijlr/article/view/777

Somvanshi R (2011). Papillomatosis in buffaloes: a less-known disease. Transboundary and Emerging Diseases, 58(4):327–332. DOI: https://doi.org/10.1111/j.1865-1682.2011.01211.x

Somvanshi R, Koul G, Sharma B, and Biswas J (1986). Clinico-pathological observations on cutaneous bovine papillomas. Indian Journal of of Animal Sciences, 56:836-840. https://agris.fao.org/search/en/providers/122648/records/6471c36b77fd37171a6eb957

Studdert MJ, McCoy K, Allworth MB, and Staples P (1988). Papilloma of the ears of calves following tattooing. Australian Veterinary Journal, 65(12):399. DOI: https://doi.org/10.1111/j.1751-0813.1988.tb14285.x

Ugochukwu ICI, Aneke CI, Idoko IS, Sani NA, Amoche AJ, Mshiela WP, et al. (2019). Bovine papilloma: aetiology, pathology, immunology, disease status, diagnosis, control, prevention and treatment: a review. Comparative Clinical Pathology, 28(3):737–745. DOI: https://dx.doi.org/10.1007/s00580-018-2785-3

Usman M and Gwadabawa U (2024). Management of cutaneous bovine papillomatosis in cross bred Holstein Friesian cow. Journal of Sustainable Veterinary and Allied Sciences, 6(2): 153-155. https://josvasmouau.com/wp-content/uploads/2024/07/24.-Usman-Gwadabawa-2024.pdf

Yıldırım Y, Kale M, Özmen Ö, Çağırgan AA, Hasırcıoğlu S, Küçük A, et al. (2022). Phylogenetic analysis and searching bovine papillomaviruses in teat papillomatosis cases in cattle by performing histopathology, immunohistochemistry, and transmission electron microscopy. Microbial Pathogenesis, 170:105713. DOI: https://doi.org/10.1016/j.micpath.2022.105713