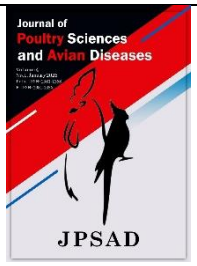
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Localized Non-Pigmented Villonodular Synovial Proliferation in a Domestic Canary (*Serinus canaria domestica*): A Case Report and Pathological Findings

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A B S T R A C T

Villonodular synovitis (VNS) is a rare, proliferative disorder of the synovial membrane that occurs predominantly in mammals, particularly humans and large domestic animals. It presents as localized or diffuse forms characterized by villous and nodular synovial hyperplasia. While VNS is well documented in human and veterinary orthopedic literature, reports in birds are exceptionally rare. An adult domestic canary (*Serinus canaria domestica*) was presented with a dome-shaped nodular swelling at the left wing. The bird was maintained under indoor breeding conditions with a seed-based diet. Surgical excision was performed under isoflurane anesthesia following standard aseptic preparation. The mass was removed via blunt and sharp dissection, and the wound was closed in two layers. Postoperative care included meloxicam and enrofloxacin administration. Histopathology revealed a localized papillary, villous, and nodular synovial-type proliferation supported by fibrovascular stroma, with synovial-lined, cleft-like spaces, and without detectable hemosiderin-laden macrophages or multinucleated giant cells. The findings were most consistent with a localized non-pigmented VNS-like synovial proliferative lesion. Short-term postoperative recovery was uneventful, with complete wound healing within two weeks. This report highlights the need to include synovial proliferative disorders in the differential diagnosis of avian joint swellings and underscores the diagnostic value of histopathology in such cases.

Keywords: *Villonodular Synovitis; Canary (Serinus canaria domestica); Avian Pathology; Synovial Proliferation; Joint Disease*

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1 Introduction

Villonodular synovitis (VNS) is a rare, benign but locally aggressive proliferative disorder of the synovial membrane that affects both humans and animals. It is most commonly reported in humans, with an estimated annual incidence of 1.8 cases per million individuals, and typically involves large joints such as the knee and hip (El Hassali et al., 2024; Fałek et al., 2018). The disease can present in localized or diffuse forms, with the diffuse variant showing a higher recurrence rate after treatment (Matar & Acharya, 2019; Oni & Cavallo, 2011). Although VNS is not considered transmissible, it has been documented in domestic animals, including dogs, horses, and cattle, suggesting that similar pathogenic mechanisms may exist across species (Akerblom & Sjöström, 2006). However, reports of this condition in non-mammalian species are exceedingly rare, and it remains largely unexplored in avian medicine.

The pathogenesis of VNS remains incompletely understood, with proposed mechanisms including chronic inflammation, trauma, and neoplastic transformation linked to cytogenetic abnormalities (Semenova & Radenska-Lopovok, 2010). Histopathologically, VNS is characterized by villous and nodular hypertrophy of the synovial membrane, accumulation of hemosiderin-laden macrophages, fibroblast proliferation, and multinucleated giant cells (Coutinho et al., 2015; Fałek et al., 2018). These lesions often cause pain, swelling, restricted motion, and recurrent effusion, and MRI and histopathology are essential diagnostic tools (El Hassali et al., 2024; Matar & Acharya, 2019).

In avian species, proliferative synovial disorders such as VNS are exceedingly rare and often underdiagnosed due to limited awareness and diagnostic challenges. Most avian joint diseases are attributed to infectious, traumatic, or degenerative causes rather than proliferative or neoplastic conditions (Leclerc et al., 2023). Clinical signs, including lameness and joint swelling, can easily be misinterpreted as gout, bacterial arthritis, or articular infections. With advancements in avian diagnostic imaging and histopathology, recognition of non-infectious proliferative joint diseases is gradually increasing. This report describes a localized, non-pigmented villonodular synovial proliferation in a canary (*Serinus canaria domestica*), aiming to expand knowledge of avian joint pathology, highlight diagnostic considerations, and contribute to a more comprehensive understanding of synovial proliferative disorders in birds.

2 Case presentation

An adult domestic canary (*Serinus canaria domestica*) of unknown sex (exact age unknown) was referred to the Teaching Hospital of the Faculty of Veterinary Medicine, Shahid Bahonar University of Kerman. The bird weighed 18 g. A dome-shaped, red nodular lesion was observed on the surface of the carpometacarpal joint of the left wing, measuring 2.5×4.3×5.6 mm (Fig. 1). Based on owner information, the bird was maintained as a pet, housed in pairs in breeding cages (50×40×40 cm) with artificial lighting. No other birds in the same facility showed similar joint masses or lesions in the preceding year. The diet consisted mainly of a traditional seed mixture (millets and linseed), soft food (fruits and vegetables), cuttlefish bone, and grit. No known history of trauma to the wing was reported by the owner.



Figure. 1. Clinical appearance of the left carpometacarpal joint in a domestic canary. The nodular, dome-shaped mass (arrow) is visible on the dorsal aspect of the left wing. The lesion measured approximately 2.5×4.3×5.6 mm.

On physical examination, the nodule was firmly attached to the underlying periarticular region over the carpometacarpal joint. Still, it was mobile relative to the overlying skin, suggesting a subcutaneous/periarticular origin rather than a strictly cutaneous or deeply intra-articular lesion. The bird did not exhibit overt lameness or wing droop at rest; however, mild reluctance to fully extend the affected wing was noted upon gentle manipulation. The mass was non-painful on palpation, and no local heat, effusion, or open wound was observed. Preoperative radiography was not performed because the mass was superficial and clearly localized, and the patient's small size limited the diagnostic yield of conventional radiography in this context. Bacterial culture was not indicated, as there were no clinical signs of infection (e.g., purulent discharge, swelling, or systemic illness). Gout was clinically considered due to the species' predisposition. Still, gross inspection of the joint at the time of surgery revealed no chalky white urate deposits, and subsequent histopathology excluded this diagnosis.

Anesthesia was induced with isoflurane (3–4%) and maintained at 1.5–2.5% via face mask. The surgical site on the left wing over the carpometacarpal joint was aseptically prepared. A skin incision was made over the palpable mass, and blunt and sharp dissection were used to excise the mass while carefully preserving adjacent tendons and blood vessels. The joint capsule was not entered. Hemorrhage was controlled, and the excised mass was submitted for histopathological analysis in 10% neutral buffered formalin. The wound was closed in two layers. Postoperative analgesia and antibiotic therapy included meloxicam (1 mg/kg, PO, q12h for 3 days) and enrofloxacin (15 mg/kg, PO, q12 h for 5 days), based on standard avian pharmacological references. The bird uneventfully recovered, and sutures were postoperatively removed 10–14 days. At the two-week follow-up examination, no recurrence of the mass was observed, and the bird had regained full use of the affected wing without apparent discomfort.

Histopathological examination of multiple serial sections revealed a circumscribed, non-encapsulated but well-demarcated mass arising from the periarticular soft tissues overlying the carpometacarpal joint, without definitive evidence of intra-articular origin or invasion into the joint capsule. The mass was closely composed of numerous arranged villous and papillary projections of variable size and shape. Multiple slit-like (pseudo-glandular) spaces lined by synovial cells were present within the proliferative tissue (Fig. 2). The villi were covered with a layer of synovial cells. The stroma under the synovial cells exhibited variable degrees of fibrosis and hyalinization and was infiltrated by a heterogeneous population of mononuclearhistiocyte-like cellsandfoamy macrophages**.** The lesion was highly vascular, with prominent small- to medium-caliber blood vessels distributed throughout the stroma. The proliferating cells had uniform nuclei without significant atypia, pleomorphism, hyperchromasia, or prominent nucleoli. No mitotic figures were identified in 20 high-power fields, and no areas of coagulative or geographic necrosis were seen. Some structures similar to osteoid and bone trabeculae, accompanied by very limited foci of cartilage, were observed. Inflammatory infiltrates consisting of histiocytes and lymphocytes were present, especially at the base of the lesion. The surgical margins were evaluable and appeared free of lesional tissue. To reduce the risk of sampling error, multiple serial sections were systematically examined. No visible hemosiderin pigment was identified in the serial H&E-stained sections examined; however, Prussian blue staining was not performed. Similarly, no multinucleated giant cells were identified in the sections examined (Fig. 3). The observed microscopic findings were suggestive ofnon-pigmented villonodular synovial proliferation, characterized by villous synovial proliferation and fibrovascular stromal expansion in the absence of hemosiderin deposition.

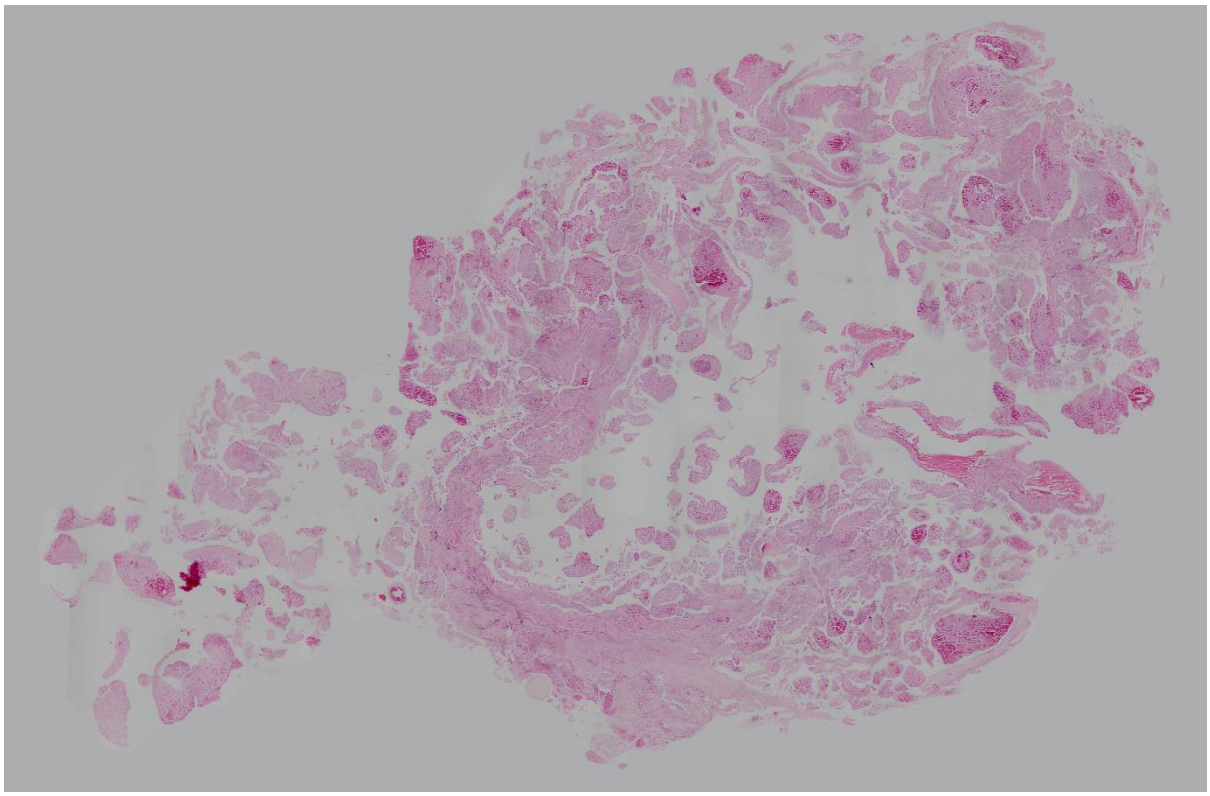


Figure. 2. Subgross view of the excised mass. The lesion displays numerous closely arranged villous (rectangle) and papillary projections (circle) with intervening synovial-cell-lined cleft-like (pseudo-glandular) spaces (arrows). The architecture is supported by a fibrovascular stroma. (H&E stain; original magnification×40; scale bar=1 mm).

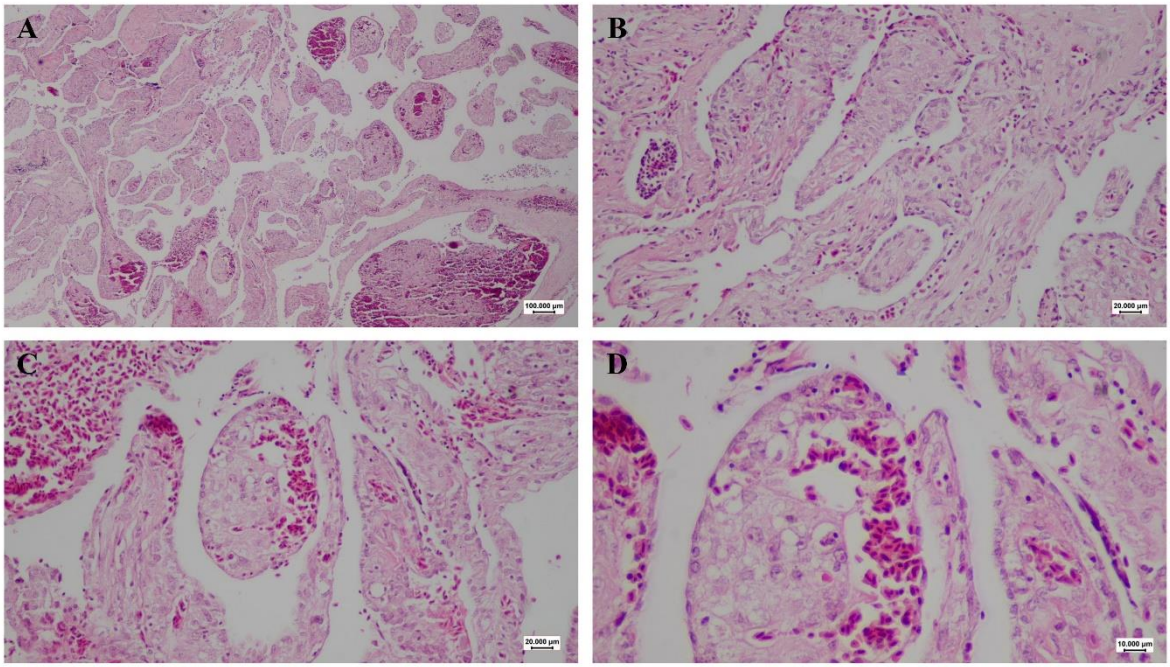


Figure 3. Histopathological features of the localized, non-pigmented villonodular synovial proliferation in a canary. (A**)**: Low-power view showing an exophytic villonodular proliferation composed of multiple papillary and villous projections. (B & D): Higher magnifications demonstrate villous projections covered by synovial cells (arrow) with underlying fibrovascular tissues, cleft-like spaces, and foamy macrophages (arrowhead) within the fibrovascular stroma. (C): Focal osseous metaplasia characterized by osteoid formation and developing bony trabeculae (asterisk) (H&E staining; Scale bars: A=100 µm, B=20 µm, C=50 µm, D=10 µm).

3 Discussion

The pathogenesis of VNS remains elusive. Villonodular synovitis has previously been described as a rare proliferative lesion of the joint synovium in older cockatiels (Reavill & Dorrestein, 2010). However, to the best of the authors' knowledge, based on a search of PubMed, Scopus, Web of Science, and Google Scholar using the terms "non-pigmented villonodular synovial proliferation", "villonodular synovitis", "pigmented villonodular synovitis", "tenosynovial giant cell tumor", "bird", "avian", and "canary". This is the first detailed and histologically illustrated report of a localized non-pigmented villonodular synovial proliferation in a domestic canary. Whether the diagnostic criteria and biological behavior established for mammalian VNS are directly transferable to avian species remains uncertain, and caution is warranted in extrapolating mammalian paradigms to this case. Chronic trauma, intra-articular hemorrhage, and repeated inflammation have also been proposed as contributory factors in the development of VNS, supporting a reactive pathogenesis in at least some cases (Jaffe, 1941; Murphey et al., 2008). In veterinary literature, limited case series in dogs show that medical management with anti-inflammatories and nutraceuticals has some efficacy, but a full understanding of the disease remains lacking (Akerblom & Sjöström, 2006). However, in non-mammalian taxa such as birds, chronic inflammation or repeated trauma may be more plausible etiologic factors, particularly given the small joint size and the potential for mechanical irritation in caged environments (Doneley, 2016). The carpometacarpal joint's superficial location in the wings makes it susceptible to friction from cage bars or perches, causing chronic synovial irritation. Based on our understanding of trauma or hemorrhage as potential triggers in human PVNS (Xie et al., 2015), we hypothesize that chronic mechanical irritation from cage bars or perches may have predisposed to synovial proliferation in this case; however, this remains speculative and is presented as a potential contributing factor rather than a confirmed cause. Radiologically and pathologically, VNS is characterized by synovial hyperplasia with villous or nodular projections, frequent hemosiderin deposition and multinucleated giant cells, and, in diffuse forms, by bone erosion and articular destruction (Bernard et al., 2024; Fazio et al., 2025; Murphey et al., 2008).

In birds, however, such proliferative synovial lesions remain virtually undocumented. Comprehensive avian pathology references, such as Schmidt et al. (2003), do not describe VNS or similar synovial proliferative lesions in passerines, further supporting the rarity of this finding (Fulton, 2024; Schmidt et al., 2003). One plausible reason is that avian joint disorders are most commonly attributed to infectious arthritis, trauma, gout, or degenerative changes rather than to proliferative synovial neoplasia (Leclerc et al., 2023; Rothschild & Panza, 2006). The present case of a canary with a dome-shaped, nodular mass at the carpometacarpal joint and histopathology revealing papillary and villous synovial structures without hemosiderin or giant cells suggests a localized, non-pigmented synovial proliferation that shares morphological similarities with the "non-pigmented" variant of VNS described in human orthopedic literature (Rao & Gowda, 2022). Nevertheless, the absence of hemosiderin and giant cells precludes a definitive diagnosis of classical VNS; therefore, we classify this lesion descriptively. Scattered focal osteoid formation, bony trabeculae, and cartilaginous tissue were also observed within the lesion. These elements constituted only a minor component of the mass and were interpreted as secondary osseous and cartilaginous metaplasia associated with synovial proliferation and stromal remodeling (Oda et al., 2007).

From a diagnostic standpoint, recognizing synovial proliferative disease in birds requires a high index of suspicion. In mammals, MRI or CT may show characteristic low-signal foci from hemosiderin and synovial thickening, helping with diagnosis (Spierenburg et al., 2023). In small avian patients, such imaging may not always be feasible; thus, surgical excision and histopathological evaluation remain the gold standard. It must be emphasized that, in avian clinical practice, infectious arthritis, gout, and degenerative joint disease are considerably more prevalent causes of periarticular swelling in canaries than proliferative synovial disorders; hence, the latter diagnosis should be only entertained after rigorous histological exclusion of these common entities. A more comprehensive differential diagnosis for nodular periarticular masses in canaries, including traumatic granuloma, chronic synovitis, infectious arthritis/periarthritis, gouty tophus, fibroma/fibrosarcoma, synovial cyst, papillomatous or fibroepithelial proliferation, haemangioma, xanthoma, synovial sarcoma, and tenosynovial giant cell tumor-like lesions, should be considered. These conditions were considered and excluded based on the absence of their characteristic histopathological features, including granulomatous inflammation, infectious exudates, urate tophi, marked cellular atypia, vascular proliferation, epithelial components, or malignant

mesenchymal characteristics. Prominent villous and nodular synovial proliferation with synovial-lined cleft-like spaces supported a synovial proliferative lesion.

Therapeutically, early surgical excision in localized cases yields a favorable outcome, as observed in human series where complete synovectomy reduces recurrence risk (Sharma & Cheng, 2009). In the present case, prompt excision and adequate postoperative management produced an excellent result; this suggests that, at least for localized non-pigmented lesions, the short-term postoperative outcome may be favorable. However, we caution that recurrence of such lesions (well documented in mammalian VNS) cannot be ruled out with only two weeks of follow-up. Diffuse forms, if ever identified in avians, might carry a higher risk of recurrence, mirroring mammalian patterns, and would require more extensive synovectomy and possibly adjunctive therapy (Keyhani et al., 2025).

In conclusion, this report describes a rare localized synovial proliferative lesion arising in the carpometacarpal region of a domestic canary and, to the authors' knowledge, represents a localized, non-pigmented villonodular synovial proliferation in a domestic canary, contributing a valuable comparative data point to the limited literature on avian joint pathologies. Histopathological examination revealed characteristic villous and nodular synovial proliferation supported by a fibrovascular stroma and accompanied by histiocytic infiltration. However, classical features such as hemosiderin deposition and multinucleated giant cells were absent.

Significant limitations of the present report include the absence of preoperative imaging, lack of immunohistochemical and molecular characterization, no special histochemical stains (such as Prussian blue or Masson's trichrome), and limited postoperative follow-up (two weeks). These constraints preclude definitive characterization of the lesion's immunophenotype, stromal composition, proliferative index, and long-term biological behavior. We did not perform special stains primarily because of the limited availability of remaining tissue after routine diagnostic processing and the lack of avian-validated antibodies in our diagnostic setting. Furthermore, the limited follow-up period is insufficient to exclude late recurrence, a well-documented phenomenon in mammalian VNS. Consequently, we refrain from making any claims about long-term prognosis or permanent cure, and we advocate continued clinical surveillance. Our diagnosis and conclusions remain strictly morphology-based, relying on systematic examination of multiple serial sections on routine H&E staining.

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Use of Artificial Intelligence

Generative artificial intelligence was only used for English-language editing and grammatical improvement. The authors reviewed and verified the entire manuscript and take full responsibility for its scientific content.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

S.A. contributed to the pathologic investigation and manuscript review & editing; R.K. evaluated the pathologic results. MFA contributed to the laboratory techniques. AM, writing - review & editing; SD, writing–review and editing the manuscript. All authors read and approved the final manuscript.

Data Availability Statement

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

Ethical Considerations

Ethical approval was not required for this case report, as all procedures were performed as part of routine clinical examination and diagnostic work-up. Written informed owner/guardian consent was obtained for all procedures and for publication of this report (including any images, if applicable). All procedures were conducted in accordance with accepted veterinary ethical standards and applicable animal welfare regulations.

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