

*Case report*
**A DILATED PORE OF WINER IN A YOUNG IBERIAN LYNX  
(*LYNX PARDINUS*)**

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A 1.5-year-old male Iberian lynx born in captivity presented with a 2.2 cm exophytic nodular alopecic mass at the left tarsus medial aspect, before being released into the wild. The lesion had keratinised material protruding through a 1.2 cm pore, forming a cutaneous horn. Histopathology revealed a cystic dermo-epidermal lesion lined by psoriasiform hyperplasia of the epithelium, thicker at the base of the cyst, together with abrupt to progressive keratinization and keratin pearls. The central cystic cavity was filled with fibrillary keratin and ghost cells. Immunohistochemistry for pan-cytokeratin showed strong positive immunolabeling in the hyperplastic epithelium and a weaker immunolabeling at the content of the cyst. A final diagnosis of a Dilated Pore of Winer was made. This paper is the first reported case of a DPW in a lynx and a wild felid.

**Keywords:** dilated pore, feline, lynx, skin

## INTRODUCTION

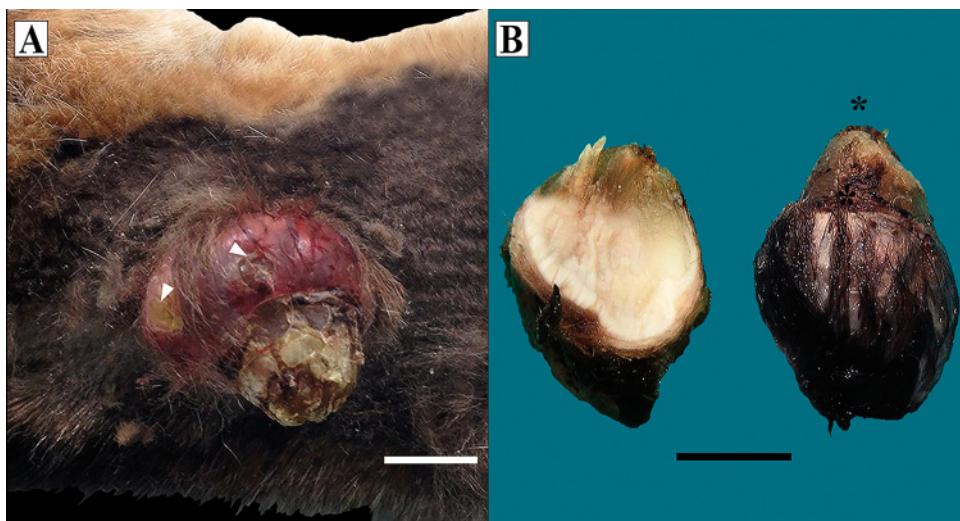
The dilated pore of Winer (DPW) is a benign, keratin-filled, hyperplastic and pyriform-shaped dermo-epidermal cyst that is considered a proliferative variant of the infundibular cyst [1,2]. The aetiology of DPW is unknown, but it has been suggested to be the result from follicle obstruction and increased intrafollicular pressure, with consequent hyperplastic changes [2,3]. DPW has usually been described on the face and neck of middle-aged or old cats, without breed or sex predilection [1,3]. DPW has

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been rarely described in other species, such as dogs and horses [4], and it is also relatively common in the head, neck and upper trunk of human beings [5]. The pathology of DPW corresponds to a nodular and alopecic infundibulocystic mass containing compact and laminated keratin with a dilated patent follicular ostium acting as a pore on the surface. Keratin can sometimes protrude to the exterior, forming a cutaneous horn [1,3–7]. Microscopically, the wall of the cyst resembles infundibular epithelium, presenting with prominent psoriasiform hyperplasia at the base of the lesion and a thinner epithelium in the proximity of the pore. The cyst epithelium invades the underlying dermis forming scalloped, regular rete ridges at the base [1,3,5,8–10]. The present report describes the first case of DPW in an Iberian lynx (*Lynx pardinus*), an endangered felid rescued from extinction based on intensive ongoing conservation actions [11].

### CASE PRESENTATION

A 1.5-year-old male Iberian lynx born in captivity in 2013 in the *Centro Nacional de Reprodução do Lince Ibérico* (Silves, Portugal) was presented for clinical examination with a cutaneous alopecic mass located on the left tarsus medial aspect (Figure 1) that was surgically removed before releasing into the wild. The lynx was negative, either serologically or by PCR, for feline immunodeficiency virus, feline coronavirus, feline calicivirus, feline leukemia virus, feline herpesvirus, feline parvovirus, canine distemper virus and *Leptospira* spp. A comprehensive clinical study showed no other

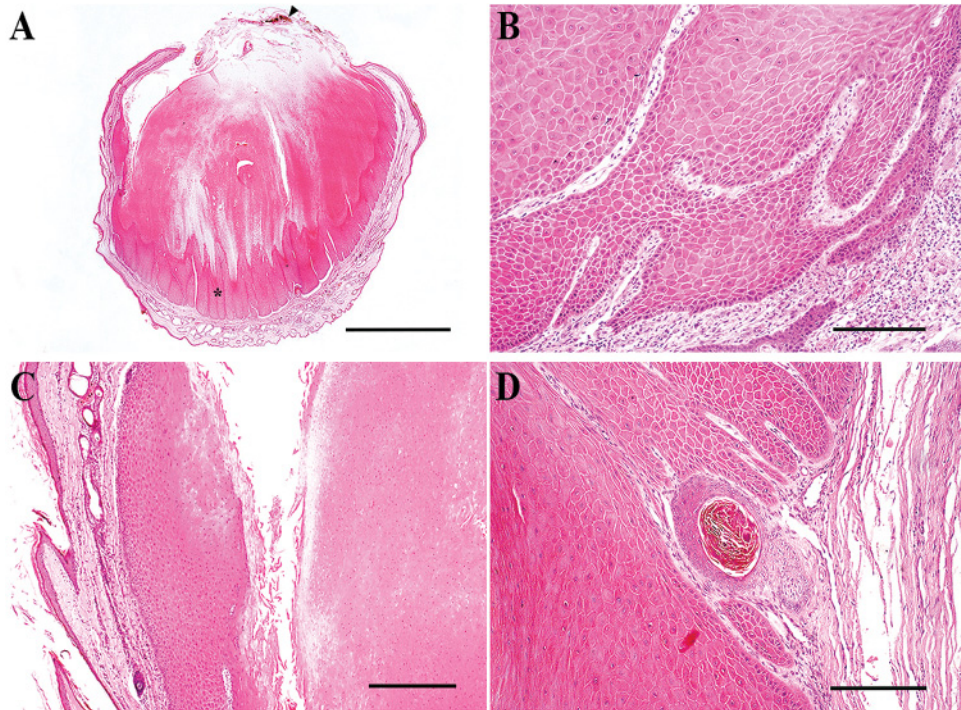


**Figure 1.** Dilated pore of Winer, left tarsal skin, Iberian lynx (*Lynx pardinus*). **(A)** Two cm alopecic nodule showing a wide-mouthed pore and a cutaneous horn (asterisk). Tears in the capsule (arrowheads) can be observed. Bar, 1 cm. **(B)** Longitudinal section of the fixed dilated pore. Whitish keratin material in the center, surrounded by the epithelial growth, also shows white discoloration. The cutaneous horn (asterisks) shows grey-yellowish discoloration.

abnormalities. The entire mass was fixed in 10% neutral buffered formalin and sections routinely embedded in paraffin wax and 4 µm sections were stained with haematoxylin and eosin (HE). Pan-cytokeratin immunohistochemistry was performed using a mouse anti-human cytokeratin (CK) monoclonal (AE1/AE3; M3515, Dako) at 1:50 dilution. Antigen retrieval with a 10 mM citric acid solution, an avidin–biotin complex peroxidase kit, and 3'3'-diaminobenzidine (both from Vector, Burlingame, USA) was performed.

Grossly, the mass was a solid, round, 2.2 cm, exophytic, partially alopecic, cutaneous nodule containing whitish keratinized, cornified material and a 1.2 cm dilated pore on the surface, through which the cornified material protruded to the exterior, forming a cutaneous horn; the capsule of the lesion presented tears (Figure 1A). The cut section of the mass demonstrated central whitish discoloration, whereas a darker colour was observed at the cutaneous horn (Figure 1B).

Microscopically, the dermo-epidermal mass corresponded to a round cystic structure lined by a layer of exaggerated regular hyperplastic (psoriasiform) and keratinizing

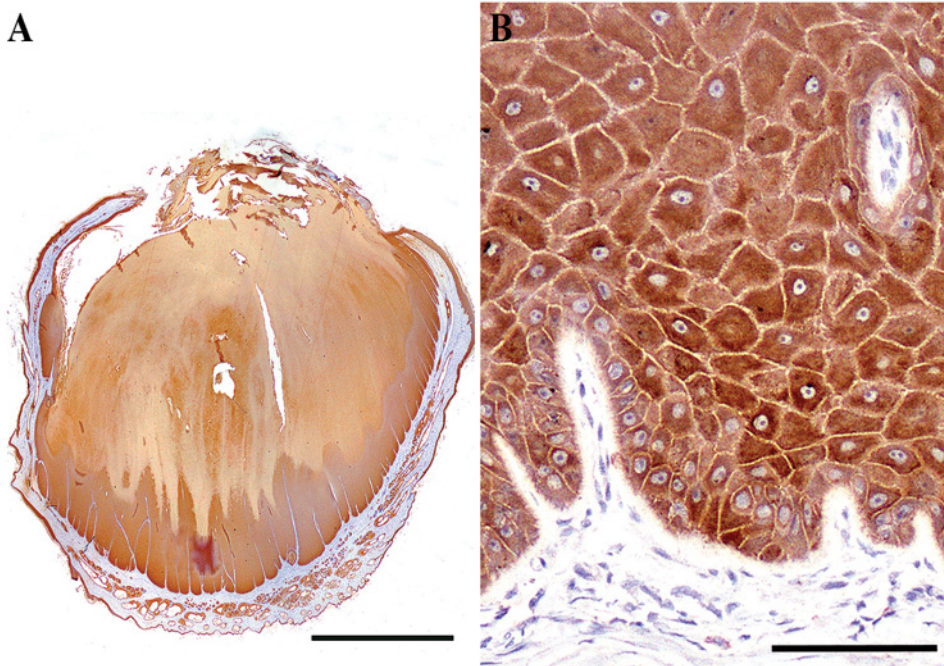


**Figure 2.** Dilated pore of Winer, Iberian lynx (*Lynx pardinus*). **(A)** A large amount of keratin is delimited by a marked psoriasiform hyperplasia of the epithelium (asterisk), with keratin emerging through the dilated pore (arrowhead). Surrounding pilosebaceous structures appear atrophied. HE. Bar, 2500 µm. **(B)** Hyperplastic squamous epithelium with thick rete ridges formed by polygonal keratinocytes with prominent intercellular spines. HE, Bar, 200 µm. **(C)** Hyperplastic epithelium surrounds an important amount of amorphous and fibrillary keratin admixed with squamous cells (ghost cells). HE, Bar, 200 µm. **(D)** Concentric lamellar keratin (keratin pearl) formation within the hyperplastic squamous epithelium HE. Bar, 200 µm.



squamous epithelium of infundibular origin that was thicker at the base of the cyst and thinner at the vicinity of the pore (Figure 2A). One or two layers of basal cells and numerous polygonal keratinocyte layers that showed moderate eosinophilic cytoplasm, prominent intercellular bridges, rounded uniform nuclei and inconspicuous nucleoli (Figure 2B) formed the epithelium. Hyperplastic rows of epithelial cells rested on the prominent basal membrane. Variable areas of abrupt to progressive keratinization were observed along the hyperplastic epithelium (Figure 2C). The central cystic cavity was filled by a large amount of amorphous and fibrillary keratin and abundant lightly stained squamous cells (ghost cells). At the periphery of the wall, the epithelium showed occasional keratin pearl formation (Figure 2D). A thin layer of connective tissue that displaced the rest of the pilosebaceous structures laterally and ventrally (Figure 2A) delimited the epithelium. A peripheral lymphoplasmacytic infiltrate was observed together with occasional neutrophilic foci. IHC for pan-cytokeratin showed strong positive immunolabelling in the hyperplastic epithelium and a weaker signal at the content of the cyst (Figures 3A and B).

This paper is the first report of a DPW in a non-domestic felid, and some of its characteristics differ from previous reports in cats [1,3,12,13]. Whereas DPW affects



**Figure 3.** Dilated pore of Winer, Iberian lynx (*Lynx pardinus*) (A) Immunohistochemistry against cytokeratin. Positive immunolabelling in keratinocytes at the hyperplastic epithelium and keratin content. Non-affected epithelial structures of the skin are also positive for the staining. IHC, AE1/AE3. Bar, 2500  $\mu\text{m}$ . (B) Keratinocytes with strong immunolabelling for AE1-AE3 (tan brown).

middle-aged or older cats, the present case was observed in a 1.5-year-old Iberian lynx. Interestingly, only a few cases of DPW have been recorded in cats 1-5 years-old [3,12]. A similar situation is found in humans, in which DPW is more common between 60-70 years old, but cases in young individuals have been reported [5,14]. The location of the DPW in this lynx differs from the most frequently affected areas in domestic cats. In this case, DPW was found on a limb, whereas in cats, DPW is more frequently reported on the face and neck [3]. To the best of the authors' knowledge, this lesion has not yet been reported in a felid limb. Histopathologic features are similar to those described in cats, but the present case showed the formation of keratin pearls, a feature not commonly described for DPW [1,9,13].

Differential diagnoses for DPW in cats are limited [13], although some can be considered for the present case in a lynx. The most important is the infundibular keratinizing acanthoma (IKA), a non-recurrent benign follicular tumour with a keratin-filled central cavity arising from the squamous epithelium of the isthmus and infundibulum. IKA has only been documented in the scientific literature in dogs [13,15]. Some of the DPW characteristics are reminiscent of those of canine IKA, including: i) formation of a partially alopecic solitary nodule, ii) age range that includes animals under 5 years old, iii) location in the limbs, iv) eventual extrusion of keratin through a pore, forming a cutaneous horn and v) formation of variable numbers of keratin pearls [1,3,15,16]. Indeed, some early forms of IKA showing evident epithelial trabecular projections and scarce keratin pearls [1] may be evocative of this case of DPW in an Iberian lynx. Interestingly, in human beings, early arising pillar sheath acanthoma (the IKA counterpart in humans) could also be indistinguishable from DPW [7,8]. However, the characteristic rete ridge formation of the hyperplastic epithelium is a hallmark of DPW [15]. Well-differentiated squamous cell carcinoma (SCC) is another lesion to consider among the differential diagnoses. SCC has been described in the cervical region of a Canada lynx (*Lynx canadensis*) [17], inducing lytic lesions in the right mandible of an elderly bobcat (*Lynx rufus*) [18] and, recently, on the tongue of a European lynx (*Lynx lynx*) [19]. However, the location of SCC and its microscopic characteristics, such as the presence of cellular atypia together with a high number of mitoses and keratin pearls, differ from features observed in the present case of DPW.

Surgical removal of the whole DPW is curative in veterinary and human medicine [3,5,7,20]. After recovering from the surgery, this Iberian lynx was fitted with a GPS-GSM collar and released into the wild, near the city of Toledo (Spain). The individual travelled a total of 1605 km in 321 days. It was eventually a victim of roadkill, but no recurrences of the DPW were observed on post-mortem examination. In conclusion, we have described a DPW in an Iberian lynx and any other wild feline for the first time. We have also discussed its main differences with similar lesions reported in domestic cats and other felines. Regardless of out-of-control anthropological factors, this work highlights the importance of pathologic studies in wildlife conservation to ensure a suitable health condition at releasing of captive-bred animals to ensure the widest possible life span.

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## Authors' contributions

EP carried out the research (HE and IHC visualization), writing and review of the original draft. JFLB showed the case performed the surgery and sent the sample. PP carried out the research methodology, sample preparation, IHC and writing-review-editing. RS showed the case performed the surgery and sent the sample. JA participated in the methodology, research and writing-review. JM participated in the methodology, research, and writing-review. LL carried out the conceptualization, research, resources, writing-review, editing, visualization and supervision. MP carried out the conceptualization, research, resources, writing the original draft, review, visualization, supervision, and project administration. All authors read and approved the final manuscript.

## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## REFERENCES

1. Gross TL, Ihrke PJ, Walder EJ, Affolter VK: Follicular tumors. In: *Skin diseases of the dog and cat: clinical and histopathologic diagnosis*. Odder, Denmark: Blackwell Science Ltd; 2005, 604-637.
2. Scott DW, Miller WH, Griffin CE: Neoplastic and non-neoplastic tumors. In: *Muller and Kirk's small animal dermatology*. St. Louis, Missouri: Elsevier Inc; 2001, 774-844.
3. Luther PB, Scott DW, Buerger RG: The dilated pore of Winer: an overlooked cutaneous lesion of cats. *J Comp Pathol* 1989, 101(4):375-379.
4. Mauldin EA, Peters-Kennedy J: Integumentary system. In: *Jubb, Kennedy & Palmer's Pathology of Domestic Animals*. St. Louis, Missouri: Elsevier Inc; 2016, 509-736.
5. Gerding H, Zettl A, Timmermann M: Bothersome cutaneous lesion for more than 30 years: dilated pore of Winer. *Klin Monbl Augenheilkd* 2017; 234(4):595-596.
6. Cabrera R, Matus P, Coulon G, Castro A, Reculé F: Skin collision tumour and dermoscopic diagnosis of melanoma in situ and dilated pore of Winer. *Australas J Dermatol* 2022, 63(1):98-101.
7. Adya K, Inamadar A, Palit A: Dermoscopic characterization of dilated pore of Winer: report of two cases. *Clin Dermatology Rev* 2019, 3(1):96-98.
8. Tellechea O, Reis JP, Gameiro AR, Poiaras Baptista A, Cardoso JC, Ramos L, Coutinho I: Benign follicular tumors. *An Bras Dermatol* 2015, 90(6):780-798.

9. Murphy GF, Elder DE: Benign tumors with pilosebaceous differentiation. In: *Atlas of tumor pathology: non-melanocytic tumors of the skin*. Washington D.C, Rosai J, Sobin LH, editors. Armed Forces Inst. Pathol. Washington D.C., United States: Armed Forces Inst. Pathol; 1991, 120-147.
10. Steffen C: Winer's dilated pore: the infundibuloma. *Am J Dermatopathol* 2001, 23(3):246–253.
11. Rodríguez A, Calzada J: *Lynx pardinus*. The IUCN red list of threatened species 2015, [<https://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T12520A174111773.en>]
12. Abramo F, Pratesi F, Cantile C, Sozzi S, Poli A: Survey of canine and feline follicular tumours and tumour-like lesions in central Italy, *J Small Anim Pract* 1999, 40(10):479–481.
13. Goldschmit MH, Munday JS, Scruggs JL, Klopffleisch R, Kiupel M: Cysts. In: *Surgical pathology of tumors of domestic animals: Volume 1: Epithelial tumors of the skin*. Illinois, USA: Davis Thompson DVM Foundation; 2018, 211-226.
14. Klövekorn G, Klövekorn W, Plewig G, Pinkus H: Giant pore and hair-shaft acanthoma. Clinical and histologic diagnosis. *Hautarzt* 1983, 34(5):209–216.
15. Goldschmidt MH, Goldschmidt KH: Epithelial and melanocytic tumors of the skin. In: *Tumors of domest animals*. Iowa, United States: John Wiley & Sons, Inc.; 2017, 88–141.
16. Hauck ML, Oblak ML: Tumors of the skin and subcutaneous tissues. In: *Withrow and McEwen's small animal clinical oncology*. Misuri, United States: W.B. Saunders; 2020, 352–366.
17. Byrne G, Shenk T: Squamous cell carcinoma in a Canadian Lynx (*Lynx canadensis*). *Japanese Soc Zoo Wildl Med* 2002, 7(2):153–156.
18. Sladakovic I, Burnum A, Blas-Machado U, Kelly LS, Garner BC, Holmes SP, Divers SJ: Mandibular squamous cell carcinoma in a bobcat (*lynx rufus*). *J Zoo Wildl Med* 2016, 47(1):370–373.
19. Altamura G, Eleni C, Meoli R, Cardeti G, Friedrich KG, Borzacchiello G: Tongue squamous cell carcinoma in a European lynx (*Lynx lynx*): papillomavirus infection and histologic analysis. *Vet Sci* 2018, 5(1):1.
20. Winer LH: The dilated pore, a trichoepithelioma. *J Invest Dermatol* 1954, 23(3):181–188.

## **PROŠIRENA WINER-PORA KOD MLADOG IBERIJSKOG RISA (*LYNX PARDINUS*)**

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Mužjak iberijskog risa starosti 1,5 godinu, rođen u zatočeništvu, prezentovan je sa nodularnom masom sa alopecijom prečnika 2,2 cm na levoj medijalnoj strani tarzusa, pre nego što je pušten u divljinu. Unutar lezije nalazio se keratinizovani materijal koji je prominirao kroz poru od 1,2 cm, formirajući kožni rog. Histopatološkim pregledom, ustanovljena je cistična dermo-epidermalna lezija obložena hiperplastičnim epitelom naročito izraženim u bazi ciste, uz prisutnu keratinizaciju. Centralna cistična šupljina bila je ispunjena keratinom uz prisustvo tipičnih „ghost cells“. Imunohistohemijskim

ispitivanjem na pan-citokeratin, ustanovljena je izražena pozitivna reakcija u hiperplastičnom epitelu i slabije izražena reakcija u sadržaju ciste. Postavljena je konačna dijagnoza proširenih *Winer*-pora. Ovaj rad predstavlja prvi opis dilatiranih *Winer* pora - DPV kod risa, odnosno divlje mačke.