

# The Use of an Advancement Flap to Manage a Chronic Skin Lesion in a Laying Hen (*Gallus gallus domesticus*)

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## ABSTRACT

Skin flaps are used to cover large skin defects, particularly in areas where skin tension is high or skin elasticity is low. Despite their usefulness, the utilization of skin flaps in avian patients has been rarely reported. Here we describe the treatment of a chronic skin lesion located on the pelvic limb of a Leghorn laying hen using an advancement skin flap. While surgery was initially successful, recurrence of the lesion warranted further diagnostic measures. Histopathology from the lesion was diagnostic as squamous-cell carcinoma, hence the limb was amputated. The hen recovered from the amputation and was doing well one year post-surgery. As in mammals, skin flaps can be useful in managing skin lesions in avian patients; however, the authors recommend performing a biopsy prior to any attempt to close chronic non-healing wounds.

**Keywords:** Skin Flap; Chicken; *Gallus gallus domesticus*; Squamous Cell Carcinoma; Amputation.

## INTRODUCTION

Avian skin is covered to a large extent by feathers, and is often thinner and more elastic than mammalian skin. In most parts of the body the avian skin is loosely attached to the underlying tissues, allowing for the movement required during flight. In other parts, like the skull and wing tips, the avian skin is firmly attached and its mobility is much reduced. Glabrous (unfeathered) skin of the head, feet and sometimes other areas is often thick and markedly modified (1). Avian epidermal cells proliferate, differentiate, and slough from the surface either continuously as individual cells, or periodically as fragments or larger pieces (1).

In the domestic chicken (*Gallus gallus domesticus*) and some other avian species, the glabrous skin covering the legs from the tarsus distally (podotheca) is heavily cornified and composed of thick scales (1).

Skin flaps are used to cover large skin defects, particularly in areas where skin tension is high, excess skin is limited and/or skin elasticity is low. Pedicle flaps are “tongues” of

epidermis and dermis, which are partially detached from the donor sites in an adjacent area, and placed over the skin defect (2). The base, or pedicle, of the flap contains blood supply, which is important for the healing process and the survival of the flap. Pedicle flaps allow immediate coverage of the skin defect, and prevent excessive scarring and skin contracting in second intention healing (2). Skin flaps can be classified in various ways based on their location, blood supply, and tissue formation (2). Unilateral skin flaps, or single pedicle advancement flaps, are used for closure of square or rectangular wound beds, with mobile skin only available on one side, and on the same plane as the wound.

Pedicle skin flap failure occurs because of necrosis and dehiscence (2). Survival of the flap is reliant on adequate blood supply from the donor site; therefore, the preferred surgical technique includes leaving a wide flap base, as well as avoidance of flap tension and motion. As in all surgeries, prevention of infection of the surgical site is vital. In mammals, skin reconstruction should attempt to preserve the

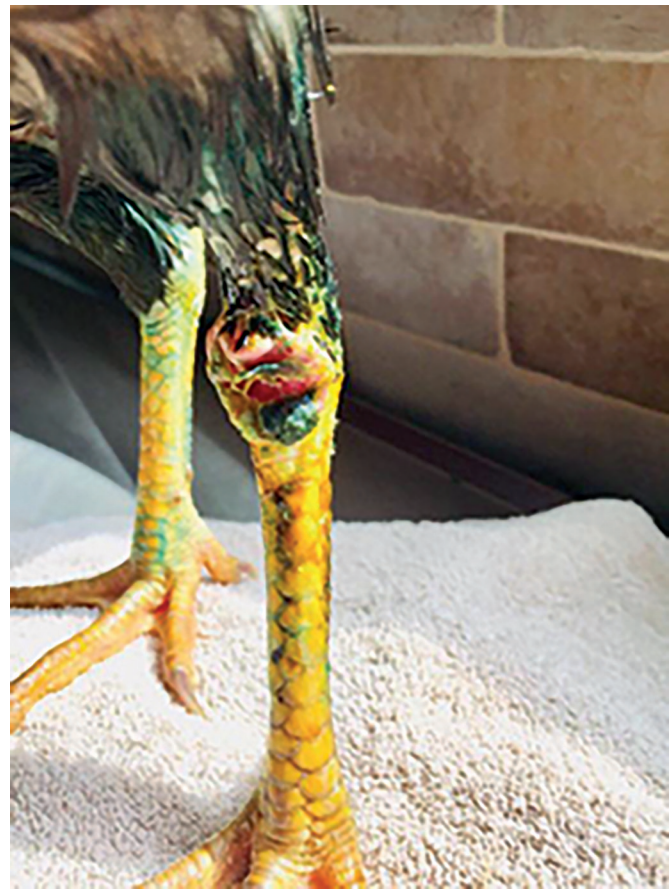
direction of the hair growth and pattern (2) and, given the important functions of feathers, the same principle should apply for avian species.

In the following report, we describe the treatment of a chronic skin lesion located on the pelvic limb of a Leghorn laying hen using an advancement skin flap, a technique that has been scarcely reported in avian species. The reasons for choosing this technique, its application, treatment outcome and the final diagnosis are discussed later in this article.

### CASE SUMMARY

A 4-year-old Leghorn laying hen from an animal shelter presented for a chronic wound on the dorsal surface of its left tarsal joint. The lesion had been present for at least five months, during which the hen had been treated repeatedly with wound debridement and dressings as well as various topical and systemic medications (including iodine ointment, oral meloxicam and injectable enrofloxacin, penicillin-streptomycin, and amoxicillin).

On physical examination, the hen was alert and responsive, in fair body condition and its hydration state was judged normal. It was noticeably lame, barely bearing weight on its left leg. A large ulcerated wound, approximately 4x3cm in size, with a hard, rough-appearing pinkish surface was located on the dorsal aspect of the left tarsal joint (Figure 1a). The joint's range of motion was decreased by 30% compared to the right side. Radiographs showed mild thickening of the soft tissues around the joint with no skeletal involvement. The wound's surface was sampled for in-house culture and sensitivity and plated on a standard blood-agar (Kimron Veterinary Institute, Bet Dagan, Israel) at 37°C, aerobically. The hen received oral meloxicam (Norbrook Laboratories Ltd, Northern Ireland, UK; 0.5mg/kg q12h) pending results. Within 24 hours a homogeneous layer of bacterial growth was apparent. The bacteria was transferred on to Mueller-Hinton agar (Kimron Veterinary Institute, Bet Dagan, Israel) for a disc diffusion test that included amikacin 30µg, amoxyclav 30µg, cefuroxime 30µg, azithromycin 30µg, piperacillin/tazobactam 100µg, sulfa/trimethoprim 25µg, doxycycline hydrochloride 30µg, ceftazidime 30µg, chloramphenicol 10µg, enrofloxacin 10µg (HiMedia Laboratories Pvt. Ltd., Mumbai, India). In addition, the bacteria were microscopically assessed. The



**Figure 1(a):** The chronic wound on first presentation

results showed that these were Gram-negative rods sensitive to piperacillin-tazobactam, ceftazidime, amikacin and azythromycin.

The hen was presented again seven days later for surgical treatment. Induction of anesthesia was performed by mask with 5% Isoflourane (Piramal Critical Care, Inc. PA 18017, USA). Butorphanol (Richter Pharma AG, Wels, Austria; 1 mg/kg intramuscularly) was administered for analgesia, and Lidocaine (Rafa Laboratories, Jerusalem, Israel) 2 mg/kg diluted in saline was infiltrated subcutaneously proximal to the lesion to create a local block. Ceftazidime (Panpharma Z.I.du Clairay, Luitre, 35133 Fougères, France) was administered at 100 mg/kg IM. The area around the left tarsal joint was surgically prepared, necrotic and putative granulation tissue was debrided, and the wound was washed with Ringer's-lactate solution (Bieffe Medital SA, Sabiñánigo, Spain).

Due to the size and location of the lesion, bordering on the heavily cornified podotheca, there was not enough remaining skin for closure of the wound, so a simple apposition





**Figure 1(b):** The wound after debridement and the advancement-flap in progress

of the skin was not possible. In addition, the thick skin of the podotheca on the distal aspect of the wound barely allowed any mobility and could not be pulled proximally. Because of these limitations, an advancement skin-flap, using the healthy and much more mobile skin proximal to the lesion, was elected as the closure technique. Two parallel incisions were prepared from the proximal corners of the wound, ranging two-thirds towards the knee joint. A skin flap was created by undermining and then advanced distally to achieve complete



**Figure 1(c):** The post-operative wound, closed with a single pedicle advancement skin-flap

coverage of the wound bed. Simple interrupted sutures 4-0 PDS (Atlas Medical Ltd, Gerakas Athens, Greece) were placed 3-4 mm apart along the circumference of the skin flap (Figures 1b and 1c). The leg was bandaged with Robert-Jones dressing for movement-restriction, prevention of contamination, and edema reduction.

The hen received post-operative meloxicam (Norbrook Laboratories (GB) Ltd., Northhamptonshire, UK) 0.5mg/kg and ceftazidime (100mg/kg), both given intramuscularly,

q12h for seven days post-surgery. One week after surgery, the bandage was removed for inspection of the site. The skin-flap was in place, appeared viable and the surgical site appeared to have healed. The hen was able to walk and bare weight normally with a full range of motion of the left tarsal joint. The skin sutures were removed and antibiotic treatment was continued for an additional three days (ten days in total). The hen was rechecked three weeks post-surgery. Moderate edema was noted distally to the surgical area, therefore recurrence of the chronic inflammation and infection was suspected. Azythromycin (Azenil 200mg/5ml suspension, Haupt Pharma Latina S.r.l, Italy) 30mg/kg PO q24h was prescribed for two-weeks, at the end of which (5 weeks post-surgery) the hen was presented again. At this time the ulcerated proliferative lesion had recurred and the skin flap was no longer recognizable. An incisional biopsy was taken under a short general anesthesia, and the hen was sent home with topical treatment of silver sulfadiazine cream 1% (Teva Pharmaceutical Industries, Petah-Tikva, Israel) q12h pending results.

Histopathology showed a poorly circumscribed, unencapsulated, infiltrative neoplasm extending from the epidermis to the deep dermis. The mitotic index of the neoplastic cells was high. The diagnosis was squamous cell carcinoma (SCC) of the glabrous skin. As the hen appeared painful and was lame, the owners were given the choice of leg amputation or, due to the concern of complications of amputation, euthanasia. After some consideration, the owners elected amputation, which was performed 6 weeks later, at the level of the mid-femur. The hen recovered well from surgery but was mainly recumbent for two weeks. One month post-amputation, the owners reported that the hen was doing well, was able to stand, maintain balance and walk on one leg. At the time of writing this report (twelve months post-surgery) the hen appeared healthy and was doing well. Due to the characteristics of SCC tumors, which are discussed later, the possibility of metastases was not an immediate concern.

## DISCUSSION

Managing large superficial wounds can pose a challenge in avian patients. In most feathered areas, avian skin is thin and easily torn (3). While loosely attached to underlying muscles over a large area of the body surface, the skin is more firmly attached to the skull, sternum and extremities. On the hen's legs, the heavily cornified podothecais, which was attached

extremely well to the underlying tissue, was thick and lacked elasticity, making it particularly difficult to handle surgically. Some wounds of this nature tend to heal slowly depending on their location. For example, wounds of the distal extremities have less vascular supply, which slows their recovery (3). The mobility of the site may cause further difficulty. Areas that are highly mobile, such as skin overlying joints, may require temporal immobilization to heal, while excessive scarring in these areas can result in restricted limb movement (2,3).

Skin flaps can provide the means for closure of large wounds if nearby skin is loose enough. When designing a flap, the surgeon should consider the elasticity of the skin and tension on the flap in order to preserve an adequate blood supply to the recipient bed of tissue and prevent flap necrosis (4). Feather type and their orientation within the flap are important for the patient's future functionality and cosmetic appearance (3).

There is a paucity of reports in the literature on the use of skin flaps to treat avian patients (3-6). Defects of the toes and lateral tibia and pododermatitis have been successfully managed by skin flaps in three eastern-imperial-eagles (*Aquila heliaca*) (4), and red-tailed hawk (*Buteo jamaicensis*) (5). Other wounds reported were of the distal antebrachium (3) and the head (3,6) in raptors, ring-necked pheasant (*Phasianus colchicus*), rock dove (*Columba livia*), and red-tailed hawk (*Buteo jamaicensis*).

In this case, the hen was treated with a single pedicle skin flap of the lower antebrachii and with an antibiotic corresponding to culture and sensitivity results. Although the flap has originated from a feathered area and the skin was reasonably elastic, it had to be sutured distally to the edge of the podotheca, which did not hold sutures well. For this reason and due to the high mobility of the tarsal joint, our decision was to temporarily immobilize the joint using a modified Robert Jones bandage. These measures resulted initially in satisfactory healing; however with the underlying etiology of SCC the lesion rapidly recurred.

Dermal SCC in chickens has been reported previously (7-14). Lesions are described grossly as raised and horny with superficial ulceration. In one study of SCC in young broiler chickens brought to slaughter (9, 12), lesions were present on the back, waist, neck, legs, abdomen, and wing feather tracts. As in other domesticated animals, SCC in avian species is a malignant, highly invasive, and slow to metastasize tumor (7). It has been described in both young broilers as well as

older pet chickens (7, 9-12). As in most cases of SCC the etiology of the neoplasm in this hen is unknown. Viral agents (Marek's disease, fowl pox, avian leukosis virus), husbandry and environmental conditions (UV exposure, chemical irritants) as well as genetic predisposition have all been suggested as possible etiologies of SCC (7,12-14).

The hen in this report was a rescue animal, with unknown previous history, that lived in an animal sanctuary farm with free roaming facilities for approximately four years. The appearance of the lesion in this case resembled a chronic wound and was not suspected at first to be a neoplasm, largely because it was relatively superficial on the skin. However, given the history of a chronic ulcerated lesion that was unresponsive to therapy, neoplasia may have probably been suspected earlier, during the examination of the bird, and a skin biopsy should have been taken prior to attempting surgical closure.

Following the diagnosis of SCC, the case was eventually treated by leg amputation. In a previous report, a distal femur amputation of a blue-and-gold macaw (*Ara ararauna*) was successful in treating a soft tissue sarcoma (15). Other successful limb amputations have been described in various avian species for a variety of pathologies (15). The long-term prognosis of leg amputation in birds may be guarded. Complications, such as pododermatitis of the remaining foot, are a serious risk, particularly for ground-dwelling species and heavy bodied patients (16). In this case, the hen was functioning well on one leg within one-month post amputation; however, this may not have been the case with a heavier broiler.

While the outcome of the various therapeutic approaches used in this case was satisfactory, the authors recommend performing a biopsy in chronic non-healing wounds prior to treatment, even if their appearance does not immediately suggest a neoplasm.

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