pISSN 1598-298X / eISSN 2384-0749
J Vet Clin 37(1) : 53-56 (2020)
http://dx.doi.org/10.17555/jvc.2020.02.37.1.53

Journal of Veterinary Clinics
www.ksvc.or.kr

Management of a Severe Cervical Degloving Injury in a Bean Goose (*Anser fabalis serrirostris*)

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(Received: July 06, 2018 / Accepted: January 04, 2020)

Abstract : A wild juvenile bean goose (*Anser fabalis serrirostris*) was rescued after sustaining an extensive degloving injury around the neck and chin region. Except for the degloving injury, physical and radiographic examination detected no other trauma-induced abnormality. On the day of presentation to the hospital, the patient underwent extensive debridement and suturing. A twice-daily force feeding with diluted parrot weaning food was required during the hospitalization due to severe anorexia. On day 18, the bean goose was moved to the aviary to undergo rehabilitation and feeding by itself. Management of the severe degloving injury of the cervical region with medical intervention and nutritional assistance was successful in this case, and the results of this case shows the proper management can be implemented to produce satisfactory outcomes.

Key words **:** bean goose, waterfowl, skin, degloving injury, wound healing.

Introduction

The avian integument is thin and loose, and its structure is simpler that of the mammalian integument. Therefore, the former is more fragile to external impact. It also lacks a blood supply and cannot mount immune responses, which are thought to be the main factors integral to wound healing. Additionally, waterfowls have long necks; the neck contains the major structures that are crucial in the maintenance of life, including the esophagus, trachea, jugular vein, and carotid artery. The bean goose (*Anser fabalis serrirostris*) is a medium-sized waterfowl that belongs to the family Anatidae and the order Anseriformes. This bird is designated as the second-grade endangered wildlife animal by the Ministry of Environment in Korea. It summers in eastern Siberia, and its wintering range is in Korea, China, and Japan.

Severe trauma is a predominant presentation of wild animals that are rescued and admitted to the Wildlife Center. Birds of prey and wild cats commonly attack birds such as geese, ducks, and pigeons. In recent decades, it has become increasingly clear that artificial structures, such as wire entanglements, electric wires, and windows, are the main cause of critical trauma that can lead to death in wild animals.

This case report describes in detail the treatment of an extensive degloving injury on the neck and the chin of a bean goose, and it also describes the observed satisfactory outcomes (without any functional complications) of the procedures despite the considerable size of the defect.

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Case Description

A free-living bean goose that was unable to fly after sustaining a severe trauma was found in the middle of a farmland in Wanju-gun, Jeollabuk-do, Republic of Korea and rescued; it was admitted at the Jeonbuk Wildlife Center (Fig 1A). The initial body weight of the goose was about 2,530 g, and the bird had relatively faint, small, and round wings with irregular ends; the bird was considered to be a juvenile female (6). On physical examination, the bird was bright, alert, and responsive. Assessment of the general health status of the patient showed the body condition had a score of 2/5 and there was moderate dehydration. There were severe degloving injuries of unknown cause around the neck and chin, but there were no palpable fractures. Radiologic examination revealed no specific findings (Fig 2). Laboratory findings included moderate anemia (packed cell volume, 27%; reference interval, 41-48%) on complete blood count (Table 1), and severe depletion of serum albumin (0.5 g/dL; reference interval, 1.52-1.92 g/dL) with elevation of aspartate aminotransferase and creatinine kinase on the results of clinical chemistry (Table 2).

An operation was performed on the day of arrival to the center. It seemed that there was only subtle cervical skin loss, and the remaining skin was rolled up to each end. The underlying structures, including the jugular vein, carotid artery, trachea, esophagus, and surrounding muscles, seemed viable based on their color, ongoing bleeding, and pain response. The region with the skin defect was thoroughly washed using warm Hartmann solution (Daihan Pharm, Seoul, Korea). A catheter was inserted into the medial metatarsal vein, and warm normal saline (0.9% NaCl; Daihan Pharm) (9 mL/hour

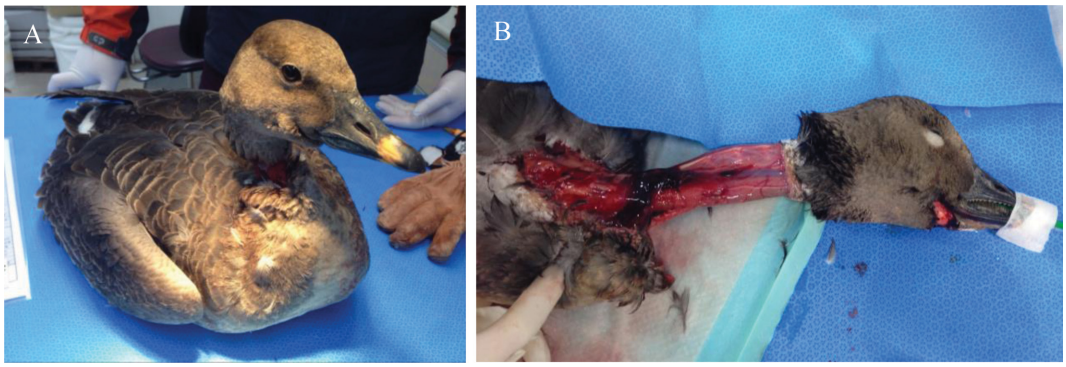

Fig 1. A juvenile bean goose on the day of admission with extensive degloving injury; it had a normal mental status and no other trauma-induced abnormality (A). The bean goose under anesthesia before surgery on the same day (B).

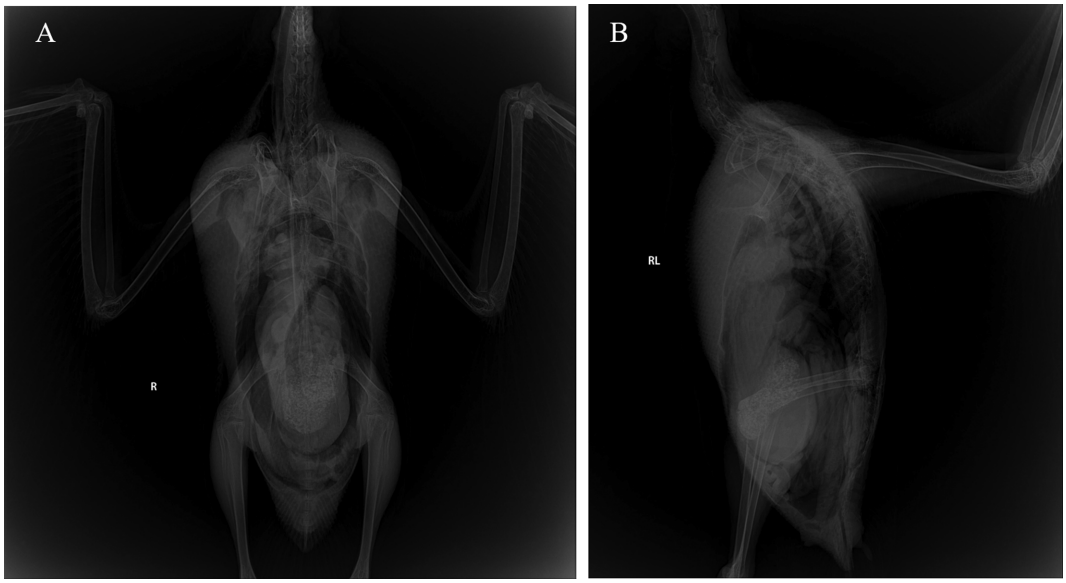

Fig 2. No remarkable findings were observed on radiographic examination. Ventro-dorsal view (A). Right lateral view (B).

Table 1. Patient's results of complete blood count on day 1 and day 9

Items	Day 1	Day 9	Reference interval**
Red blood cells ($\times 10^6/\mu L$)	2.59	ND*	2.34-3.16
Hemoglobin (g/dL)	15.43	ND	13.45-15.65
Packed cell volume (%)	27	35	41.58-47.84
Mean corpuscular volume (fL)	104.2	ND	131.6-204.4
Mean corpuscular hemoglobin (pg)	59.6	ND	42.6-66.9
Mean corpuscular hemoglobin concentration (g/dL)	57.1	ND	28.1-37.6
White blood cells ($\times 10^3/\mu L$)	11	ND	18.28-20.62

*Not determined.
**Greyleg geese (*Anser anser*; 5).

intravenously) was administered to compensate for the fluid loss during the operation and to resolve the dehydration. Prophylactic medications, including cefazolin sodium (Chong Kun Dang, Seoul, Korea) (25 mg/kg intravenously) as a broad-spectrum antibiotic and butorphanol tartrate (Myungmoon Pharm, Seoul, Korea) (1 mg/kg intravenously) as a systemic analgesia, were administered 30 minutes prior to anesthesia. The anesthesia was induced with 2% isoflurane (Ifran®; Hana Pharm, Seoul, Korea) using a face mask in 100% oxygen (2 L/minute); this was followed by endotracheal intubation using an uncuffed endotracheal tube (ID:4.0 OD:5.4). Anesthesia was maintained with 1.5% isoflurane in 100% oxygen (2 L/minute).

The bird was placed on an operating table in a left lateral recumbency. Both the proximal and rostral part of the injured area was plucked of the feathers. The surgical region was scrubbed using 0.5% chlorhexidine 2 to 3 times. After the tissue debris and blood clots were removed from the degloved

Table 2. Patient's results of clinical chemistry on day 1 and day 9

Items	Day 1	Day 9	Reference interval*
Aspartate aminotransferase (U/L)	4829	63	17.64-40.94
Bile acid (μmol/L)	104.2	50.3	Not Available
Creatinine kinase (U/L)	5643	651	130.3-632.66
Uric acid (mg/dL)	4.7	3.4	1.31-5.21
Glucose (mg/dL)	204	192	198.95-245.41
Calcium (mg/dL)	7.89	9.68	10.28-12.12
Phosphate (mg/dL)	6.33	4.75	4.72-8.18
Total protein (g/dL)	1.8	3.5	3.66-5.06
Albumin (g/dL)	0.5	0.6	1.52-1.92
Globulin (g/dL)	1.3	2.9	1.74-3.54

*Greyleg geese (*Anser anser*; 5).

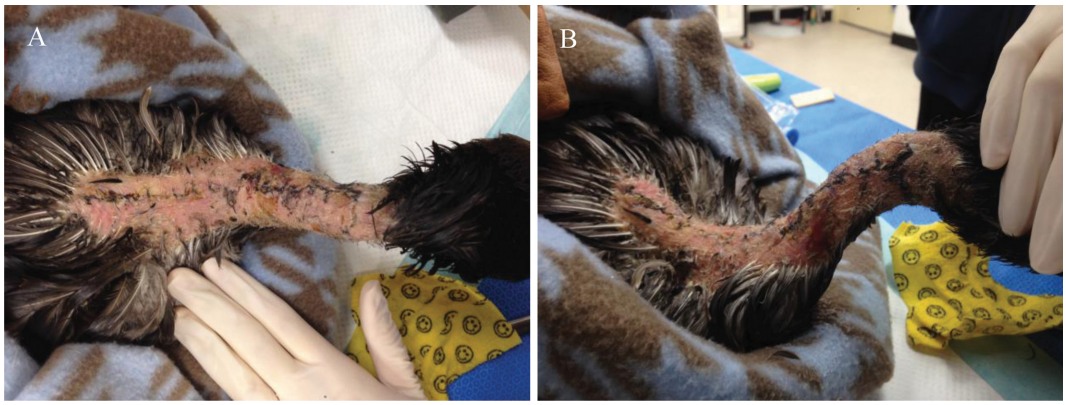

Fig 3. The surgical sites had recovered well, without discharge, dehiscence, or abnormal granulation on day 10.

region using a moistened gauze, the subcutaneous tissues were sutured using 4-0 absorbable polydioxanone suture (Ethicon, Somerville, New Jersey, USA) in a simple continuous pattern, and the skin was closed with 3-0 nylon suture (Ailee, Busan, Korea) in a simple interrupted pattern. The surgical sites were covered with gauze, absorbent cotton roll, and cohesive bandage in that order. Caution was required not to tighten the bandage so much that the bird would be choked.

After the operation, amoxicillin-clavulanate (Kuhnil Pharm, Seoul, Korea) (125 mg/kg, q 12h), cimetidine (Tai Guk Pharm, Hwaseong-si, Gyeonggi-do, Korea) (5 mg/kg, q 12h), and meloxicam (Metacam®; Boehringer Ingelheim, Ingelheim am Rhein, Germany) (0.5 mg/kg, q 24h) were prescribed orally for two weeks. Dressing and bandaging of the surgical wound after checking the sutures and healing was performed daily for the following 11 days after the operation. On day 3 after admission, dark-greenish discharge from the lesion and partial blackening of the skin of the cervical region were observed. In order to improve the perfusion, pentoxifylline (HUTECS, Hwaseong-si, Hyeonggi-do, Korea) (30 mg/kg, q 12h) was added to the prescription from this day (8). Since the patient was consistently anorectic during the hospitalization, fluids were changed to 5% dextrose on day 3 after admission. Because the patient had lost 10% of the initial body weight (2,293 g) by day 5, twice-daily force feeding with 50 mL of diluted parrot weaning food was initiated on this day.

On day 10, a few stitches were removed because the surgical sites seemed to have recovered well, without any sign of infection, discharge, dehiscence, or abnormal granulation (Fig 3). Blood was collected on this day to make a follow-up of the previous blood test results. Results of clinical chemistry revealed elevation of serum albumin and total protein and normalized levels of AST and CK (Table 2). The skin lesions were fully healed and all the stitches were removed on the 12th day. On the 18th day, the goose was moved from an indoor cage to a rehabilitation housing unit with an artificial pond so that the bird could eat and rehabilitate by itself. Because the bean goose was a winter visitor of South Korea, it was discharged and got back to nature on day 31 after admission (March 2).

Discussion

Avian species have a thin-layered and looser skin than mammals do; therefore, birds in both wildlife and captive populations commonly present with extensive cutaneous wounds secondary to trauma. Additionally, waterfowls have long necks; the neck contains the major structures that are crucial to maintain life, including the esophagus, trachea, jugular vein, and carotid artery. When birds present with such cutaneous problems, the unusual features of avian anatomy of this region should be considered (2). There are some significant points that make conventional treatment suited to mammalians unfavorable in birds. For instance, if there is evidence of an infection or formation of purulent exudate, drain placement is not recommended because avian het-

erophils lack lysozymes and the avian pus is usually caseous; therefore, it does not easily drain from a contaminated wound (3). Careful selection of suture methods is required as avian skin consists of a fatty subcutaneous layer; hence, sutures often do not hold well. A histological study on rock doves using five suture materials within the body wall and skin showed that polydiaxanone (PDS; Ethicon) has only minimal tissue reaction and is partially degraded at 120 days (6). In addition, sutures should be tied closer because swelling of the surgical site is rarely seen in birds (3). In addition, the neck region of the bird is closely related to the cervical air sac, suggesting that neck injury can induce subcutaneous emphysema not only in the neck but also in the thorax, abdomen and even thighs. Though the emphysema is self-limiting, cauterizing one or two holes into skin can be helpful (2).

In the conventional sense, wound healing is dependent on local and systemic conditions. Local factors include wound perfusion, tissue viability, infection, and mechanical factors. Systemic factors include immunologic factors, nutrition, age, and systemic diseases (7). In these aspects, the avian integument has many disadvantages against the mammalian integument. For instance, the avian cutaneous vasculature is located beneath the muscle, which is placed deep in the dermis, and the epidermis is completely avascular, which means its nutrition and oxygen supply depend on simple diffusion from the deep dermis. In addition, the avian cutaneous structure lacks the other tissues to support and give tension to the adjacent skin.

Although few investigations have been performed on avian wound healing, some experimental studies from chickens are available. According to these experiments, there are some dissimilarity between birds and mammals. For example, during the inflammatory stage of wound healing, macrophages gather to make multinucleated giant cells by day 5 to 9 after injury in birds, which does not happen in mammals. Furthermore, during the maturation stage, which is responsible for wound contraction owing to collagen deposition, birds characteristically to gain earlier maturation of the collagen within few weeks only, whereas the process in mammals requires weeks to months; this means avian species achieve full maturation of the skin much more quickly (4,7). The ultrastructure of avian collagen fibrils is neatly arranged in a horizontal orientation with few vertical fibrils; this allows birds to have thinner dermis with lower weight and with cutaneous pliability (4). Thus, it is thought that there was adaptation of avian skin for flight that was made possible by minimizing the bulk and firmness of the skin, resulting in a compensatory response characterized by a relatively rapid recovery following an injury.

As discussed above, there is still controversy on whether avian wound healing can be compared with that of mammals, which makes it difficult to apply the results of mammalian research on birds as they are. This case also demonstrated some complications, such as the dark-greenish discharges and signs of ischemic necrosis, on the initial postoperative days. This may be an evidence of the effect of poor vasculature in the avian cutaneous structures. To overcome this problem, pentoxifylline was prescribed, and this treatment was certainly effective in improving blood supply. However, it is important not to miss out the following possibilities: this patient had an ASA (American Society of Anesthesiologists' classification of physical health) score of 1-2 based on its young age, it was nutritionally managed for a long time, its initial entire body condition and mental status were favorable, and its size was big enough to allow a relatively large variety of medical procedures such as intravenous fluid administration. These factors may have contributed to the satisfactory outcome observed in this patient. Most of the wild birds that are rescued are weak and weigh much lesser than a bean goose, suggesting that a high ASA score would be given. This means that the severity of the underlying health impairment can alter the response to the traumatic injury, resulting in unfavorable prognosis, with tissue necrosis, severe disability, or functional loss, which can be a strong determinant of euthanasia in wild animals. Thus, not only empirical deductions but also thorough investigations on the characteristics of avian wound healing in diverse areas are needed to improve the treatment of other avian patients with poor conditions.

In summary, a bean goose with severe skin defects of the cervical region that were extensive and probably contaminated was treated with thorough debridement, suturing, and regular dressing with proper medications, this resulted in a successful recovery of the defect without any disabilities. It seems that there is still necessity for further investigation on avian wound healing mechanisms to identify specific concepts applicable to birds.

Acknowledgement

The subject is supported by Korea Ministry of Environment (MOE) as "Public Technology Program based on Environmental Policy (No. 2016000210002)", and also supported by the National Research Foundation of Korea (NRF) Grant funded by the Korean Government (MOE; No. 2016R1D1A3B03932480).

References

1. Bennett RA, Yaeger MJ, Trapp A, Cambre RC. Histologic evaluation of the tissue reaction to five suture materials in the body wall of rock doves (*Columba livia*). J Avian Med Surg 1997: 175-182.
2. Beynon PH, Forbes NA, Harcourt-Brown NH. BSAVA manual of raptors, pigeons and waterfowl. British Small Animal Veterinary Association Ltd.; 1996.
3. Doneley B. Avian medicine and surgery in practice: companion and aviary birds. CRC press; 2016: 163-185.
4. Ferrell ST. Avian integumentary surgery. J Exot Pet Med 2002; 11: 125-135.
5. Jahantigh M, Zamani-Ahmadmahmudi M. Hematology and serum biochemistry values in greylag geese (*Anser anser*) in Southeast Iran. Comp Clin Path 2016; 25: 671-675.
6. Park J. Identification Guide to Birds of Korea. Seoul, South Korea: Econature Books. 2014: 39-91.
7. Tobias KM, Johnston SA. Veterinary Surgery: Small Animal-E-BOOK: 2-Volume Set. Elsevier Health Sciences. 2013: 448-492.
8. Velaei K, Bayat M, Torkman G, Rezaie F, Amini A, Noruzian M, Tavassol A, Bayat M. Evaluating the effects of pentoxifylline administration on experimental pressure sores in rats by biomechanical examinations. Lab Anim Res 2012; 28: 209-215.