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Ventriculostomy for Removal of Foreign Bodies from Sarus Cranes

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SUMMARY

Of 7 captive sarus cranes *(Grus antigone)* that ingested foreign metallic objects, 3 became ill, and 1 of the 3 died. Clinical signs included difficulty in standing, sitting on hocks, and diarrhea. A surgical approach was developed, using pigeons as models, to open the gizzard for removal of the foreign bodies. The surgery was performed successfully 3 times on 2 of the cranes that had signs of illness.

Fig 1—Lateral radiograph of crane 3, showing metallic debris within the gizzard.

MAJOR ABDOMINAL SURGERY of birds is seldom performed. Problems encountered are accurate presurgical diagnosis, safe general anesthesia, adequate surgical exposure, and postoperative care. When the decision to perform surgery has been made, however, the size of the avian patient and its inherent anatomy often make the surgery extremely difficult.

Sarus cranes with clinical signs from "hardware" accumulated in the gizzard required surgery. The concern was how a muscular organ such as the gizzard would heal, inasmuch as sutured muscle has relatively poor holding power.

The following is a description of a successful surgical approach for removal of foreign objects from the gizzard.

Clinical Histories

A 2½-month-old sarus crane (crane 1) at the National Zoological Park's Conservation and Research Center, Front Royal, Va, was sitting down more than normal, with its weight resting on its hocks instead of the sternum. The bird had a difficult time standing and maintaining balance. Harsh expiratory respiratory sounds were heard, accompanied by open-mouth breathing. The bird had been eating well and passing normal feces but drinking excessive amounts of water. A tentative diagnosis of pneumonia was made, and treatment with 50 mg ampicillin[a] IM twice daily was started. Results of blood analysis were normal, as determined by comparison with white blood cell count, red blood cell count, packed cell volume, and total protein content, previously determined in healthy cranes.

The following day the bird would not eat. Tube feeding was begun, giving 25 ml of gruel made from pelleted feed TID. The bird's breathing became more audible, and it experienced greater difficulty trying to stand. The bird died after 7 days of supportive care.

Postmortem radiography revealed radiopaque material in the gizzard. At necropsy, 15 pieces of metal (wires, metal nuts, and flat metal clips) were found in the gizzard. The keratinoid lining contained several hyperemic areas, though the muscle wall had not been penetrated. The bird was in a poor nutritional state. A large amount of undigested and partially digested food was in the intestinal tract.

This crane, along with others, had been introduced into newly constructed enclosures 3 weeks prior to onset of the clinical signs. The yards had been carefully raked for any debris left by the construction crew and were believed clean.

One week later, a 2-month-old sarus crane (crane 2) was sitting down, with its weight resting on its hocks. The bird's legs would tremble when it stood. Radiography revealed 1 piece of wire in the gizzard. The bird was hospitalized for observation. Hematologic findings were considered normal.

The following week this crane's sibling (crane 3) was hospitalized because it registered strongly on a metal detector[b] that had been obtained to examine the cranes' body and their new yards more thoroughly. This crane was clinically normal. Radiography revealed several screws and other metal objects in the gizzard (Fig 1). Hematologic findings were within normal limits.

Several days after crane 3 was hospitalized, it started passing loose feces that smelled like sour feed. The WBC count began to increase from 10,670 to 19,800/μl. Crane 2 had occasional days of diarrhea but, in general, the feces were considered normal. Surgery was considered the only course of treatment for these cranes.

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[a] Polyflex, Bristol Laboratories, Syracuse, NY.

[b] Relic 5 Magnum, Compass Electronics Corp, Forest Grove, Ore.

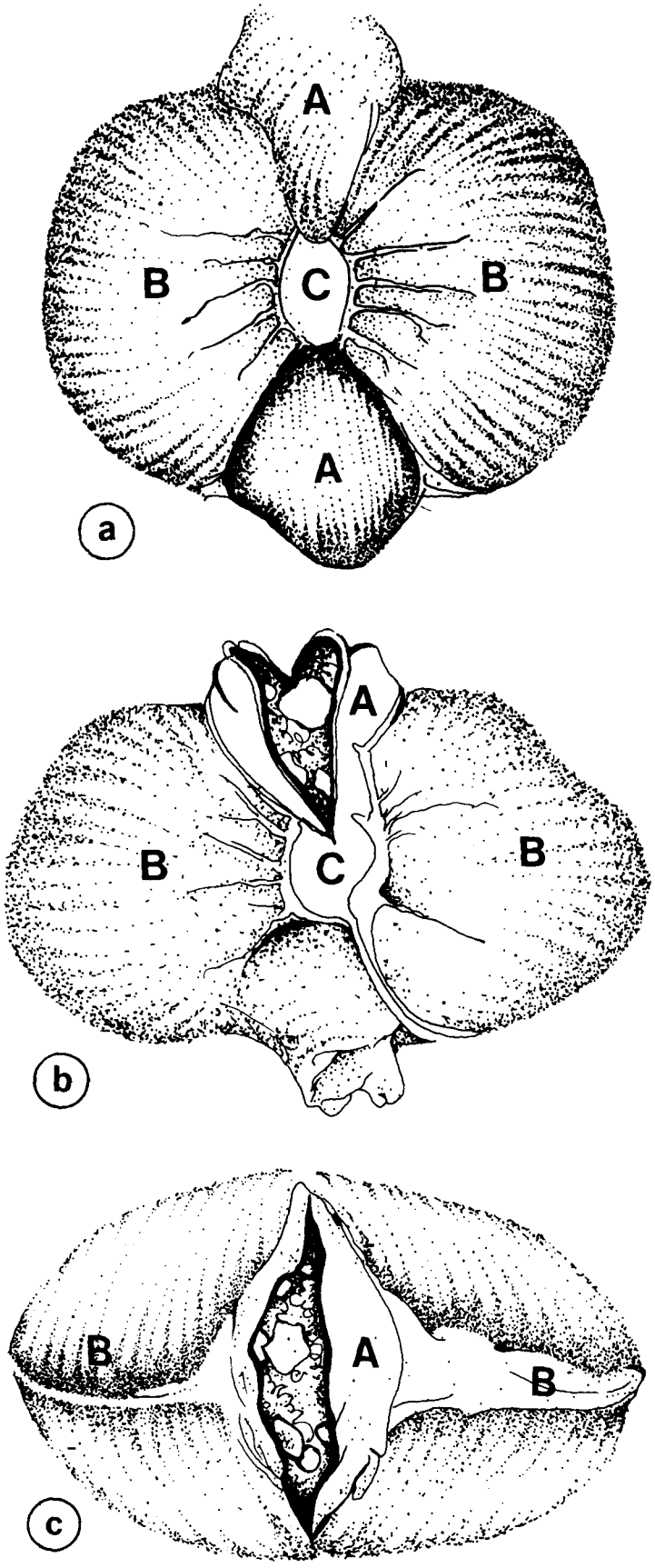

Fig 2a—Anatomic drawing of gizzard and muscles. Musculi intermedii (A), musculi laterales (B), and tendinous aponeurosis (C).

b—Site of gizzard incision through the musculi intermedii (A).

c—Gizzard rotated 90 degrees to show the length of the incision through the musculi intermedii (A).

Anatomy

The gizzard (ventriculus) is composed of 2 pairs of muscles. The thin musculi intermedii arise near the proventriculus and posterior end of the gizzard. On either side of the musculi intermedii are the thick musculi laterales. The 2 pairs of muscles insert on a tendinous aponeurosis on the side of the gizzard[1] (Fig 2a).

Pilot Surgery

To determine the best surgical approach to the gizzard, 8 adult pigeons were used as experimental models. Each pigeon was given 50 mg of ketamine HCl[c] IM for induction of anesthesia, which was maintained after intubation by 1 to 1.5% halotane[d] and a nitrous oxide/oxygen mixture at a ratio of 2:1 on a nonrebreathing system. Each bird was positioned right side down, with the wings reflected dorsally and the left leg pulled cranially. The area caudal to the last rib was plucked and prepared for aseptic surgery.

A 2-cm skin incision was made just posterior and parallel to the last rib. The abdominal muscles were separated along the direction of their fibers to expose the peritoneum, which was cut to gain access to the abdominal cavity. The gizzard was exteriorized with 2 stay sutures through its muscular walls and packed off with saline solution-moistened, sterile gauze.

An incision was made through the musculus intermedii at the posterior end of the gizzard in 4 pigeons (Fig 2b and 2c). The gizzards of the remaining 4 birds were incised over the aponeurosis.

A 3-layer closure of the gizzard was made, using 4-0 chromic gut for each layer: (1) The mucosa and submucosa were closed with simple interrupted sutures. Part of the muscle wall was incorporated into this layer because the mucosal layers were so thin. (2) The muscle wall was closed with a combination of horizontal and vertical mattress sutures. (3) An interlocking continuous pattern was placed in the adventitia, which tore easily.

The abdominal muscles and skin were closed separately, using a simple interrupted pattern of 4-0 chromic gut. The birds were euthanatized 5 days later and necropsied.

All 8 pigeons continued to eat well postoperatively but had loose, watery feces. At necropsy, the gizzards that had been incised over the aponeurosis had ruptured, resulting in a generalized peritonitis. Adhesions had developed around the incision sites in the musculi intermedii of the 4 other pigeons, with localized peritonitis in 1 of them.

[c] Ketaset, Bristol Laboratories, Syracuse, NY.

[d] Fluothane, Ayerst Laboratories, Inc, New York, NY.

Surgical Treatment of Cranes

Crane 3 was operated on first because of its clinical signs of pain and loose feces. The bird was fasted 48 hours to minimize spillage of ingesta, a problem that had been encountered in the pigeons.

Other changes in the procedure were preoperative. Gentamicin sulfate[e] (30 mg) and atropine sulfate[f] (0.125 mg) were given IM prior to anesthesia. Ketamine HCl (15 mg) was used to calm the crane, which was then given 1.5% halothane and a nitrous oxide/oxygen mixture at a ratio of 3:2 via face mask. An IV drip was started with lactated Ringer's solution in the medial leg vein. Five milliliters of 50% dextrose was given as an IV bolus prior to and after surgery to combat any hypoglycemia that may have resulted from the fasting.

The crane was placed in right lateral recumbency and the skin incision was made parallel to the last rib. The gizzard was exteriorized as before and the incision was made through the musculus intermedii.

Penicillin G[g] (5×10^6 units) was placed in the body cavity before closure. The abdominal air sac, which was incised to facilitate exposure of the gizzard, was closed with simple interrupted sutures of 4-0 chromic gut. The bird was given gentamicin sulfate (30 mg, BID, IM, on the day after surgery). Crane 2 was operated on in the same way 5 days later. Radiographs taken after surgery showed the gizzard free of any radiopaque objects in both birds.

Both cranes were fed reduced rations for 5 days after surgery. For 2 to 4 days after surgery, their water consumption was greatly increased. Feces remained quite loose and contained undigested food for 10 days after surgery.

The gizzard could be palpated through the skin attached to the abdominal wall 5 days after surgery in crane 3 and 10 days after surgery in crane 2. Within a month, the gizzard of each crane was palpated free in the body cavity. The cranes were returned to their pens, which had been examined with a metal detector. One month after surgery, however, both birds were screened with a metal detector and were positive. Radiography revealed a metal washer in the gizzard of crane 2, but surgery was not considered necessary because the bird was clinically normal. Radiography revealed a key in the gizzard of crane 3 (Fig 3). This bird had an increased appetite and again passed mostly undigested food in its feces. Surgery was repeated in the same manner as before. Scar tissue and adhesions were found at the original surgery site on the gizzard. In addition to the key, a plastic band 30 cm long, other small pieces of plastic, and 2 pieces of wire were removed from the gizzard. The bird recovered without incident. The feces were normal 6 weeks after surgery.

The remainder of the cranes at the Conservation and Research Center were screened with the metal detector. Negative readings were recorded for 7 Florida sandhill cranes *(Grus canadensis pratensis)*, 1 greater sandhill crane *(Grus canadensis tabida)*, and 4 Stanley's cranes *(Anthropoides paradisea)*. Four more sarus cranes were positive for metal. Radiographs of 2 of them revealed considerable amounts of metal objects in the gizzard but none that appeared sharp. Inasmuch as both birds were clinically normal, surgery was not performed. The other 2 cranes had a nail protruding through the gizzard. In 1 crane, the nail was protruding ventrally, pressing against the skin (Fig 4a). A skin incision was made over the palpable end of the nail, and the nail was extracted. In the other crane, the nail was protruding dorsally toward the vertebral column (Fig 4b). After celiotomy, the nail was extracted without opening the gizzard. Both birds recovered without incident.

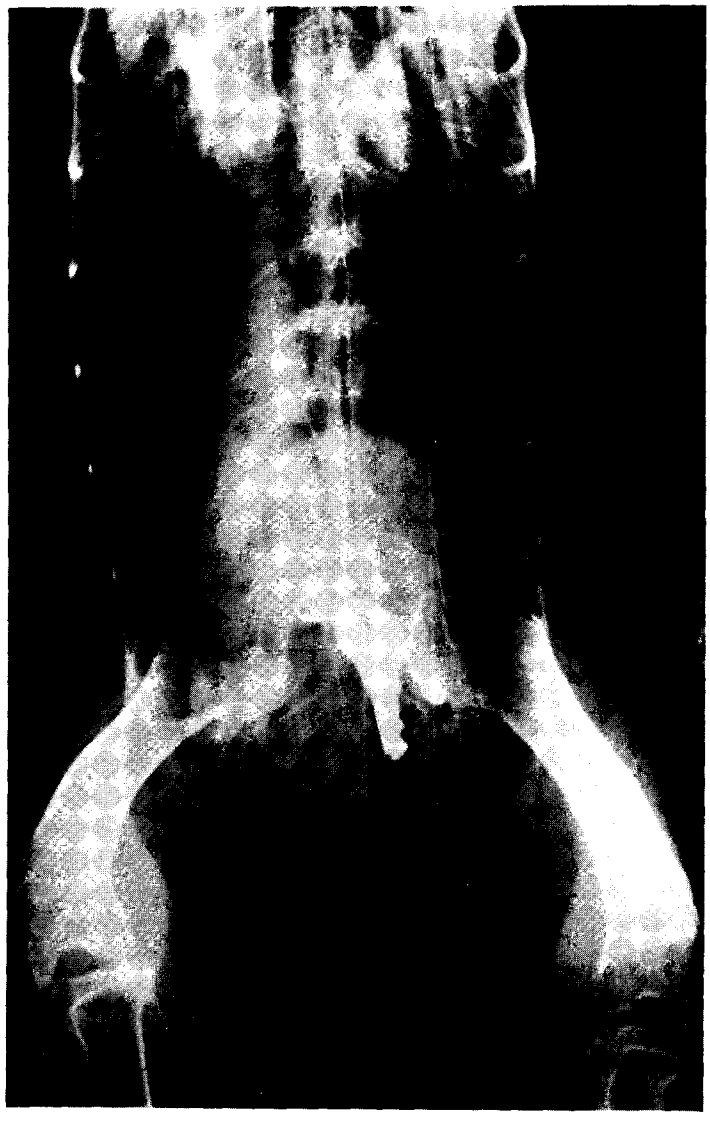

Fig 3—Ventrodorsal radiograph of crane 3, showing 2 wires and a key within the gizzard.

Discussion

Six months later, all sarus cranes at the Conservation and Research Center were well. The crane yards were carefully screened with the metal detector, and the only pieces of metal found in the yards were several inches below the surface of the ground. All species of cranes kept at the Zoo and the Conservation Center

[e] Gentocin, Schering Corp, Kenilworth, NJ.

[f] Atropine sulfate injection U.S.P., A. J. Buck & Son, Inc, Cockeysville, Md.

[g] Penicillin G Sodium N.F., The Upjohn Company, Kalamazoo, Mich.

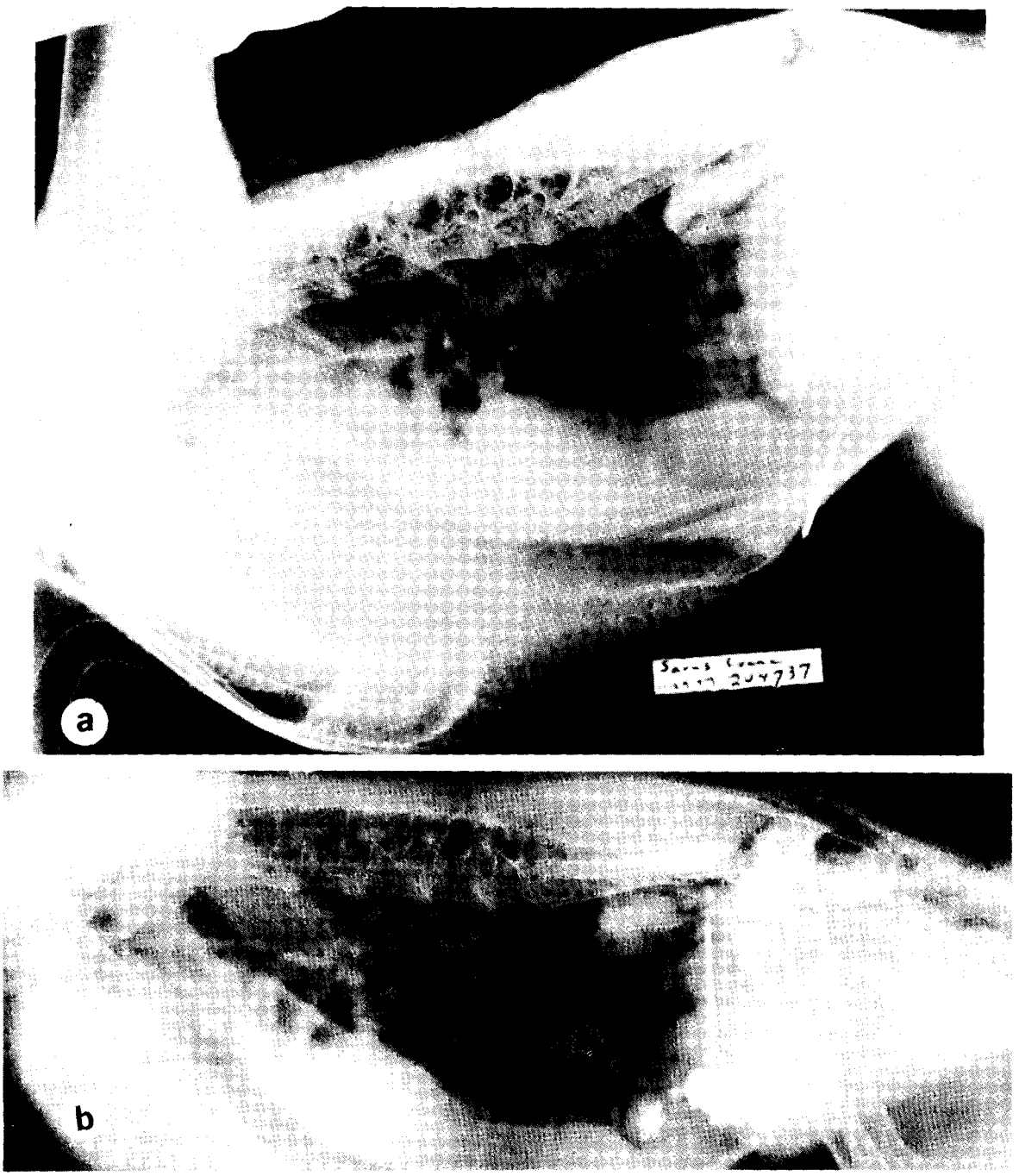

Fig 4a—Lateral radiograph of a sarus crane with a nail protruding ventrally through the gizzard wall.
b—Lateral radiograph of a sarus crane with a nail protruding dorsally through the gizzard wall.

probe and dig up the ground with their bills, looking for worms and insects. Since only the sarus cranes ingested any metal, their behavior would appear to be less discriminatory than that of the other species. Also, the sarus cranes are a much larger bird, and thus could more readily ingest large foreign objects.

As a muscular organ, the gizzard posed certain surgical considerations. Dehiscence of the suture line was considered probable because of the poor holding strength of sutured muscle combined with the rhythmic contraction of the gizzard, adding extra strain to the suture line. The first phase of the contraction cycle is the asymmetric contraction of the musculi laterales, causing narrowing of the lumen, producing a grinding action.[2] The musculi laterales insert at the aponeurosis, which is devoid of any muscle tissue itself.[3] The contraction of the musculi intermedii is the second phase of the contraction cycle.[2] Grinding of feed does not depend on this phase, so less stress is probably placed on the suture line.

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