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Case Report

Surgical Treatment of Recurrent Rectal Prolapse in an Adult Female Black-crested Mangabey (*Lophocebus aterrimus*) by Colopexy

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A 13-y-old, multiparous female black-crested mangabey (*Lophocebus aterrimus*) underwent surgical treatment for chronically recurring rectal prolapse by laparotomy and subsequent colopexy. Initially, a laparoscopic approach was attempted but was converted to an open approach after intraabdominal adhesions were noted. The colopexy was performed through a ventral midline incision, with no complications intraoperatively or postoperatively. The predisposing factors responsible for the development of this condition likely were related to pelvic floor weakness due to multiple past pregnancies. Transport-associated stressors likely contributed to the acute worsening of this patient's condition. Rectal prolapse is a common condition in laboratory-housed NHP. This case report describes an effective surgical treatment for recurring or otherwise nonreducible rectal prolapse in these species.

In humans and NHP, rectal prolapse can occur secondary to diseases that lead to tenesmus or increased intraabdominal pressure due to straining, such as neoplasia of the lower gastrointestinal tract, prostatitis, urolithiasis, parasitic or bacterial infections leading to colitis, chronic diarrhea, rectal foreign bodies, and trauma.[6,11] In NHP, environmental or social distress can trigger rectal prolapse.[11] Although perhaps more likely in young animals, rectal prolapse can occur in animals of any age or sex.[11] This clinical condition has been reported in a variety of animals, including domestic dogs and cats, ferrets, rabbits, mice, hamsters, sheep, goats, horses, cattle, swine, and several species of NHP.[4,5,11,13] Rectal prolapse may be partial, involving externalization of the rectal mucosal tissue only, or complete, which presents as a cylindrical protrusion and involves all layers of the rectal tissue.[4,11]

The treatment of rectal prolapse varies greatly, depending on the severity and progression of the disorder. A partial prolapse may reduce spontaneously or require manual reduction with the aid of lubricants, hypertonic compresses, and pursestring sutures. More severe cases that are associated with infection, necrosis, or irreversible trauma may necessitate resection of the damaged tissue in conjunction with a perianal pursestring suture to prevent recurrence.[11] This procedure has been performed in both free-ranging gorillas and long-tailed macaques in a laboratory setting, with variable outcome.[7,9] When a pursestring suture fails to stop recurrence, and as long as the rectal tissue is healthy, colopexy is suggested as a surgical treatment option for small animals and NHP.[11] However, to our knowledge, the surgical correction of recurrent rectal prolapse in a NHP by using colopexy has not previously been reported.

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Case Report

A 13-y-old, 7.56-kg, female black-crested mangabey (*Lophocebus aterrimus*) was received into quarantine at the Brookfield Zoo (Chicago, IL). This animal had a 3-y history of intermittent rectal prolapse at the previous institution. For the first occurrence, pursestring sutures were placed for 2 d before removal. On subsequent episodes, the condition reportedly resolved spontaneously within 2 to 3 h on each occasion, with only mild sporadic bleeding. At that time, serum biochemistry and CBC revealed no abnormalities, and the mangabey was treated with an antiinflammatory, antiparasitic, and postoperative antibiotics. A recent abortion and hormonal influences were the suspected cause of these episodes. Consequently, a melengesterol acetate contraceptive implant was placed in an attempt to reduce the incidence of rectal prolapse. Over the next 3 y, self-correcting rectal prolapse was reported on 6 occasions, with 4 to 12 mo between incidents. Repeated fecal examinations were consistently negative for parasites. An additional pregnancy and birth occurred during this time between periods of contraceptive control with melengesterol acetate implants and medroxyprogesterone acetate injections.

On arrival to the zoo, the mangabey was placed in quarantine housing with her 2 female offspring (ages, 1 and 3.5 y), with the younger intermittently nursing still. One day after arrival in quarantine, a rectal prolapse of approximately 5 to 7cm accompanied by considerable bleeding was discovered. Over the course of 5 d, rectal prolapse was either directly observed or strongly suggested by the presence of blood in the enclosure on 3 separate occasions. The prolapse resolved spontaneously each time. An increase in aggressive behavior, resulting in injury to the oldest offspring, along with keeper observations of agitation initiated the pursuit of a more permanent treatment solution.

The following full examination of the mangabey was performed under general anesthesia 8 d prior to the surgical procedure. After oral premedication with diazepam (0.33 mg/kg

PO) 2 h before surgery, anesthesia was induced with ketamine (3.93 mg/kg IM), midazolam (0.13 mg/kg IM), and medetomidine (0.026 mg/kg IM) and maintained with 0.75% to 3% isoflurane delivered in oxygen (flow rate, 1.5 L/min) through a 4.5-mm endotracheal tube. Diagnostics included a complete physical exam, CT with contrast enhancement, whole-body lateral and ventrodorsal digital radiographs, abdominal ultrasonography, ultrasound-guided cystocentesis for urinalysis, gastric and rectal endoscopy and biopsies, femoral venipuncture for CBC and serum biochemistry, and rectal culture.

A moderate normocytic, hypochromic regenerative anemia, with a PCV of 24% was noted on CBC, and serum was icteric. Endoscopic visualization of the rectum and distal colon revealed diffusely pale mucosa, with several focal ulcerations and diffuse edema. Biopsies of gastric fundic and rectal mucosa revealed morphologic diagnoses of moderate gastric fibrosis with *Helicobacter* spp. and minimal to mild multifocal, eosinophilic proctitis, respectively. Overall, no specific change to account for recurrent rectal prolapse was found. On ultrasonography, the uterus was moderately enlarged, with possible cystic endometrial changes and large, dilated uterine vessels. Results of all other diagnostic tests were within normal limits.

After completion of diagnostic evaluations, the mangabey was started on meloxicam (0.13 mg/kg daily for 5 d), fluoxetine (1.6 mg/kg daily for 7 d), diazepam (0.65 mg/kg twice daily for 7 d), and trimethoprim–sulfadiazine (31.4 mg/kg daily for 7 d) to manage pain, reduce inflammation, and reduce anxiety until the surgery could be performed 1 wk later. We decided to perform the colopexy surgery laparoscopically, if possible, given this species' tendency to dismantle sutures, and to limit postoperative discomfort as much as possible.

Anesthesia for surgical colopexy was induced by using ketamine (4.22 mg/kg IM), dexmedetomidine (0.025 mg/kg IM), and midazolam (0.24 mg/kg IM) administered by using a blowdart while the managabey was contained alone in a quarantine enclosure after overnight fasting. An additional dose of ketamine (2.11 mg/kg IM) and topical lidocaine (0.2 mL) were used to facilitate intubation. A surgical anesthetic plane was maintained by using isoflurane delivered in oxygen at 1% to 2% through a 4.5-mm endotracheal tube, and analgesia was provided by using long-acting buprenorphine (Simbadol, Zoetis, Kalamazoo, MI) in 2 doses (0.20 mg/kg SC and 0.01 mg/kg SQ, respectively) throughout the procedure. A saphenous catheter was placed after induction, and 2 boluses (60 mL each) of lactated Ringer solution were given intravenously over the course of surgery. Prior to surgery, a blood sample was obtained from the mangabey's femoral vein, and right and left lateral and ventrodorsal abdominal radiographs were taken to evaluate the fullness of the distal colon. Although the mangabey spontaneously ventilated successfully at the start of the anesthetic period, insufflation of the abdomen with CO_2 made spontaneous ventilation more difficult after placement of the laparoscope. Therefore, the animal's breathing was maintained by using a ventilator during laparoscopic insufflation of the abdomen; normal spontaneous ventilation resumed after conversion to an open approach. Temperature, heart rate, respiratory rate, end-tidal CO_2, oxygen saturation, and blood pressure were measured every 5 to 10 min throughout anesthesia. Brief hypothermia (35.5 °C) was successfully corrected by using warmed airway, forced-air thermal support, and warmed fluids, all of which were discontinued on resolution near the end of the surgical procedure. Total anesthetic time was approximately 3 h, with no other anesthetic complications observed.

A 1-cm incision was made midline over the umbilicus by using a no.15 scalpel blade. Blunt dissection with tissue forceps and sharp dissection with the scalpel were used to penetrate the body wall for insertion of a 5-mm, 0° laparoscope (a modified Hasson approach).[8] An intraabdominal pressure of 8 mmHg was reached and maintained. Numerous intraabdominal adhesions between the cecum and body wall were present and prevented adequate insufflation with CO_2 and space to facilitate laparoscopic dissection. We therefore determined that laparotomy would be a more suitable approach for this animal.

A 4-cm incision was made midway between the umbilicus and pubis by using a no.10 scalpel blade. Blunt and sharp dissection were used to penetrate the body wall. The linea alba was not readily visible, and the rectus abdominus muscle along the incision line was dissected laterally to better visualize the internal rectus fascia for entry into the abdomen. On abdominal entry, the left ovary was visible and appeared grossly healthy. Some adhesions were present but were easily broken apart by digital dissection. The colon was located and retracted cranially. The serosa of the antimesenteric side of the colon was scarified by using a surgical blade, and electrocautery was used to disrupt the peritoneal surface of the left caudal body wall. The colopexy was achieved by using three 3-0 polydioxanone sutures in a cruciate pattern (Figure 1). The abdomen was flushed with sterile saline, and the subcutaneous and intradermal tissue layers were closed separately. Liposomal encapsulated bupivacaine (5.3 mg/kg; Nocita, Aratana Therapeutics, Leawood, KS) was infiltrated along all layers of the closure. The umbilical port site was closed in the same manner. Surgical steel sutures and staples were placed into the skin. Four additional staples were placed at the base of the extremities to distract from the incision site. Bupivacaine (0.07 mg total) was injected subcutaneously into the distal pads of the second and third digits of each hand to desensitize fingertips, thereby reducing potential tactile stimulation from the incision site.

Meloxicam (0.20 mg/kg SC), maropitant citrate (0.92 mg/kg SC), and ampicillin (22mg/kg IV) were given immediately after surgery. Anesthetic recovery was smooth, and the animal was climbing comfortably within 1 h after discontinuation of isoflurane. An additional dose of midazolam (0.28 mg/kg IM) was given once the mangabey was removed from a recovery squeeze cage and returned to her regular enclosure. Trimethoprim (31.4 mg/kg PO daily for 14 d), fluoxetine (1.3 mg/kg PO daily for 14 d), and ibuprofen (7 mg/kg PO twice daily for 7 d) were prescribed for the management of pain and inflammation. The animal was housed separately from both of her offspring for 24 h after surgery, to prevent unnecessary exertion. She was reintroduced with her youngest daughter thereafter with no incident, but she was kept separate from her older daughter to remove the risk of fighting during recovery. The surgical incision remained intact, with moderate swelling and dependent edema during the first week.

The mangabey remained hospitalized for 4 wk, during which time neither recurrence of rectal prolapse nor rectal bleeding occurred. Appetite and stool production remained normal. The animal was reevaluated under general anesthesia at 1 mo after surgery, when the anemia had resolved, the surgical site had healed without complication, and the sutures were removed.

Discussion

Although surgical correction with colopexy is suggested as a treatment for recurrent rectal prolapse when other treatments are unsuccessful,[11] a report of this procedure in NHP was

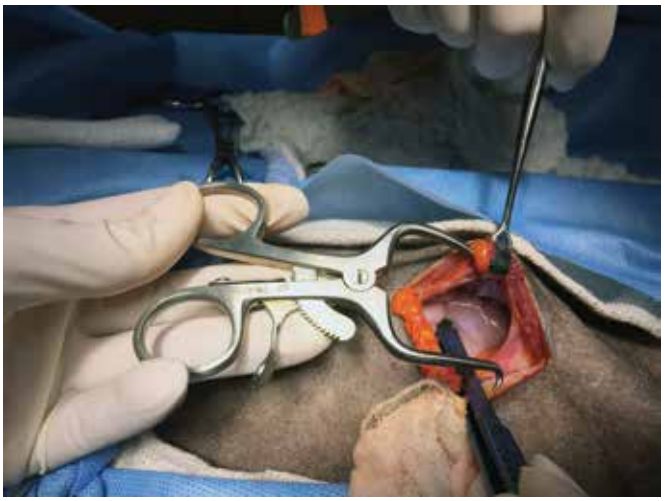

Figure 1. Completed colopexy of an adult, multiparous, female black-crested mangabey (*Lophocebus aterrimus*) viewed through the 4-cm ventral midline incision. Cranial is to the left of this image, and caudal is to the right. Sutures attaching the colon to the body wall can be seen.

unavailable previously. This dearth is somewhat surprising, given that NHP are a primary animal model for the study of pelvic organ prolapse due to birth-associated injuries of the supporting soft tissue structures in the pelvis of women.[1] In humans, rectal prolapse can occur along with vaginal prolapse in these scenarios, but NHP research focuses mainly on the biomechanics of vaginal prolapse.[3,12]

One report [4] describes a colopexy procedure via laparotomy that can be extrapolated to suit most small animal species. However, the treatment for recurring rectal prolapse in humans is rectopexy. This procedure is performed predominantly laparoscopically, with several well-described techniques that include or do not include the use of mesh implants to assist in attaching the rectum to the sacral–pelvic wall.[12] The reason for the discrepancy in surgical treatment between humans and animals is likely due to differences in pelvic orientation and bipedal ambulation, which places increased pressure on a compromised structural support system. In contrast to most small animal species, NHP display a range of pelvic positions—one reason why NHP are considered an ideal model for the study of pelvic organ prolapse.[3] Black-crested mangabeys often rest sitting in an upright position but typically ambulate by using all 4 limbs. Therefore, we decided to perform a colopexy to the caudal aspect of the abdominal wall in this animal.

Laparoscopic colopexy has been achieved successfully in both canine and feline patients.[14,15] We likewise attempted to perform laparoscopic colopexy, with the hope of reducing pain, discomfort, and the risk of dehiscence. The discovery of extensive intraabdominal adhesions on entry into the first port led to conversion to an open technique. Intraabdominal adhesions can develop either postsurgically or from inflammatory disease.[10] To our knowledge, this animal had not undergone abdominal surgery prior to this occasion. We suspect that pelvic inflammatory disease may have been the cause of adhesions in this case, given the animals extensive reproductive history. A younger NHP with rectal prolapse but without a history of a pelvic inflammatory disease or prior abdominal surgery might be an appropriate candidate for laparoscopic colopexy.

In NHP, rectal prolapses are often attributed to parasitic or bacterial infections leading to colitis or periods of extreme stress.[2] Consistently negative fecal analyses of this animal made colitis due to a parasitic or bacterial infection unlikely in this case. However, stress appeared to be an inciting factor, given the increased frequency of prolapse after the animal's transportation to a new facility. Furthermore, we suspect that changes in reproductive anatomy and physiology postpartum left this animal predisposed to the development of rectal prolapses, given that she appeared to develop this chronic condition later in life after several parities. Other potential causes such as neoplasia, chronic diarrhea, and urolithiasis were ruled out, on the basis of the animal's history and presurgical work-up.

Although spontaneously resolving rectal prolapse had occurred sporadically in this mangabey in the past, leaving her untreated was inappropriate in this case for several reasons. First, the animal's increased aggressive behavior and general agitation indicated that the prolapses may have been causing her considerable distress and discomfort. In addition, the associated bleeding likely led to the anemia, signifying a potential worsening of her condition. Finally, the animal was scheduled to be on exhibit in a large mixed-species habitat, where the risk of trauma should the prolapse recur would be very high, thus affecting quality of life.

This reported case presented several challenges relevant to the treatment of rectal prolapse in NHP. The first challenge was the discussion of which procedure would be most appropriate in light of the animal's anatomy and behavior. The next challenge was the presence of intraabdominal adhesions, thus leading to a change in surgical approach. The procedure we described here can be applied to other similar NHP species and may be useful to clinicians who are considering surgical treatment of rectal prolapses in NHP.

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