Ileocolic intussusception in a pine snake (*Pituophis melanoleucus*)

M. A. WOSAR, G. A. LEWBART

INTUSSUSCEPTION of the gastrointestinal tract has been reported in reptiles, but a review of the literature does not yield any reports of the treatment of this condition in snakes. In other species, irreducible intussusceptions can be treated with resection and anastomosis of the involved organ. Due to the linear arrangement of the snake's gastrointestinal tract, end-to-end anastomoses can be difficult or impossible, depending on the length of organ removal. When an anastomosis cannot be performed, other surgical options must be available to maintain the patency of the gastrointestinal tract. This short communication describes ileocolic intussusception in an adult female pine snake (*Pituophis melanoleucus*).

The pine snake was presented to the North Carolina State University Veterinary Teaching Hospital for evaluation of a caudal coelomic mass that had first been noted four months previously. The snake was 60 cm long and weighed 470 g. The mass was in the caudal quarter of the body, approximately 20 scutes cranial to the vent, and approximately doubled the diameter of the body. Bloody faecal matter was noted leaking from the vent. A warm water enema was not productive. The snake's reproductive history and the time of year made it unlikely to have a retained egg.

Examination of a sample of faeces revealed unidentified protozoal organisms. Fine-needle aspiration cytology of the mass showed heterophilic inflammation and the presence of mixed bacteria. Radiographs and coelomic ultrasonography revealed a soft tissue opacity within the coelomic cavity, with small gas opacities, but could not identify the origin of the mass.

The snake was prepared for an exploratory coeliotomy, anaesthetised via a mask using isoflurane (Forane; Abbott Laboratories), and maintained on 2 to 3 per cent isoflurane in oxygen via an endotracheal catheter. The snake was placed in left lateral recumbency and a 10 cm incision was made between the first and second row of scales directly over the mass. The mass was exteriorised and found to be an intussusception of the ileocolic area (Fig 1). The intussusception could not be reduced, and so the involved intestine (including the ileocolic junction) was resected. An anastomosis was attempted, but the ends of the intestine and colon could not be approximated without excessive tension. In an attempt to relieve this tension, the colonic segment was freed from its mesenteric attachments caudally to its insertion in the cloaca, and the ileal segment was freed from its mesenteric attachments cranially for a distance of approximately 15 cm. This did not provide sufficient mobility to the intestine to allow an anastomosis. To maintain patency of the intestinal tract, a permanent ileostomy was made at the cranial end of the skin incision. The intestinal mucosa was sutured to the body wall with 4-0 polyglyconate (Maxon; Tyco Healthcare) in a simple interrupted pattern. A 5 F red rubber catheter was placed in the ileostomy site to maintain patency. The end of the colonic segment was closed with a simple encircling suture of 4-0 polyglyconate. The coelom was flushed with warm saline. The body wall was closed with 4-0 polyglyconate in a simple continuous pattern. The skin was closed with 3-0 polyglyconate in a horizontal mattress pattern. Histopathology of the intestinal section showed an intussusception with multifocal ulceration and necrosis of the mucosa.

FIG 1: Intraoperative view of ileocolic intussusception in a pine snake (*Pituophis melanoleucus*), exteriorised via a paramedian incision

The snake recovered from anaesthesia uneventfully. It received 0.25 mg/kg butorphanol (Torbutrol; Fort Dodge) intramuscularly every 24 hours for three days and 20 mg/kg ceftazidime (Fortaz; GlaxoWellcome) intramuscularly every 72 hours for 30 days. The ileostomy catheter was maintained for 24 hours and then removed. The snake passed urates normally from the vent. The snake was tube-fed twice and willingly ate pinkies 14 days after surgery. On day 30 after surgery, faeces were manually expressed from the ileostomy site. During the act of expressing faecal material, some faeces were noted to be coming through the wound edges around the ileostomy site. The next morning, the snake was found dead in its cage. During the time between surgery and death the snake had not gone through an ecdysis cycle.

Postmortem examination revealed dehiscence of the ileostomy site, with leakage of the intestinal contents and a fibrinous peritonitis. The distal end of the ileum, just proximal to the ileostomy, had transmural necrotising enteritis characterised by areas of necrotic villi associated with fibrin exudation and marked submucosal and serosal oedema. Moderate numbers of degenerate heterophils were scattered throughout the wall of the intestine.

Intussusception of the intestine has been reported in the green iguana (*Iguana iguana*) (Bennett and Mader 1996) and has been referred to in other reptiles (Wallach and Boever 1983). A review of the literature found no reports of the treatment of intussusception in snakes. Although resection of the luminal organs in snakes has been reported, most reports describe only short segments being removed. Resection and anastomosis of the pyloroduodenal area of a python for treatment of a gastric rupture has been reported; however, the length of intestine removed was only 4 per cent of its body length (14 cm in a 350 cm boa) (Jacobson and Ingling 1976). Colonic resection and anastomosis for the treatment of adenocarcinoma has been reported in a corn snake (Latimer and Rich 1998); the length of colon removed was not specified, but the report suggests that it was short. The successful resection and anastomosis of five tracheal rings in a 127 cm python has also been described (Diethelm and others 1996). In an experimental study in Burmese pythons (*Python molurus bivittatus*), the middle third of the small intestine was resected without complications in 21 snakes (Secor and others 2000). The authors of that study noted that the small intestine of juvenile pythons is uniquely serpentine in arrangement, and the anastomosis was therefore accomplished without tension because of the mobility of the intestine in this area. They noted that the gastrointestinal tract orad and aborad of the small intestine is not arranged in the same way, and cannot be mobilised to the same degree (S. M. Secor, personal communication).

In the present case, the intestinal resection left a 10 cm gap in a 50 cm long gastrointestinal tract (snout-cloaca length)

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M. A. Wosar, DVM,
MSPVM, DACVS,
G. A. Lewbart, MS, VMD,
DACZM,
Department of Clinical
Sciences, College of
Veterinary Medicine,
North Carolina State
University, Raleigh,
NC 27606, USA

Dr Wosar's present
address is Miami
Veterinary Specialists,
8601 Sunset Drive,
Miami, FL 33143, USA

(McCracken 1999) – 20 per cent of the length of the snake's gastrointestinal tract. This could not be anastomosed without excessive tension. The only option for maintaining patency of the gastrointestinal tract was to perform a permanent ileostomy. During the attempts to mobilise the cranial aspect of the intestine, a large length of the mesentery was elevated from the intestine; this may have affected the integrity of the blood supply to the caudal ileum. This may in part explain the necrosis of the ileum at the ileostomy site. The thin nature of snake intestine allowed for only a single-layer stoma with the skin. The skin of snakes is relatively metabolically inactive between ecdysis cycles, and heals slowly. The snake did not complete an ecdysis cycle between the surgery and its death. This may have led to the late dehiscence of the stoma and peritonitis.

This case highlights the difficulty encountered when a large length of a snake's gastrointestinal tract must be resected. Unlike mammals and other reptiles, in which the gastrointestinal tract is coiled and anatomically distant regions of the tract are spatially in close proximity, the linear nature of the snake's body does not allow for resection of any great length of intestine without leaving a large defect. Furthermore, the tight attachment of the mesentery to the intestine does not allow longitudinal mobility of the gastrointestinal tract. Together, these features mean that there is a limit to the length of gastrointestinal tract that can safely be removed while still allowing a functional anastomosis. In an adult snake, this appears to be well below the 20 per cent length attempted in this case. A more reasonable limit may be

10 per cent or less, as previous reports of successful surgery describe resections of only this length. When a snake requires extensive intestinal resection, a permanent enterostomy may be the only surgical option. This requires a secure enterostomy technique, with attention paid to preserving the blood supply to the remaining intestine.

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