

# Foreign body attachment to polypropylene suture material extruded into the small intestinal lumen after enteric closure in three dogs

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- ▶ Polypropylene, which is completely nonabsorbable, when used in a continuous suture pattern in the intestines, may act as a site of attachment for a foreign body.
- ▶ Suitable alternatives to polypropylene for use in a continuous pattern for closure of small intestinal surgery sites include absorbable materials with strength retention through day 14 after surgery, such as polydioxanone and poliglecaprone 25.

An 11-month-old spayed female Shih Tzu was evaluated because of a 1-week history of vomiting, diarrhea, lethargy, and decreased appetite. A presumptive diagnosis of acute gastroenteritis had been made 2 days earlier, but conservative management, which included withholding food and water for 24 hours, had failed to control clinical signs. On physical examination, the dog had signs of abdominal pain and loose feces in the rectum. Results of a CBC and serum biochemical profile were within reference ranges, except for slight monocytosis (1,090 cells/ $\mu$ L; reference range 0 to 840 cells/ $\mu$ L), slightly high serum activity of alkaline phosphatase (157 U/L; reference range, 5 to 131 U/L), and slightly low serum amylase activity (274 U/L; reference range, 290 to 1,125 U/L). Analysis of a free-catch urine sample revealed moderate proteinuria and concentrated urine (specific gravity > 1.040). Survey abdominal radiographs revealed no abnormalities.

Because of a lack of identifiable causes and to further characterize the nature of the gastrointestinal signs and associated pain, a ventral midline exploratory celiotomy was performed. A linear foreign body (rope) was identified in the distal third of the jejunum; viability of a 1.5-inch portion of the intestine at the site was questionable. Intestinal resection and end-to-end anastomosis were performed to remove the rope. The anastomosis was performed by use of a modified simple continuous pattern with 4-0 polypropylene<sup>a</sup> suture with a swaged-on, taper-cut needle, as described.<sup>1</sup> Routine 3-layer closure of the abdomen was performed. Recovery from anesthesia and surgery was routine. The dog was fed small amounts of an easily digestible diet starting 2 days postoperatively, had no further signs of gastrointestinal upset, and was discharged from the hospital on the third postoperative day.

Approximately 7 months after surgery, the dog was evaluated because of clinical signs similar to those at the initial evaluation. Signs of abdominal pain were detected on physical examination. A CBC and small animal serum biochemical profile revealed mature neutrophilia ( $22.5 \times 10^3$  cells/ $\mu$ L; reference range, 3.5 to  $12.0 \times 10^3$  cells/ $\mu$ L), slightly low amylase activity (315 U/L; reference range, 500 to 1,500 U/L), and mild hypoglycemia (70.4 mg of glucose/dL; reference range, 77 to 125 mg/dL). On abdominal radiographs, the small intestines appeared diffusely dilated, with excessively dilated and plicated segments in the caudoventral portion of the abdomen.

Because of the high index of suspicion for a small intestinal obstruction, a ventral midline exploratory celiotomy was performed. A linear foreign body, starting at the site of previous intestinal resection and anastomosis, was identified. The distal third of the jejunum was hyperemic. An enterotomy was performed to remove a string and piece of plastic that were caught on a portion of polypropylene suture material from the previous surgery, which had been extruded into the lumen of the jejunum. The knot of the polypropylene suture was grossly visible on the serosal surface of the jejunum and, unlike the remainder of the suture, had not moved. The enterotomy site was closed with 4-0 polypropylene<sup>a</sup> suture material in a simple continuous pattern, and a serosal patch was placed over the enterotomy. An enlarged intestinal lymph node was seen, and an incisional biopsy of the node was performed for histopathologic analysis. No other abnormalities were noted. The abdomen was flushed with 1 L of warm saline (0.9% NaCl) solution. Routine 3-layer closure of the abdomen was performed.

Recovery from anesthesia and surgery was routine. The dog was fed small amounts of an easily digestible diet starting 2 days postoperatively, had no further signs of gastrointestinal upset, and was discharged from the hospital. The lymph node biopsy specimen yielded a diagnosis of a hemorrhagic reaction, presumably reflecting drainage from the intestinal tissue damaged by the linear foreign body. Eighteen months after the second surgery, the owner reported that the dog did not have further signs of gastrointestinal upset.

A 3-year-old neutered male Gordon Setter was evaluated because of vomiting, and a diagnosis of intestinal foreign body was made on the basis of results of physical examination and survey abdominal radiographs. A gastrotomy and proximal jejunal enterotomy were performed to remove a cloth linear foreign body. The enterotomy was closed with 4-0 polypropy-

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lene<sup>a</sup> in a modified simple continuous pattern, and the gastrotomy was closed in a double layer with 3-0 polydioxanone in a simple continuous pattern oversewn with a Cushing pattern. During the next 36 hours, the dog developed ventricular tachycardia and vomiting, which resolved with supportive care, and the dog was discharged on the fifth postoperative day.

Three months later, the dog was returned for evaluation of signs of abdominal tenderness and lethargy. Results of a CBC and serum biochemical profile were unremarkable, and findings on abdominal radiographs suggested the possibility of a foreign body in the small intestine. Exploratory celiotomy revealed that the intestine at the previous surgery site was plicated, and an obstructing linear foreign body was identified. The foreign body was caught in polypropylene suture from the previous surgery that had been extruded into the lumen. The knot was palpable in the serosa at the antimesenteric border of the healed anastomosis. Two enterotomies were performed to remove the foreign body and closed with 4-0 polydioxanone<sup>b</sup> in a simple interrupted pattern. The dog recovered routinely and was discharged 2 days postoperatively. Fifteen months after the second surgery, the owner reported that the dog had been free of signs of gastrointestinal upset.

A 6-month-old neutered male Dachshund was evaluated because of a 1-month history of persistent flank biting and signs of abdominal discomfort on palpation. The dog's appetite was good, and no vomiting or diarrhea was reported by the owner. Pertinent history included a jejunal resection and anastomosis for a foreign body (performed by the referring veterinarian) approximately 6 weeks previously. Abdominal radiography and ultrasonography did not identify a reason for the clinical signs. Abdominal exploratory celiotomy revealed a foreign body palpable at the previous jejunal resection and anastomosis. The object was not moveable, and resection and anastomosis were performed to remove a stick entwined in polypropylene suture from the first surgery that had been partially extruded into the lumen. The anastomosis site was closed with a modified simple continuous pattern with 4-0 polypropylene<sup>c</sup> with a swaged-on, taper-cut needle. The dog recovered from surgery without complications and was discharged from the hospital 1 day postoperatively.

Ten months later, the dog was returned to the hospital for evaluation of signs of gastrointestinal upset, including inappetence, vomiting, and signs of abdominal pain. Abdominal radiographs revealed a large amount of radiodense material in the small intestine and apparent plication of the small intestines in the midabdomen. Abdominal exploratory surgery was performed, and no evidence of obstruction was found. Omental adhesions at the previous resection and anastomosis site were found and broken down, but no polypropylene knots were identified. The radiodense material was moved into the colon and removed through the anus. The dog recovered routinely from surgery and was discharged from the hospital. Approximately 6 months postoperatively, the dog was euthanatized for an

unrelated health problem at another veterinary hospital.

The use of polypropylene suture material to close incisions into the lumen of the small intestine, such as during enterotomy or a resection and anastomosis, is a common and accepted practice.<sup>2,3</sup> In the 3 dogs described here, foreign bodies were caught on a portion of polypropylene suture that had evidently been extruded into the lumen of the small intestine after its use for closure of a previous intestinal surgery. To the authors' knowledge, there are no previous reports of migration of polypropylene suture into the lumen of the intestine or of suture material acting as a catch point for foreign bodies.

Like other nonabsorbable suture materials, polypropylene elicits minimal tissue response characterized by early and rapid proliferation of connective tissue that encapsulates the suture and persists for years.<sup>4</sup> Polypropylene has been compared with other suture materials for closing incisions in the stomach and colon and was the least reactive of the suture materials studied in a report<sup>5</sup> involving 127 dogs. In a study<sup>4</sup> of 27 human patients requiring gastrointestinal surgery, polypropylene was well tolerated, with available autopsy reports indicating clearly visible sutures without gross evidence of tissue reaction and only minimal microscopic evidence of fibrous tissue reaction surrounding the sutures.

Rare but potentially important suture reactions to polypropylene have been documented. In a 5-year study of tissue reaction to polypropylene, 351 suture sites in the abdominal wall muscles of rabbits were examined, 9 of which (in different animals) had formation of bone, cartilage, or both around the suture.<sup>6</sup> No such bone or cartilage formation was grossly observed in the 3 dogs reported here, although histologic analysis was not performed. In the same study,<sup>6</sup> at 18 months and even more often at 2 years, an occasional polypropylene suture had started to fragment from 1 edge of the suture material, causing a slightly increased tissue reaction. In another study,<sup>7</sup> similar fragmentation of polypropylene sutures implanted in rat gluteal muscles was seen, and no evidence of increased tissue reaction surrounding fragmented sutures was evident. In end-to-end arterial anastomoses in pigs, polypropylene causes chronic inflammation that may contribute to stenosis or thrombus formation.<sup>8</sup> In the urinary bladder wall of rabbits, polypropylene sutures can cause persistent inflammation, cyst formation, and incrustation with subsequent urolith formation surrounding the sutures.<sup>9</sup> Also, nonabsorbable sutures such as polypropylene may migrate from the tissue into the lumen of the bladder, thus serving as a nidus for urolith formation.<sup>10</sup> Polypropylene suture has been used for ureteral anastomosis, which was associated with numerous luminal diverticula at 4 and 7 months postoperatively.<sup>11</sup>

Stainless-steel surgical staples are considered minimally reactive, and their use has been associated with rapid wound healing in the colon.<sup>12</sup> In a recent study<sup>13</sup> comparing stapled approximating anastomoses and traditional hand-sewn approximating anastomoses in the jejunum of dogs, no significant differences in

bursting strength, lumen diameter, lumen circumference, and healing characteristics were detected between the 2 techniques. However, staples placed by use of a gastrointestinal anastomosis surgical auto-stapling instrument during intestinal surgery in dogs may come loose and be extruded into the lumen, but only when an inverting serosa-to-serosa anastomosis is performed.<sup>14</sup>

Although no such data were found for polypropylene in the gastrointestinal tract specifically, it is possible that a similar chronic inflammatory response in conjunction with the normal peristaltic contractions of the small intestines may have contributed to extrusion of the polypropylene suture material into the intestinal lumen of the dogs in this report. We also speculated that the use of polypropylene in an interrupted pattern would not result in the same type of complications because of the short segments of suture that are used. Additionally, the discovery of a foreign body attached to the intraluminal portion of the suture in the dogs reported here underscores the clinical relevance of such suture migration and the need to prevent it.

Because the Dachshund was, chronologically, the first affected dog encountered of these 3 dogs, a trend had not yet been identified and the second intestinal surgery site was closed with polypropylene. The authors have chosen to replace polypropylene with polydioxanone suture material for use in the closure of intestinal surgeries because it is absorbable<sup>3</sup> and have not since encountered similar cases. Polypropylene<sup>a</sup> suture was initially selected because of the availability of a swaged-on, taper-cut needle. A similar needle is available swaged on polydioxanone.<sup>b</sup>

A comparison of stomach and colonic wounds closed with absorbable sutures and those closed with nonabsorbable sutures found no significant differences in breaking strength curves.<sup>7</sup> By 14 days postoperatively, the relative contribution in strength from sutures in small intestinal anastomoses is negligible.<sup>15</sup> Polydioxanone suture material has a 14% reduction in tensile strength by day 14 with complete resorption by day 180<sup>2,3</sup>; therefore, it should provide adequate time for intestinal healing to occur. Poliglecaprone 25, an absorbable monofilament suture material with a breaking strength retention of approximately 20% to 30%

after 2 weeks and complete absorption by 91 to 119 days with minimal tissue reaction,<sup>16</sup> could be considered as another alternative to polypropylene for use in closure of small intestinal surgical sites.

<sup>a</sup>Prolene, Ethicon Inc, Somerville, NJ.

<sup>b</sup>PDS II, Ethicon Inc, Somerville, NJ.

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