

## Bilateral hydronephrosis and hydroureter after ovariohysterectomy using nylon cable tie: a case report

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**ABSTRACT:** A spayed crossbred female dog was presented due to progressive weight loss, emesis and anorexia over the preceding month. A complete blood count, urinalysis, serum biochemical panel, and ultrasound were initially performed. Computed tomography urography was performed as a complementary exam. Based on ultrasound and CT findings an exploratory celiotomy was performed to remove hyperdense structures that could be the cause of the hydronephrosis and hydroureter in both kidneys. An extensive granulomatous reaction was found near the caudal pole to the left kidney. A nylon cable tie adhering firmly to this tissue was removed during surgical excision. On the dorsal surface of the bladder an extensive granulomatous reaction that had entrapped the right ureter was also noted. Another nylon cable tie was removed and the ureter was released. Eight months postoperatively, the dog was in good general physical condition, showing appetite and vigour. Abdominal ultrasonography showed improvement of the hydronephrosis in both kidneys. The urea ratio was normal, but the creatinine level was slightly elevated, suggesting a guarded prognosis. Thus, bilateral hydronephrosis as observed in the present study should be considered as a major complication after elective ovariohysterectomy.

**Keywords:** nylon cable tie; renal injury; surgery, computed tomography excretory; dog

Complications after elective ovariohysterectomies may occur during surgery or at short or long intervals after the surgical procedure (Furieux et al. 1973; Werner et al. 1992; Burrow et al. 2005; Goethem et al. 2006; Howe 2006; Adin 2011; Kennedy et al. 2011). Depending on the degree and type, the complication may be life-threatening (Werner et al. 1992; de Gopegui et al. 1999; Goethem et al. 2006; Kennedy et al. 2011).

Complications associated with the suture material or ligature include haemorrhage, abdominal wall dehiscence, surgical wound infection, stump granuloma, fistulous draining tracts, inadvertent ureteral ligation, and chewed-out sutures (Kyles et al. 1996; Pollari and Bonnett 1996; Burrow et al. 2005; Goethem et al.

2006; Howe 2006; Adin 2011; DeTora and McCarthy 2011; Kennedy et al. 2011). Nylon cable ties have been used as ligating material during the spaying of cats and dogs since they are lower in cost and less time-consuming, especially in free campaigns that utilise minimally invasive celiotomy (Hammond et al. 1998; Barros et al. 2009; Lima et al. 2010). Complications reported in the use of nylon cable tie including loosening, fistulous tract, unilateral hydroureter and hydronephrosis (Werner et al. 1992; Murphy et al. 1998; Macedo et al. 2012). The purpose of this report was to describe another potential life-threatening complication encountered using this material - bilateral hydronephrosis and hydroureter – and the course of recovery after treatment.

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### Case description

A six-year-old spayed crossbred female dog, weighing 10 kg was presented to the Veterinary Hospital due to progressive weight loss, emesis and anorexia over the preceding month. The symptoms appeared after use of an anti-inflammatory drug. According to the owner, the female dog had been spayed in a free campaign approximately four years previously. Physical examination revealed signs of cachexia and lethargy, and pale mucous membrane. Pain signs in the mid-abdomen, enlarged kidneys and enlarged bladder were detected on palpation. A complete blood count (CBC), urinalysis, serum biochemical panel, and ultrasound were initially performed. Computed tomography (CT) urography was performed as a complementary exam.

Hypochromic microcytic anaemia, elevated urea (122 mg/dl; reference range 21.4 to 59.92 mg/dl), elevated creatinine (3.6 mg/dl; reference range 0.5 to 1.5 mg/dl), and hypokalaemia (2.9 mEq/l; reference range 4.37 to 5.65 mEq/l) were the most relevant abnormalities. Abdominal ultrasonography (B-mode scan) (MyLab Alpha, Esaote, Genoa, Italy) showed bilateral renal enlargement with renal cortical atrophy, loss of corticomedullary differentiation, dilated pelvis and dilatation of both ureters, suggesting hydronephrosis and hydroureter. Potassium chloride in lactated Ringer's solution was administered (80 ml/kg/day). Under general anaesthesia, CT urography was performed with a helical scanner (Shimadzu SCT-7800CT, Shimadzu Corp., Kyoto, Japan) with the dog positioned in dorsal recumbency. A bolus injection of non-ionic iodinated contrast agent (2 ml of iopromide/kg, *i.v.*) was used after plain CT. The scanning parameters were as follows: voltage peak, 120 V; current, 150 mA; pitch, 1:0; and rotation time, 1 s/rotation. CT findings included bilateral hydronephrosis and thickening of the renal wall, the presence of an abnormal hyperdense structure in the caudal pole of the left kidney and another located on the dorsal surface of the bladder neck (Figure 1).

Based on these findings, an exploratory celiotomy was performed to remove these hyperdense structures that could be the cause of the hydronephrosis and hydroureter in both kidneys. The dog was premedicated with morphine (0.5 mg/kg, *i.m.*). General anaesthesia was induced with propofol and maintained with isoflurane in oxygen. Transoperative analgesia included continuous infusion of 0.9% saline solution (500 ml) with morphine

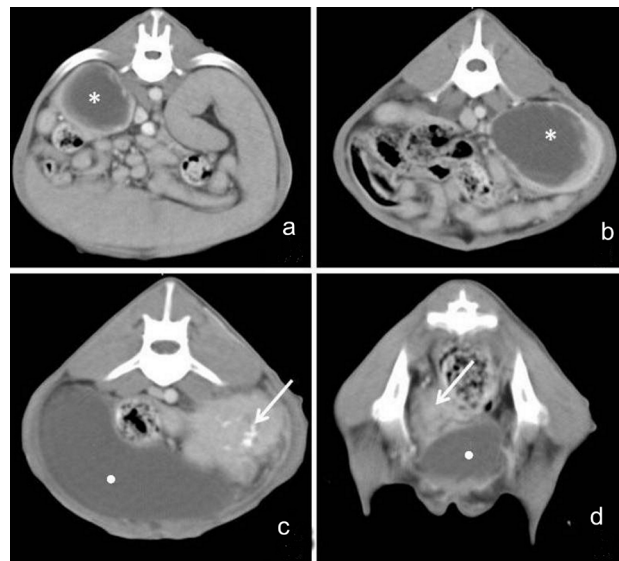


Figure 1. Representative CT urography images before surgery. (a) Right kidney (\*) with hydronephrosis; (b) left kidney (\*) with hydronephrosis and thickening of renal wall; (c) bladder (●) and hyperdense structure (arrow) in the caudal pole of the left kidney; (d) hyperdense structure (arrow) located on the dorsal surface of the bladder neck (●)

(1 ml), lidocaine 2% (7.5 ml) and ketamine 10% (0.3 ml). A midline abdominal incision was extended from the xiphoid process to the pubis. Both kidneys were found to be enlarged, but the right kidney had a fluctuant consistency while the caudal pole of the left kidney had firm consistency on palpation. An extensive granulomatous reaction was found near the caudal pole of the left kidney. A nylon cable tie adhering firmly to this tissue was removed during surgical excision. A cable tie was not found on the right ovarian pedicle. In addition, the left ureter that had become entrapped in the surrounding tissue was released using sharp and blunt dissection. On the dorsal surface of the bladder an extensive granulomatous reaction that had entrapped the right ureter was also noted. Another nylon cable tie was removed and the ureter was released. Omentum was placed over the freed sites of the ureters. Closure of the abdomen was routine, following irrigation of the abdominal cavity. The nylon cable ties were examined using a stereoscope (Carl Zeiss Citoval 2, Jenoptik Jena GmbH, Berlin, DDR). Defects and signs of degradation were observed at 25× and 50× magnifications (Figure 2).

The dog received ceftriaxone (20 mg/kg, q 12 h) immediately before surgery and for seven days after surgery, followed by omeprazole (1 mg/kg, q 24 h, *p.o.* for seven days) and furosemide (4 mg/kg,

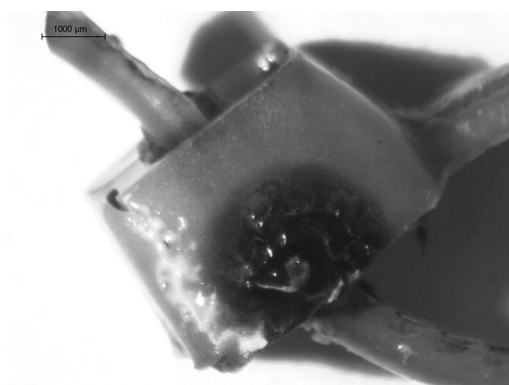


Figure 2. Photograph of the nylon cable ties examined on a stereoscope showing the presence of defects and signs of degradation; bar = 1000 µm

*p.o.* for 30 days). Tramadol chlorhydrate (4 mg/kg, *s.c.*, q 12 h) was administrated for five days. The dog received intravenous fluid therapy for four days in a private practice due to the owner's request. Skin sutures were removed 10 days after surgery, and the dog showed better general physical condition. The vomiting had stopped and the dog started to eat. New biochemistry analysis revealed improvement of creatinine (2.2 mg/dl) and potassium (4.5 mEq/l), but not of urea (125 mg/dl). On day 30 after surgery, the owner reported cloudy

urine. Urinalysis showed severe leukocytosis. Biochemistry revealed improvement of urea (82 mg/dl), but not of creatinine (2.7 mg/dl). Urine culture and antibiotic sensitivity test were performed, revealing an *Escherichia coli* strain sensitive only to chloramphenicol. Antibiotic therapy was prescribed for 10 days (40 mg/kg, *p.o.*, q 12 h). On the 60<sup>th</sup> postoperative day, the dog was in good general physical condition, showing appetite and vigour. The urinalysis was normal. The urea ratio was also normal (56 mg/dl), but the creatinine level (2.1 mg/dl) remained elevated. Abdominal ultrasonography showed improvement of the hydronephrosis in both kidneys and reduced distinction of corticomedullary region (Figure 4). CT urography revealed amelioration of the hydronephrosis and corticomedullary differentiation with contrast present in the renal pelvis of both kidneys (Figure 3). Eight months after surgery, the dog was in excellent general physical condition. The urea and creatinine levels were the same as on the 60<sup>th</sup> postoperative day. The ultrasound showed that both kidneys were free of hydronephrosis, while corticomedullary differentiation was reduced (Figure 4).

## DISCUSSION AND CONCLUSIONS

The choice of the suture material is important to reduce inflammation and avoid granuloma formation (Goethem et al. 2006; Adin 2011). Reports of urinary incontinence after ovariohysterectomy have been attributed to stump granulomas in female dogs (Okkens et al. 1981; Werner et al. 1992; Goethem et al. 2006). Extramural ureteral compression due to uterine scar tissue located in the bladder trigone or ovarian pedicle granuloma may contribute to postoperative development of hydronephrosis (Werner et al. 1992; de Gopegui et al. 1999; Kanazono et al. 2009), as observed in the present case. The potential of nylon cable tie to induce inflammation and complications is controversial (Werner et al. 1992; Murphy et al. 1998; Hammond et al. 1998; Barros et al. 2009; Lima et al. 2010; Macedo et al. 2012). The origin of the granuloma in the present study was thought to be a reaction to a nylon cable tie, as observed in another study (Werner et al. 1992). The defects observed in the nylon cable tie on stereoscopic examination support this hypothesis. However, inadequate aseptic technique or excessive residual devitalised tissue or excessive tissue trauma are other causes that may

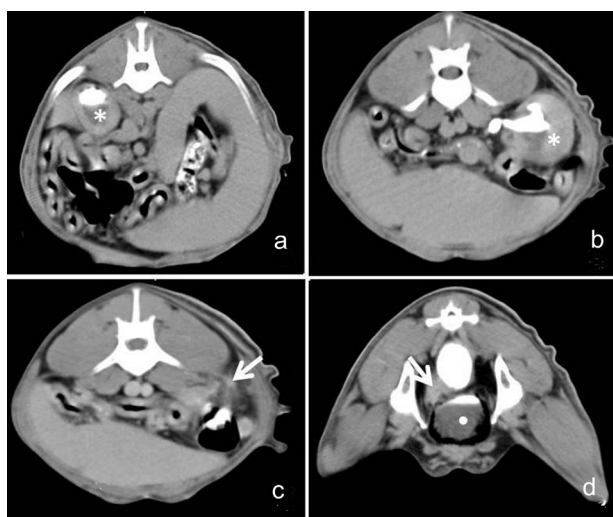


Figure 3. Representative CT urography images on the 60<sup>th</sup> postoperative day. (a) Right kidney (\*) with contrast in renal pelvis and corticomedullary differentiation; (b) left kidney (\*) with hydronephrosis and hydroureter, both with contrast; (c) vestige of structure hyperdense (arrow) in the caudal pole of the left kidney; (d) vestige of hyperdense structure (arrow) located on the dorsal surface of the bladder neck (•)



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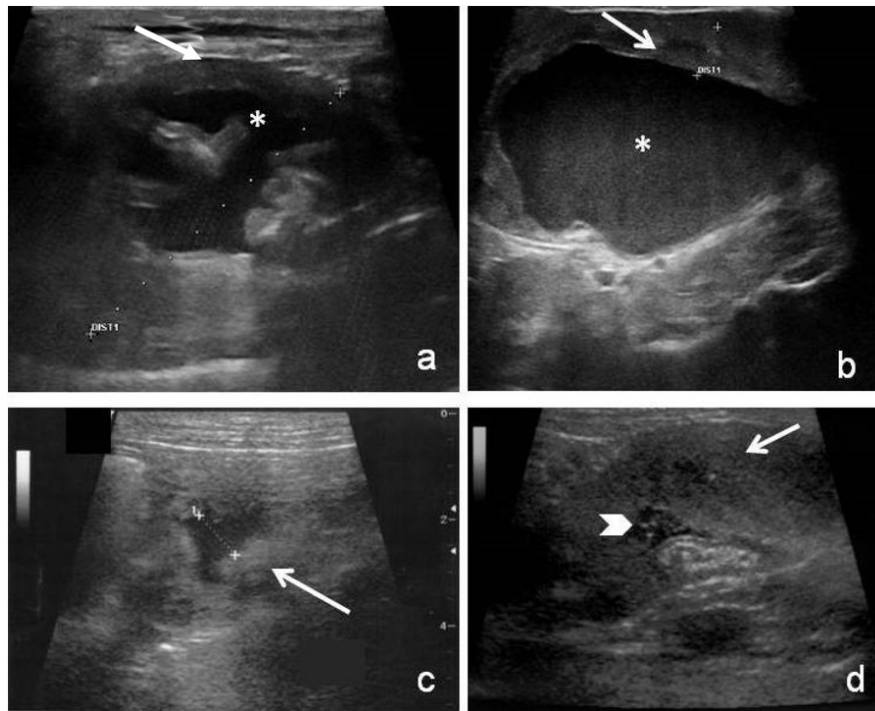


Figure 4. Representative ultrasonographic images of the right (a,c) and left (b,d) kidneys. Longitudinal images at two months after surgery: increased volume in right (a) and left (b) kidneys with severe hydronephrosis (\*) (dilated pelvis and diverticuli), reduced distinction of the corticomedullary junction (arrows) and hyperechoic cortex. Longitudinal image of the right kidney at eight months after surgery (c): dimensions close to the normal, pelvis slightly distended (+), poor definition of corticomedullary region (arrow) and hyperechoic cortex. Frontal ultrasonographic image of the left kidney at eight months after surgery (d): dimensions close to the normal, pelvis slightly distended with echogenic dots (arrowhead), loss of definition of the corticomedullary region (arrow), and heterogeneous and hyperechoic cortex

contribute to excessive inflammation and granuloma development (Werner et al. 1992; Murphy et al. 1998; Goethem et al. 2006; DeTora and McCarthy 2011).

Only a few reports have described chronic ureteral obstruction secondary to spaying (Werner et al. 1992; de Gopegui et al. 1999; Kanazono et al. 2009). The dog in the present study probably developed a chronic renal disease, which, after the use of an anti-inflammatory drug became clinically apparent. Based on the clinical signs of progressive weight loss, emesis, anorexia, and a creatinine value of 3.6 mg/dl, the dog was in Stage 3 of kidney disease. This stage presents azotemia, a reduction in the glomerular filtration rate (GFR) with creatinine values from 2.1 to 5.0 mg/dl, and clinical signs of anorexia, weight loss, dehydration, oral ulceration, vomiting and diarrhoea (Aiello and Mays 1998). Hypochromic microcytic anaemia, elevated urea and hypokalaemia may be other signs of diminution of the functional kidney mass in the present case.

The sensitivity of ultrasonography and CT are apparently similar in ureteral dilation diagnosis

(Hardie and Kyles 2004). However, CT urography was used in the present study to aid the diagnosis of the cause of both hydroureter and hydronephrosis. The hyperdense structures revealed by CT were decisive for performing exploratory celiotomy. The treatment of ureteral obstruction is dependent on kidney function and on whether the obstruction is unilateral or bilateral (Hardie and Kyles 2004). A unilateral lesion can be treated by nephrectomy since the opposite kidney is functional (Werner et al. 1992; Hardie and Kyles 2004). A bilateral lesion may require ureteral surgery if preservation of renal function is critical to survival (Hardie and Kyles 2004). Renal descensus and ureteroureterostomy were successfully performed in a case of incomplete unilateral ureteral occlusion because of the formation of an ovarian pedicle granuloma (Kanazono et al. 2009). In the present case both ureters were released from the surrounding tissue at the same time that the nylon cable ties were removed. The procedure allowed relief of both ureteral obstructions with partial recovery of renal function. The time and

degree of obstruction are important prognostic factors for renal function recovery (Hardie and Kyles 2004). Apparently, dogs are able to survive with a small portion of functional renal tissue (Aiello and Mays 1998). The last postoperative laboratory exams indicated that despite clinical improvement of the dog in the present case, the creatinine level was higher than normal, suggesting a guarded prognosis. In conclusion, bilateral hydronephrosis as observed in the present study should be considered as a major complication after elective ovariohysterectomy.

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