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## Short Communication

## Pleural omentalisation with en bloc ligation of the thoracic duct and pericardiectomy for idiopathic chylothorax in nine dogs and four cats

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## ABSTRACT

Conventional treatment of idiopathic chylothorax (IC) involves thoracic duct (TD) ligation (with/without lymphangiography) combined with subphrenic pericardiectomy. Nine dogs and four cats with IC, which received intrathoracic omentalisation with TD en bloc ligation (not preceded by lymphangiography) and subphrenic pericardiectomy, were evaluated retrospectively. Seven of nine dogs and 3/4 cats were still alive and disease-free at the time of reporting (range 10–53 and 19–31 months, respectively). Clinical signs of IC did not decrease after the first surgery in one cat and one dog; in another dog clinical signs recurred after 5 months. Overall efficacy rate of this one-stage combined procedure was 77% (6 months), 73% (12 months), and 57% (24 months). Where a second surgery was performed in case of failure, the success rate in dogs was 89% (6 months) and 80% (24 months). Addition of pleural omentalisation to TD en bloc ligation and subphrenic pericardiectomy does not seem to improve results when compared with published data and at present does not seem advisable as a first choice.

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Chylothorax is a debilitating disease in both dogs and cats. Several possible causes have been reported (Fossum et al., 1986, 2004), but a cause is frequently not recognized and chylothorax is considered as idiopathic (IC). Currently, the conventional treatment of IC involves prediaphragmatic thoracic duct (TD) ligation with or without pre-ligation lymphangiography combined with subphrenic pericardiectomy (Fossum et al., 1986, 2004). Intrathoracic omentalisation has been reported (Williams and Niles, 1999; Lafond et al., 2002; Adrega da Silva et al., 2009), but its association with conventional treatment has not been reported. Our goal was to evaluate retrospectively the outcome of intrathoracic omentalisation combined with prediaphragmatic en bloc ligation (not preceded by lymphangiography) of all caudal mediastinal tissue between the aorta and the thoracic vertebrae (including the TD and azygous vein), and subphrenic pericardiectomy.

Between January 2004 and June 2009 nine dogs and four cats with IC (diagnosis reached after exclusion of possible causes) received these three procedures at one stage (Table 1). A minimum follow-up of 6 months was conducted. All dogs were males and 2.5–8 year-old (median 4), and 7/9 were >28 kg. Cats were 4–7 year-old (median 4.75). Clinical sign duration was 1 week–

13 months (median 4 months). Preoperative medical therapy was limited to a low fat diet. Work-up included chest radiographs, thoracocentesis and fluid analysis, ultrasonographic examination of thorax, heart and abdomen, and blood tests. A single or more thoracocenteses were performed to relieve respiratory signs, even just before anaesthesia.

Surgery consisted of (1) right (dogs) or left (cats) 9–10th intercostal thoracotomy, (2) undermining and en bloc ligation (with 1–3 3–0/2–0 polypropylene or silk sutures depending on animal size) of all structures dorsal to aorta and ventral to vertebral column (including TD and azygous vein but sparing the sympathetic trunk), without mesenteric lymphangiography, (3) subphrenic pericardiectomy (through a 4–5th intercostal thoracotomy), and (4) pleural space omentalisation. The omentum was moved intrathoracically without tension by dorsal transdiaphragmatic (10 animals) or costal-diaphragmatic (3 animals) aspiration by a Poole cannula inserted through a small tear that was then partially sutured. The omental sac was opened to extend the omentum cranially up to the cranial mediastinum. Omentopexy to the cranial and caudal mediastinum was performed with 3–0/4–0 synthetic absorbable monofilament sutures. The ventral caudal mediastinum was opened allowing communication between the two pleural cavities. Thickening of the lung serosa and pericardium was seen in 11 animals; in nine cases a biopsy of pericardium was subjected to histological

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**Table 1**

Summary of the 13 animals with idiopathic chylothorax and treated simultaneously with en bloc ligation of all caudal mediastinal tissue including the thoracic duct and azygos vein, pericardiectomy, and intrathoracic omentalisisation.

Case number	Signalment	History (duration)	Postsurgical outcome	Follow-up
1	Male Dogue de Bordeaux, 2.5 years	Dyspnoea, coughing, progressive weight loss (5 months)	Resolution within 1 week	Alive and disease free after 45 months
2	Male Rottweiler, 3 years	Tachypnoea (2 months)	Resolution within 1 week	Alive and disease free after 53 months
3	Male Rottweiler, 3 years	Dyspnoea, progressive weight loss (13 months)	Resolution within 1 week. Recurrence after 5 months → no response to 2nd en bloc TD ligation	Euthanasia after 5 months due to failure of second surgery
4	Male Dogue de Bordeaux, 4 years	Casual diagnosis of chylothorax during a programmed clinical control (1 week – slight increase in breathing noted by owners)	Resolution within 1 week	Death after 6 months of gastric torsion
5	Male mongrel dog, 4 years	Dyspnoea, coughing, progressive weight loss (4 months)	Resolution within 1 week	Alive and disease free at 53 months
6	Male West Highland White Terrier, 5 years	Dyspnoea, progressive weight loss (4 months)	Persistent IC. Second surgery at day 18: en bloc ligation and cisterna chyli ablation	Alive and disease-free 35 months after the second surgery
7	Male Borzoi, 4 years	Dyspnoea, progressive weight loss (2 months)	Resolution within 1 week	Alive and disease free after 22 months
8	Male Bull Mastiff, 5 years	Dyspnoea (2 months)	Resolution within 1 week	Alive and disease free after 20 months
9	Male Doberman, 8 years	Dyspnoea (4 months)	Resolution within 1 month	Alive and disease free after 10 months
10	Male castrated domestic short hair cat, 5 years	Dyspnoea (1 month)	Resolution within 1 week	Alive and disease free at 31 months
11	Male castrated domestic short hair cat, 7 years	Dyspnoea, progressive weight loss (3 months)	Resolution within 1 week	Alive and disease free after 22 months
12	Female spayed domestic short hair cat, 4.5 years	Dyspnoea, coughing (5 months)	Resolution within 1 month	Alive and disease free after 19 months
13	Female spayed domestic short hair cat, 4 years	Dyspnoea, progressive weight loss (6 months)	Persistent IC	Owner declined further treatment. Euthanasia after 1 month

examination. A chest tube was installed. Postoperative management included administration of intravenous (IV) crystalloids, buprenorphine (10 µg/kg three times a day) and carprofen (2 mg/kg twice a day) for 1–4 days. Animals were discharged from the clinic after removal of the thoracostomy tube (when less than 2 mL/kg/day of non-chylous fluid were withdrawn). This was possible in 11 animals within a mean of 5 days. Follow-up information was obtained through periodical clinical and radiographic examination or through the referring veterinarian (Table 1).

In all cases histology of pericardium was consistent with fibrosing serositis of varying severity. Resolution of IC occurred within 1 week in seven dogs and two cats and within 1 month in one dog and one cat. Chylothorax persisted after surgery in one cat and one dog. The thoracostomy tube was never removed from the cat, which was euthanised after 1 month; the dog had its tube removed at day 10 on owner's decision but was re-operated for en bloc ligation of TD and cisterna chyli ablation (Hayashi et al., 2005) 18 days after the first surgery; complete resolution of clinical signs occurred within 5 days (disease-free 35 months). Another dog showed recurrence of clinical signs 5 months after the first surgery and was re-operated for en bloc ligation of TD; the effusion decreased subsequently but did not resolve and the animal was euthanised at the request of the owner. Another dog died 6 months after surgery due to gastric torsion of unknown association with the previous treatment.

The survival range was 1–53 months. Seven of nine dogs (range 10–53 months) and 3/4 cats (19, 22 and 31 months, respectively) are alive and disease-free at the time of reporting. The overall success rate of the combined procedure was 77% at 6 months, 73% at 12 months, and 57% at 24 months. The overall success rate of surgery in dogs (i.e. considering also the two dogs that underwent two

surgeries) was 89% at 6 months, 86% at 12 months, and 80% at 24 months.

IC is rare and most studies involve few animals. In addition, multiple procedures are typically performed at different times due to failure of the initial treatment. This makes an accurate estimation of the success rate of any single procedure challenging. Selective TD ligation (after lymphangiography) has a reported success rate of 20–80% (Fossum et al., 1986, 2004). If subphrenic pericardiectomy was also performed, the rate increased to 88.7–100% in dogs and 80% in cats (Fossum et al., 2004; Carobbi et al., 2008). En bloc ligation is an alternative to selective TD ligation with a reduced surgical time since lymphangiography is not performed; its reported success rate when used alone is 50% (Monnet, 2003; Viehoff and Stokhof, 2003). MacDonald et al. (2008) reported a 93% success rate of TD occlusion in normal dogs after TD en bloc ligation. Therefore, TD en bloc ligation combined with pericardiectomy may yield results overlapping those using selective TD ligation after lymphangiography and pericardiectomy.

In this retrospective study, en bloc ligation of TD and subphrenic pericardiectomy were combined with intrathoracic omentalisisation. There was no difference in the amount of omentum transposed into the thorax between the two techniques (dorsal transdiaphragmatic and costal-diaphragmatic aspiration). Intrathoracic omentalisisation has been proposed as a 'salvage' procedure when other techniques have failed (Williams and Niles, 1999; Lafond et al., 2002) or as an ancillary procedure in addition to TD ligation and pericardiectomy (Adrega da Silva et al., 2009). Results of this combined procedure when used as first-line treatment have not been reported. The role of the omentum in IC is controversial, as omental lymphatics eventually drain in the lymphatic-venous system involved in IC, even after TD closure. The other potential

roles of the omentum are angiogenesis and adhesion formation (Lafond et al., 2002). The success rate reported here overlaps with results already reported by others (cited previously in the text) that performed TD ligation and pericardiectomy with or without lymphangiography.

The main limitations of this study are the small number of animals included and the lack of a control group. Many animals responded well within the first postoperative week. However, the study failed to prove that pleural omentalisation can improve the long-term efficacy of the conventional treatment of IC (TD ligation plus pericardiectomy), when the results were compared with earlier published data. A comparative study with a larger number of animals is needed for a definitive answer. In practice, in case of IC, it seems reasonable to avoid lymphangiography and to perform en bloc ligation of all caudal mediastinal tissue including TD and pericardiectomy as a first choice for treatment. In case of failure, other procedures (e.g. cisterna chyli ablation and/or omentalisation) should be considered.

#### Conflict of interest statement

None of the authors of this paper has a financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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