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Source: Journal of Feline Medicine and Surgery Open Reports, 9(1)

Published By: SAGE Publishing

URL: https://doi.org/10.1177/20551169231159635

Case Series

jfms OPEN REPORTS

Journal of Feline Medicine and Surgery Open Reports
1–4

DOI: 10.1177/20551169231159635
journals.sagepub.com/home/jfmsopenreports

This paper was handled and processed by the American Editorial Office (AAFP) for publication in *JFMS Open Reports*

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Use of a Harmonic scalpel for laparoscopic adrenalectomy in two cats

Rey M Zhang and J Brad Case

Abstract

Case series summary Adrenal tumors are rare in cats and reports of laparoscopic adrenalectomy in cats are limited. This case series describes two cats that underwent laparoscopic adrenalectomy using a Harmonic scalpel for dissection and coagulation. Both surgeries were successful, with minimal hemorrhage, smoke production and lateral thermal damage. Vessels were appropriately sealed and surgical times were appropriate. Both cats recovered without complications postoperatively.

Relevance and novel information To our knowledge, this is the first veterinary report to describe the use of the Harmonic scalpel for laparoscopic adrenalectomy as the sole device in cats. Owing to the absence of hemorrhage, there was no indication for irrigation, suction or hemostatics. The Harmonic scalpel is an ultrasonic vessel-sealing device with benefits over conventional electrosurgery, including less lateral thermal damage, less smoke production and improved safety due to the lack of an electrical current. This case report aims to highlight the usefulness of ultrasonic vessel-sealing devices for laparoscopic adrenalectomy in cats.

Keywords: Adrenalectomy; minimally invasive surgery; Harmonic scalpel; laparoscopy

Accepted: 7 February 2023

Introduction

Adrenal neoplasia is rare in cats and adrenalectomy is the definitive treatment.[1] With technological advancements in minimally invasive surgery, adrenalectomy has successfully been performed laparoscopically in dogs and cats.[2–4] Owing to the proximity of the adrenal glands to significant vasculature such as the adrenal, phrenicoabdominal and renal vessels, as well as the aorta and caudal vena cava, hemostasis is a paramount consideration during adrenalectomy. In one report of 26 cats undergoing adrenalectomy, only 77% of cats survived 2 weeks postoperatively,[5] with hemorrhage being one of the most common complications. With regard to laparoscopic surgery, even a small amount of hemorrhage may obscure the surgeon's view and necessitate conversion to an open laparotomy.[6] Further, a recent publication on laparoscopic adrenalectomy in cats revealed a conversion rate of 36% and the requirement for blood transfusion in 27% of the cats.[3] To date, electrosurgery is the most commonly reported vessel-sealing instrument used for laparoscopic adrenalectomy in dogs and cats;[2,3,7,8] however, an alternative to electrosurgery is the use of ultrasonic vessel-sealing devices (UVSD). The Harmonic scalpel uses ultrasonic energy to dissect and coagulate tissue, while producing a lower temperature than traditional electrosurgery. The benefits of UVSD have been well described in human medicine, including less thermal damage, less smoke generation and no risk of electrical current passage to the patient.[9–11] There has been one reported use of the UVSD for laparoscopic adrenalectomy in cats;[4] however, this case also reported the need for suction and hemoclips, and was the first ever reported laparoscopic adrenalectomy in a cat. Thus, our case series aims to contribute two cases to the literature, demonstrating the usefulness of the UVSD

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as the sole instrument for vascular dissection/sealing during laparoscopic adrenalectomy in cats.

Case series description

Case 1

An 8-year-old female spayed domestic longhair cat was presented to the primary veterinarian for evaluation of neck ventroflexion and dyspnea. Evaluation revealed hypokalemia, retinal detachment and hypertension. The cat was referred to an internal medicine specialist, where abdominal ultrasound revealed a hypoechoic 1.3 cm left adrenal mass. Primary hyperaldosteronism was diagnosed based on a markedly elevated blood aldosterone level (3269 pmol/l; reference interval [RI] 194–388). It was managed with albuterol and fluticasone as needed, potassium gluconate (2.2 mEq PO q24h), amlodipine (0.19 mg/kg PO q12h) and spironolactone (1.8 mg/kg PO q12h).

The cat was subsequently referred to the minimally invasive surgery service at the University of Florida for an adrenalectomy. Bloodwork revealed a moderate anemia (21.3%; RI 34–51) and hypokalemia (2.7 mEq/l; RI 3.5–5.4). A triple-phase CT angiogram revealed an enlarged left adrenal gland, measuring 2.4 × 1.7 × 1.7 cm, with no evidence of invasion of the phrenicoabdominal vein or caudal vena cava. The owner elected for laparoscopic adrenalectomy.

The cat was placed in right lateral recumbency on a hydraulic float table tilted 30° to elevate the spine. The abdomen was aseptically prepared, and four ports were introduced as previously described.[3] An exploration was performed using a 5 mm 30° endoscope (Karl Storz Veterinary Endoscopy). The left kidney was retracted caudoventrally with a blunt probe. The UVSD (HARMONIC scalpel; Ethicon) was used to enter the retroperitoneal space at the caudolateral aspect of the adrenal gland. An endoscopic cotton swab (Endo Peanut; Covidien–Medtronic) and the UVSD were used to dissect and seal the adrenal and phrenicoabdominal vessels. The gland was completely excised with no hemorrhage and removed with a specimen retrieval bag (Endo Catch; Covidien–Medtronic). The total procedure time was 92 mins. Complications were grade 1 based on the Clavien–Dindo scheme (see supplementary material) and consisted of temporary hypothermia and hypoxemia.[12] Throughout the procedure, no hemorrhage or evidence of collateral thermal injury was observed.

The patient recovered in an oxygen cage. Packed cell volume (PCV) increased postoperatively (28%). Analgesia was achieved with methadone (0.05 mg/kg IV q4h pro re nata [PRN]) for 24 h, then buprenorphine (0.01 mg/kg transmucosally q8–12h PRN) for 18 h. Hypokalemia was corrected with 0.15–0.4 mEq/kg/h potassium chloride (KCl) for 42 h. Adrenocorticotropic hormone (ACTH) stimulation revealed concerns for a post-adrenalectomy hypoadrenocortical state (pre-ACTH cortisol: 1.42 µg/dl [RI 0.8–5.0]; 60 mins post-ACTH cortisol: 2.82 µg/dl [RI 3.6–10.0]); therefore, prednisolone (0.2 mg/kg PO q12h) was added. Aldosterone levels were (207 pmol/l; RI 194–388). The patient was discharged after 2 days with oral potassium and spironolactone as previously prescribed by the referring veterinarian, gabapentin (11.7 mg/kg PO q8–12h PRN) and oral prednisolone (starting at 0.4 mg/kg/day for 14 days then 0.2 mg/kg/day for 7 days, and 0.2 mg/kg every other day for 7 days). On histopathology, the tumor was an adrenal adenoma.

Potassium was within normal limits at 2 weeks, so spironolactone and potassium gluconate were discontinued. Prednisolone was discontinued after the initial course. The owner reported resolution of all clinical signs. At 32 months postoperatively, the cat developed chronic kidney disease and arrested under anesthesia during treatment for constipation.

Case 2

A 12-year-old male neutered domestic longhair cat was presented to the emergency service at the University of Florida for inappetence and ataxia. Diagnostics revealed hypertension, hypokalemia and a left adrenal tumor on abdominal ultrasound. Aldosterone levels were elevated (2718 pmol/l; RI 194–388). The patient was medically managed in the same way as case 1, then referred to the minimally invasive surgery service for adrenalectomy. CT confirmed a 1 cm nodule in the caudal pole of the left adrenal gland with no vascular invasion or metastasis.

Patient preparation was the same as for case 1. A three-port technique was used, as previously described.[3,4] An endoscopic cotton swab (Endo Peanut; Covidien–Medtronic) and UVSD were used to dissect and seal the adrenal and phrenicoabdominal vessels. The gland was completely excised and removed using the inverted thumb of a surgical glove. Total surgical time was 54 mins. Complications were grade 1 and consisted of hypothermia and temporary hypertension. During the procedure, hemorrhage was minimal and the endoscopic cotton swab was sufficient to keep the site free of fluid. Laparoscopic suctioning devices or hemostatic clips were not necessary. No charring was noted in the surrounding tissue.

Postoperative supportive care was the same as for case 1. PCV increased postoperatively (37%). ACTH stimulation revealed concerns for a hypoadrenocortical state (pre-ACTH cortisol: 0.26 µg/dl [RI 0.8–5.0]; 60 mins post-ACTH cortisol: 0.49 µg/dl [RI 3.6–10.0]) and treated with prednisolone (0.35 mg/kg PO q24h). The patient was discharged after 2 days with the same medications as case 1. The tumor was an adrenal adenoma on histopathology.

Blood pressure and potassium were normal at 1 month postoperatively. ACTH stimulation revealed improved but persistent hypoadrenocorticism. Prednisolone (0.2 mg/kg every other day) was continued for 14 days. At 28 months postoperatively, the patient was doing well at home, with no clinical signs nor any medications.

Discussion

This report demonstrates the preliminary efficacy of the UVSD for laparoscopic adrenalectomy in two cats. Cats present a unique technical challenge for minimally invasive adrenalectomy due to their small size, narrow planes of dissection, risk for collateral thermal injury and hemorrhage.[3,4] In this report, both adrenal tumors were removed completely, with no hemorrhage or injury to adjacent tissues (Figure 1). We propose that this is, at least in part, due to the properties of the UVSD that may make it an ideal device for adrenalectomy in cats. Paramount among these are the fine tips of the device that facilitate dissection in tight tissue planes and minimal lateral thermal spread which may limit the risk of injury to adjacent vessels (eg, caudal vena cava). Furthermore, the tips of the Harmonic scalpel measure 2 mm, whereas tips of electrosurgery devices such as the Ligasure measure 3.3 mm.[13] The Harmonic tips are therefore easier to navigate and fit into tight junctions between the adrenal glands and surrounding vessels, especially in cats where the structures are small. While comparison with bipolar vessel-sealing devices (BVSD) is not possible in the current report, future studies with larger numbers of cats should be considered. However, this could be challenging given the rarity of adrenal neoplasia in cats.

At present, the veterinary literature regarding laparoscopic adrenalectomy in cats is limited to a case report and a retrospective study of 11 cats.[3,4] In the retrospective study, BVSD and 5 mm j-hook electrosurgical probes were used to dissect the adrenal masses and seal vasculature. Intermittent suctioning was required for hemorrhage and fat in multiple cases. Additionally, hemoclips and hemorrhage necessitating blood transfusion were required in two cats.[3] In the case report, a UVSD was used for dissection; however, a suctioning–irrigation device (Flovac; Conmed Endosurgery) was used intermittently to aspirate hemorrhage and fat, and the phrenicoabdominal vein was ligated using three hemoclips.[4] In the current report, all vessels, including the phrenicoabdominal veins, were sealed and divided using the UVSD.

For laparoscopic adrenalectomy in dogs, BVSD is the most common instrument for vessel sealing.[2] One recent prospective study in 10 dogs reported an increased risk of hemorrhage with the UVSD vs a BVSD.[14] Conversely, we did not require the use of laparoscopic suctioning devices or hemoclips owing to the lack of hemorrhage and effective vessel sealing. We also did not encounter hemorrhage from the sealing of larger vessels like the phrenicoabdominal vein. The Harmonic scalpel is used to seal vessels up to 5 mm in diameter, which may be a limitation in surgeries that involve larger vessels, as may be the case with dogs. However, vessels transected during adrenalectomy in cats are typically small (<5 mm) and therefore may not possess the same risk as with larger patients such as certain dog breeds.

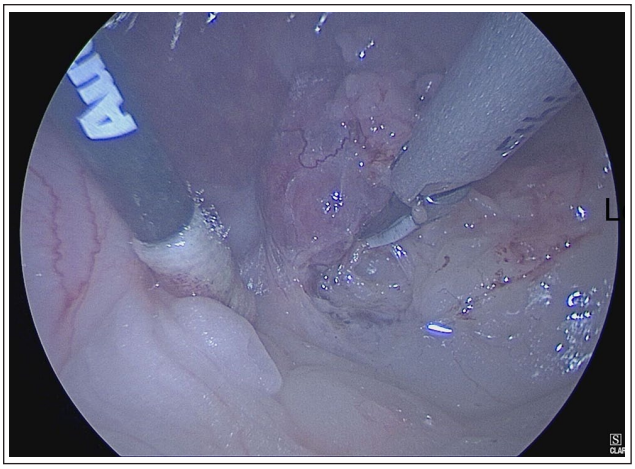

Figure 1 Adrenalectomy site of case 1 with no hemorrhage

Previously reported surgical times for laparoscopic adrenalectomy in cats ranged from 58 to 149 mins, with a mean of 107 mins.[3] Surgical durations for our cats were both below the mean and considered comparable.

Conclusions

Laparoscopic adrenalectomy is rarely reported in cats but is being performed more commonly. The limited feline literature almost exclusively reports the use of BVSD, but the risk of hemorrhage and need for additional instrumentation may suggest consideration for a better device for small feline patients.[3,4] Thus, the information reported here may be useful to surgeons performing these minimally invasive but technically challenging procedures. We suggest that the UVSD may be an ideal instrument for laparoscopic adrenalectomy in cats as it is effective in sealing vessels less than 5 mm and its fine tips facilitate dissection in tight planes with minimal lateral thermal spread. No hemorrhage or observable lateral thermal damage was observed in either of our cats, but further studies with larger numbers of cats are required to better evaluate this.

Supplementary material The following file is available online:

Surgical complication classification scheme proposed by Dindo et al.[12]

Conflict of interest The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding The authors received no financial support for the research, authorship, and/or publication of this article.

Ethical approval The work described in this manuscript involved the use of non-experimental (owned or unowned) animals. Established internationally recognized high standards ('best practice') of veterinary clinical care for the individual patient were always followed and/or this work involved the use of cadavers. Ethical approval from a committee was therefore not specifically required for publication in *JFMS Open Reports*. Although not required, where ethical approval was still obtained, it is stated in the manuscript.

Informed consent Informed consent (verbal or written) was obtained from the owner or legal custodian of all animal(s) described in this work (experimental or non-experimental animals, including cadavers) for all procedure(s) undertaken (prospective or retrospective studies). No animals or people are identifiable within this publication, and therefore additional informed consent for publication was not required.

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