Laparoscopy for the treatment of ovarian remnant syndrome in four dogs and two cats

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Keywords
Ovarian remnant syndrome, laparoscopy, dog, cat

Summary
Objective: To describe the clinical workup and laparoscopic treatment of ovarian remnant syndrome in dogs and cats. **Material and methods:** After confirming the diagnosis with some or all of the following tests – vaginoscopy with cytology, hormonal tests, and ultrasound – laparoscopic removal of the ovarian remnants was performed. A three-portal technique was used in the four dogs and a two-portal technique in the two cats. **Results:** All patients recovered well and were discharged the same day. No post-operative complications occurred in any patient. **Conclusion and clinical relevance:** Overall, in the hands of an experienced laparoscopic surgeon, laparoscopic removal of ovarian remnants appears to be a safe procedure in dogs and cats. In addition, laparoscopy offers the advantages of excellent visualization and a reduced morbidity for the patient. Careful case selection and complete pre-operative workup to rule out co-morbidities or underlying neoplasia are important. As with any laparoscopy the surgeon should always be prepared to convert to an open laparotomy if necessary.

Schlüsselwörter
Ovarrest-Syndrom, Laparoskopie, Hund, Katze

Zusammenfassung
Gegenstand und Ziel: Beschrieben wird die klinische Aufarbeitung und laparoskopische Therapie des Ovarrest-Syndroms bei Hunden und Katzen. **Material und Methoden:** Nach einer kompletten diagnostischen Abklärung mittels Vaginoskopie inklusive zytologischer Untersuchung, Hormonbestimmung und/oder Sonographie erfolgte die laparoskopische Entfernung der Ovarreste. Die vier Hündinnen wurden mittels drei Zugängen operiert und die beiden Kätzinnen mit nur zwei Zugängen. **Ergebnisse:** Alle Patienten erholten sich gut von der Operation und konnten noch am selben Tag nach Hause entlassen werden. Bei keinem Patienten traten postoperative Komplikationen auf. **Schlussfolgerung und klinische Relevanz:** Bei einem erfahrenen Operateur stellt die laparoskopische Entfernung von Ovarresten bei Hunden und Katzen einen sicheren Eingriff dar. Zusätzlich bietet die Laparoskopie den Vorteil der exzellenten Visualisierung und ist für den Patienten mit einer reduzierten Morbidität verbunden. Unabdingbar sind dabei eine gute diagnostische Abklärung und die entsprechende Auswahl der Patienten. Mögliche Differenzialdiagnosen und zugrunde liegende Tumorerkrankungen müssen zuvor ausgeschlossen werden. Wie bei jeder Laparoskopie sollten der Chirurg und auch der Patient jederzeit zu einer Laparotomie bereit sein, falls diese notwendig wird.

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Introduction

Ovariectomy and ovariohysterectomy are two of the most common surgical procedures performed in small animal surgery, which aim to completely remove all ovarian tissue. But in some cases the surgeon fails to remove all or a part of the ovarian tissue. This causes ovarian remnant syndrome (ORS), which is characterized by clinical signs related to functional residual ovarian tissue despite being spayed previously (5, 19, 36). Associated with this syndrome is an increased risk for developing mammary neoplasia, granulosa cell tumor formation (2, 10, 13), or ovarian cysts (32).

After confirming ORS by a variety of diagnostic tests, the treatment of choice is surgery, either by laparotomy, or more recently, laparoscopy. Medical treatment with synthetic progestagens is a potential treatment option but cannot be recommended, as it increases the risk for stump pyometra, diabetes, bone marrow toxicity, dermatologic disorders, and mammary or ovarian neoplasia (9, 17, 21, 25). In recent years, laparoscopy for routine spaying is increasingly used to improve visualization and to decrease morbidity for the patient. The purpose of this study is to report the workup of and use of laparoscopy for the treatment of ORS in four dogs and two cats.

Material and methods

Cases

During February 2012 to July 2013, four dogs and two cats were presented with symptoms consistent with estrus despite being previously spayed by another veterinarian. The four dogs comprised two mixed breed dogs, one Labrador Retriever, and one Rottweiler. Their ages ranged between 2 and 5 years and their weights between 27.3 and 40.2 kg. Two of the dogs had been spayed before their first heat and one after the first heat. The fourth dog was a breeding dog and had to be spayed on an emergency basis because of pyometra. All four dogs began to show signs of estrus within 4 to 12 months after they had been spayed and were presented at the time of suspected estrus. One dog had undergone three cycles before the owner decided to present the animal for further workup.

The two cats were a 2-year-old Domestic Shorthair Cat and a 3-year-old British Shorthair Cat weighing 3.4 kg and 2.81 kg, respectively. Both had been spayed before their first heat and presented owing to signs of permanent estrus.

Preoperative workup

All patients underwent a physical examination, abdominal ultrasound, and a minimum preoperative blood work, including hematocrit, total solids, urea and BUN. In every case, ultrasound was able to identify cystic-like hypoechogenic tissue caudal to one or both kidneys consistent with remaining ovarian tissue (▶Fig. 1). Three of the dogs and the Domestic Shorthair Cat were found to have bilateral remaining ovarian tissue by abdominal ultrasound, whereas one dog and the British Shorthair Cat had remaining ovarian tissue only on the right side. One dog had an additional vaginoscopy and vaginal cytology performed. Vaginoscopy revealed small amounts of bloody discharge and cytology showed mainly small and large intermediary cells, as well as superficial cells, consistent with estrogen influence. In one dog and both cats serum concentration of luteinizing hormone (LH) was measured semi-quantitatively by means of a snap test (Wittness® LH, Zoetis). This was negative in these three patients, which is consistent with remaining ovarian tissue. Another dog had a progesterone test performed by the referring veterinarian which was consistent with estrus (8.99 ng/ml; laboratory reference < 1.4 ng/ml).

Surgical procedure

After confirming remaining ovarian tissue with ultrasound in all six cases, laparoscopic exploration of the abdomen was offered to the owners to identify and remove the residual ovarian tissue. Permission for conversion to laparotomy was obtained from all owners in the case laparoscopy was not sufficient for accurate identification of the ovarian remnants.

All patients were fasted overnight and were premedicated with a combination of medetomidine (10–20 µg/kg) and butorphanole (0.3 mg/kg) intramuscularly. After 10 minutes an intravenous catheter was placed and anesthesia induced with propofol (4–6 mg/kg) intravenously until endotracheal intubation was possible and anesthesia was maintained with isoflurane. All patients were monitored with pulsoxymetry, capnography, electrocardiogram, and non-invasive blood pressure monitoring. Every patient received one dose of cephalexin (20 mg/kg i. v.) perioperatively. Dogs were placed in a tilting-table and cats on a regular surgical table in dorsal recumbency.

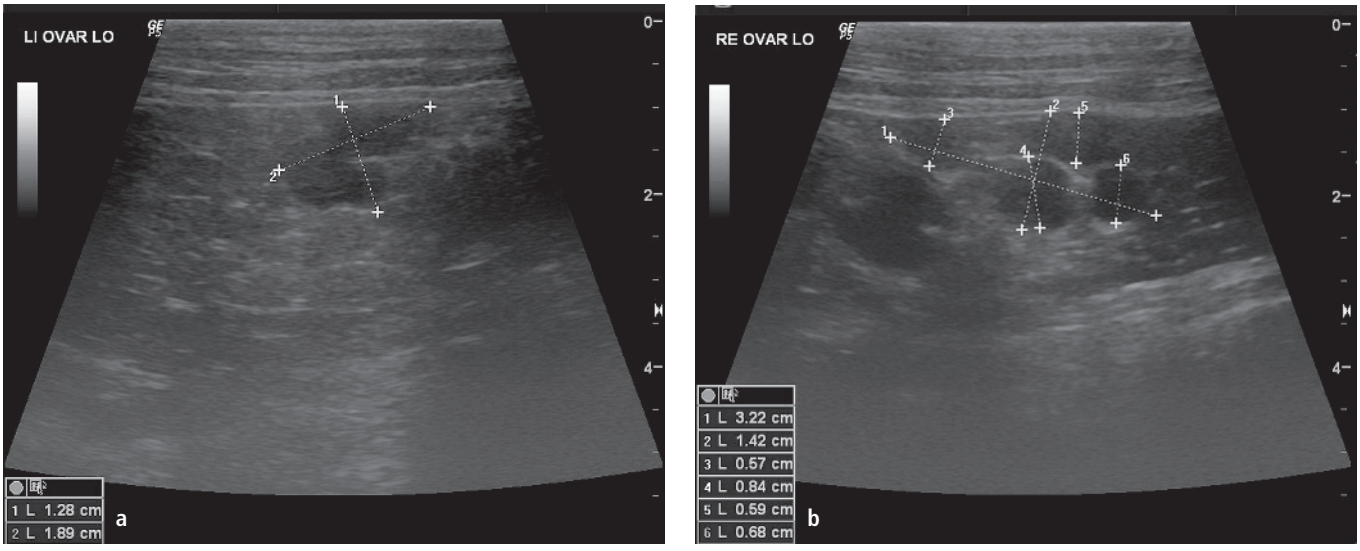
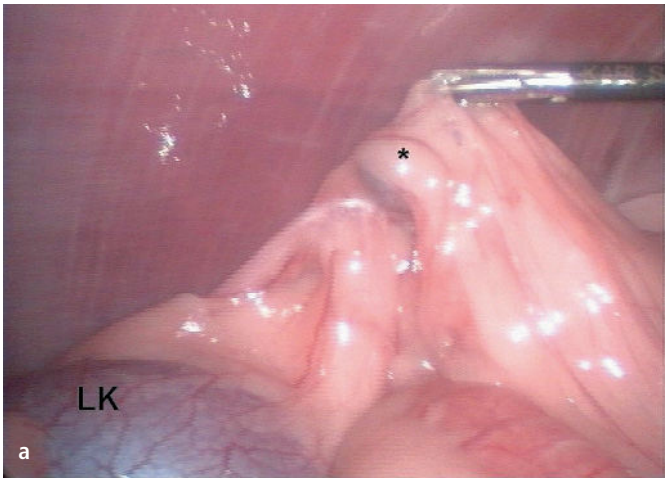


Fig. 1 Ultrasonographic images of a 3-year-old Labrador Retriever with bilateral ovarian remnants: multiple cyst-like structures in the region caudal to the left (a) and right kidney (b).

Abb. 1 Ultraschallbilder einer 3-jährigen Labrador-Retriever-Hündin mit beidseitigen Ovarresten: Darstellung mehrerer zystenähnlicher Strukturen kaudal der linken (a) und rechten Niere (b)



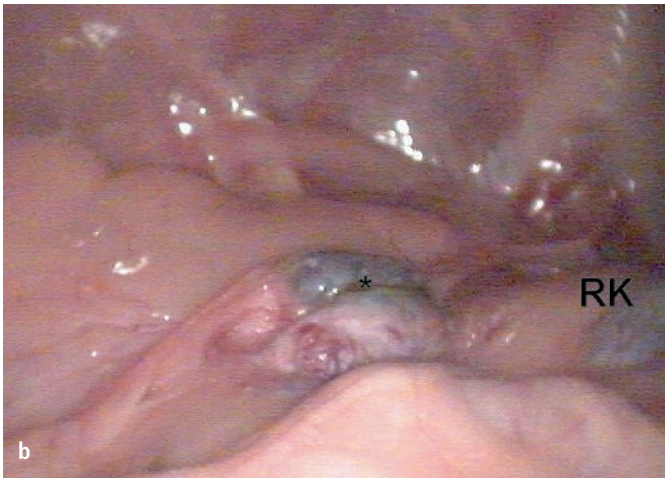
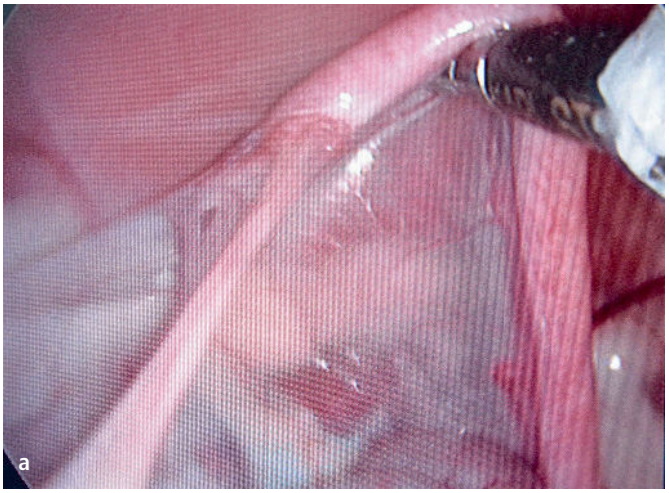


Fig. 2 Intra-operative images of the ovarian remnants of the same dog as in Fig. 1. a) The left ovary remnant (*) is lifted up by the endoscopic grasping forceps showing many adhesions to the omentum. b) Visualization of the right ovary remnant (*) after the intestines have been moved away with the two endoscopic grasping forceps. LK = left kidney, RK = right kidney.

Abb. 2 Intraoperative Bilder mit Darstellung der Ovarreste des Hundes aus Abb. 1. a) Der linke mit einer endoskopischen Fasszange angehobene Ovarrest (*) weist multiple Verklebungen mit dem Netz auf. b) Blick auf den rechten Ovarrest, nachdem die Darmschlingen mit zwei endoskopischen Fasszangen zur Seite geschoben wurden. LK = linke Niere, RK = rechte Niere.

After routine preparation of the abdomen for aseptic surgery, all patients were started on intermittent positive pressure ventilation with a volume of 10 ml/kg of body weight. In all four dogs, a Veress-Needle was placed at the umbilicus after a 5 mm skin incision had been performed. After confirming negative pressure, carbon dioxide insufflation was started with a pressure of 8–10 mmHg. The Veress-Needle was removed after the desired pressure was reached and then a stab incision was performed at the same location with a No. 11 blade. As the next step a 5 mm EndoTIP cannula (Karl Storz GmbH & Co. KG) was inserted.

First a limited exploration of the abdomen was performed with a 5 mm 30° laparoscope (Karl Storz GmbH & Co. KG, Tuttlingen, Germany), and then two additional 5 mm and 10 mm EndoTIP cannulas (Karl Storz GmbH & Co. KG) were placed in the midline under visual control, approximately 10 cm and 20 cm caudal to the first one. The table with the fixed patient was tilted to 45° to use gravity to move the organs away. Then two endoscopic Babcock Grasping Forceps (Karl Storz GmbH & Co. KG) were inserted into the two caudal instrumental portals to further manipulate the organs and closely inspect the area caudal to both kidneys (▶Fig. 2). The remaining ovarian tissue was identified and fixed with the grasping forceps in the middle cannula. The caudal grasping forceps was replaced by a bipolar vessel sealing device of according size (LigaSure™ 5 mm Blunt Tip 37 cm or LigaSure Atlas™ 37 cm Hand Switching Laparoscopic Instrument, Covidien, Neustadt/Donau, Germany), and the ovarian remnant was excised



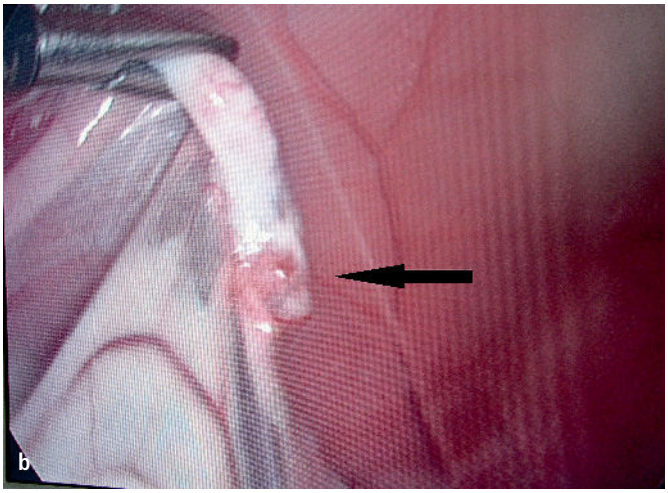


Fig. 3 Intra-operative images from the British Shorthair Cat. a) The left (as seen in the picture) and right uterine horns show adhesions to the greater omentum. b) An ovarian remnant (arrow) is visible on the right side.

Abb. 3 Intraoperative Bilder der Britisch-Kurzhaar-Katze. a) Sowohl das linke (im Bild zu sehen) als auch das rechte Uterushorn zeigt Verklebungen mit dem großen Netz. b) Auf der rechten Seite ist ein Ovarrest sichtbar (Pfeil).

along with all the adhered tissue with the LigaSure™. Finally, the remaining ovarian tissue and its attachments were pulled to the abdominal wall, retrieved through one of the instrument portals by removing the cannula, and visually inspected.

A different approach was used in the two cats with the animals placed in dorsal recumbency on a regular table and manually tilted by the surgical technician as deemed necessary by the surgeon. A suture-less modified Hasson approach, as described elsewhere (8), was used to place the first cannula in the umbilicus, and then the abdomen was insufflated to 8 mmHg (28). Only one caudal instrumental port was placed under visual control. After the instrumental port was in place, the patient was tilted to the side, the area caudal to the kidneys was inspected, and the ovary remnant was identified (▶Fig. 3). In contrast to the dogs, the remaining ovarian tissue was fixed to the abdominal wall with a percutaneous needle-suture combination. The Babcock Grasping Forceps was replaced by the LigaSure™ and the adhesions were released. Finally, the LigaSure™ was replaced by the grasping forceps; and the ovarian tissue, still attached to the suture, was pulled to the abdominal wall and removed from the abdominal cavity by removing the cannula. The percutaneous needle was released once the respective ovarian remnant was removed safely from the abdomen.

After completion of the procedure, the abdominal cavity in all patients was inspected for bleeding, deflated, and closed in a routine manner. All patients were discharged on the same day with non-steroidal anti-inflammatory drugs for three additional days.

Results

Surgery time ranged from 28 to 53 minutes, with a median of 42 minutes. At re-check examinations 10 days after surgery all patients were back to normal and according to the owners none of them developed any signs of estrus up to the 3 years post surgery. The retrieved tissue from one dog was consistent with ovarian tissue on histopathologic examination and no evidence of neoplastic tissue was found. The specimens from the other five patients were not submitted for histopathology owing to financial constraints of the owners, but follicular structures could be visually identified in all removed specimens (▶Fig. 4).

Discussion

ORS is a well-known syndrome following surgery in dogs and cats and refers to the presence of functional ovarian tissue in animals previously spayed (36). Rare causes may be ectopic (7, 11, 15, 19, 27) or accessory ovarian tissue in dogs and cats (1, 33). The most likely explanation for ORS is a result of surgical failure to completely remove all ovarian tissue (2, 9, 35). Another possible explanation is that already ligated ovarian tissue is accidentally left behind in the abdominal cavity, as experimental studies have shown that revascularization of remnants by the omental blood supply may occur in cats (5, 30, 31) and dogs (3, 14). Therefore, any bitch or queen showing signs of estrus following ovario(-hyster)ectomy should be evaluated for ORS (27).

For dogs, the literature is not unanimous, but a tendency for the right ovary to be more commonly affected has been reported (2, 19, 27, 36). This is most likely due to the more cranial location of the right ovary compared with the left (2). Interestingly, three out of four dogs in this study had bilateral ovarian remnants, making it impossible to comment on a site predilection. Clinical signs of ORS can appear anywhere from a few weeks to several years after surgery (2, 3, 9, 19, 22). Besides heavy body weight, no obvious risk factors for ORS (3, 22) have been noted. This was also the case for the dogs in this study, which were all large-breed dogs with a mean body weight of 35.3 kg. No clear risk factors are documented for cats.

The diagnosis of ORS is usually made by a combination of clinical signs of estrus, history, hormonal testing, vaginal cytology, abdominal ultrasound, and laparotomy (19). Additional tests may be required to confirm a tentative diagnosis of ORS, as signs of estrus can also be caused by endocrinologic disorders, such as adrenal neoplasia (17). Furthermore, administration of exogenous estrogens, used to treat urinary incontinence in older bitches (36), has to be ruled out as a potential underlying cause. Vaginal cytology is limited to patients not presented during anestrus but should not be used as a sole diagnostic test, especially in cats (10, 11, 19, 26). Typical signs observed in vaginal cytology during estrus include mainly superficial cells (80–90%) (7, 9, 11, 27, 36). Vaginal cytology was performed in only one patient of this study and was consistent with signs of estrus. Cytology was used in only one patient because all the other patients were referred for ultrasound and surgery the same day, and an in-house laboratory was unavailable. Furthermore, ultrasound was able to confirm follicular struc-

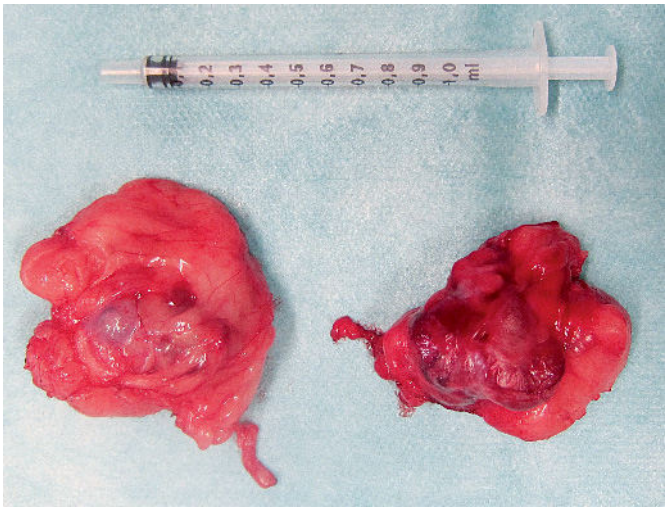


Fig. 4 Both ovary remnants of the same dog as in Figs. 1 and 2 after laparoscopic retrieval in comparison to a 1 ml syringe.

Abb. 4 Die beiden laparoskopisch entfernten Ovarreste des Patienten von Abb. 1 und 2 in Relation zu einer 1-ml-Spritze

tures in all of the patients; therefore, cytology was not considered to be of any additional benefit.

In total, four of our patients had hormone assays performed. Progesterone concentrations greater than 2 ng/ml indicate functional luteal tissue (2, 10, 19, 36). One dog in this study had a progesterone testing performed at the referring veterinarian prior to presentation, and the result was consistent with remaining functional ovarian tissue. According to the results from Wallace's study (35), progesterone measurement is advantageous over the determination of estradiol levels in dogs, as the ovary is the only source of progesterone in bitches. One of the drawbacks with hormone measurements is that basal hormone levels may fluctuate and become elevated owing to stress, pituitary-dependent hyperadrenocorticism, or adrenal adenocarcinoma, as the adrenal glands can also release sex hormones (4, 10, 19). Therefore, hormone stimulation tests such as the gonadotropine releasing hormone (GnRH) test are considered the preferred diagnostic tools. In one dog and both cats of this study, a commercially available luteinizing hormone test was used in addition to abdominal ultrasound to diagnose remaining ovarian tissue. According to a study by Scebra et al. (29), this test showed a 92% positive predictive value and a 100% negative predictive value for sexually intact queens. It is important to mention that a single high LH concentration in dogs will not confirm previous ovariectomy as sexually intact dogs can have brief episodic surges in serum LH concentrations throughout the estrous cycle. Both cats had a luteinizing hormone assay performed and results were consistent with ORS. One of the dogs also had a luteinizing hormone test performed which was consistent with functional ovarian tissue. Given the limitations of this test in dogs as discussed above, the presence of remnant ovarian tissue was therefore confirmed with ultrasonography in all cases of this case series.

Furthermore, ultrasound is also used to rule out co-morbidities such as stump pyometra or neoplastic transformation of the ovarian remnant, and to rule out possible adrenal gland disease. Two human studies showed that ultrasound was successful in diagnosing ORS in approximately 93% of cases but only after stimulation causing cystic changes in the ovarian remnants (16, 23). Similar results were achieved in a veterinary study (2). The success rate in correctly identifing ovarian tissue is closely dependent on the expertise of the ultrasonographer, as well as on the stage of the estrous cycle of the animal at the time of examination and the size of the residual ovarian tissue. The high success rate for correctly identifying ovarian remnant tissue by ultrasound in this study can be explained by the fact that all patients were showing signs of estrus at the time of presentation and that the ultrasound was performed by a board-certified internist with more than 15 years of ultrasound experience. In the unlikely event that an experienced ultrasonographer is unable to identify ovarian remnant tissue, magnetic resonance tomography may be considered as an additional diagnostic tool (12). A new hormone assay is now available, the anti-Müllerian hormone assay, which seems to be of high specificity and sensitivity for the diagnosis of ORS. Unfortunately, this test was not commercially available during the study period (26, 34).

Although all patients showed clinical signs consistent with estrus, surgery in combination with histopathology is required for a definitive diagnosis (6). Unfortunately, as noted earlier, histopathology was performed in only one patient owing to financial limitations of the patients' owners. This histopathology confirmed bilateral ovarian remnants with multiple follicles but did not find any evidence of neoplasia. Adhesion formation after a previous surgery can make distinction of the ovarian remnant from normal adjacent tissue challenging. This may explain why the surgeons in one study were unable to correctly identify remnant ovarian tissue during laparotomy (3). In that study the observations of the surgeons could not be confirmed by histopathology in 20% of their cases. Therefore, surgery is not recommended during anestrus, since remnant tissue may be too small and consequently missed during surgery. The prominence of ovarian blood vessels during proestrus, estrus, or diestrus makes the ovarian remnant more easily identifiable (24, 36).

In recent years studies have compared laparoscopic ovariectomy to open ovariectomy and these studies showed that laparoscopy improves visualization and reduces morbidity of the patient (20). Because of these advantages, laparoscopy was considered beneficial to the patients of this current study. Owing to the limitations of this minimally invasive procedure, all owners were informed that laparoscopy might not be possible due to adhesion formation from the previous surgery and that a conversion to open laparotomy might be required if the ovarian remnant could not be clearly identified. Fortunately, laparoscopy for the removal of ovarian remnants was safely performed in all six patients of this study, weighing between 2.81 kg and 40.2 kg. The excellent visualization and the possibility to closely inspect the region of interest allowed easy identification of the ovarian remnant, which could then be removed with the aid of a vessel sealing device. Adhesion formation was particularly pronounced in the canine patients and was completely excised during the procedures. Blunt dissection close to the ovarian remnant must be avoided, to minimize the risk of leaving ovarian remnants behind (16).

One of the limitations of laparoscopy in ORS is the fact that inspection of the uterine stump can be challenging, especially in dogs. Therefore, ultrasound is considered a very important tool in the preoperative workup to rule out additional diseases, such as stump pyometra or endometritis. This may become increasingly important, as ovariectomy has recently become the preferred surgery also in dogs. In our patients, the uterine horns and cervix were easily visible in both cats and did not show any obvious changes, but the uterine stump was only partially visible in the four dogs of the case series. Another limitation of laparoscopic treatment of ORS includes a lack of tactile sensation and a limited exploration of the abdominal cavity. Therefore, the experience of the surgeon is one of the limiting factors. The surgeon of this case study had performed more than 150 laparoscopic procedures prior to the first case and did not recognize any difference between a regular ovariectomy and the search for an ovarian remnant. The only difference is that there may be adhesions to the greater omen-

Conclusion for practice

Overall, laparoscopy appears to be a useful alternative to open surgery for ovarian remnant syndrome. Prior to surgery a thorough workup including ultrasound or three-dimensional imaging is strongly recommended. Since surgical failure is the main underlying cause for ovarian remnant syndrome the tissue is typically found in the specific region caudal to the kidneys. In the rare case of ectopic tissue or an unintentionally dropped ovarian tissue, there is always the possibility to convert to an open laparotomy to help identifying the tissue.

tum, making the procedure slightly more difficult; but otherwise there appears to be no additional learning curve. In addition, no special equipment is required.

Surgery time in this study population was comparatively short and none of the patients showed any postoperative complications. This is consistent with the results from the study of Mayhew et al. (18) who were able to show that laparoscopy has a lower complication rate than laparotomy. All of our patients were sent home the same day, without requiring additional pain medication. A retrospective study in human patients came to similar conclusions comparing surgery time and hospital stay with laparotomy and laparoscopy. With both groups achieving a comparable duration of surgery, patients of the laparoscopy group could be discharged after a shorter period of hospitalization, respectively (37).

A three-portal approach was chosen in dogs as this approach allows a greater range of manipulation of the viscera, especially if only straight instruments are available. Owing to the shape of the body of cats and the maneuverability of their organs, only two portals were used and the ovarian remnant was percutaneously fixed to the abdominal wall. The ovarian remnant tissue was found in the typical location in all patients, as described in the literature (2, 19), ruling out ectopic or accessory ovarian tissue in all cases of this study.

Conflict of interest

The author confirms not to have any conflict of interest.

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Rezensionen

Lahmheitsuntersuchung beim Hund – Funktionelle Anatomie, Diagnostik und Therapie

Das Buch gliedert sich in drei Teile. Im ersten Teil werden die Biomechanik der Bewegung, die Ergebnisse neuerer Bewegungsstudien und die funktionelle Anatomie von Wirbelsäule und Extremitäten gut verständlich dargelegt. Dies wird durch einprägsame Graphiken veranschaulicht. Der Einfluss der Fütterung auf den Bewegungsapparat, das Wachstum und die Entstehung bzw. Prävention von orthopädischen Erkrankungen werden näher beleuchtet.

In Teil 2 beschreiben die Autoren den orthopädischen Untersuchungsgang beim Hund strukturiert und detailliert, aber dennoch kurz und prägnant. Differenzialdiagnosen, die sich aus den einzelnen Untersuchungen ergeben, sind in übersichtlichen Boxen stichpunktartig zusammengefasst. Am Ende des Untersuchungsgangs einer Gliedmaße (am stehenden Hund) bzw. eines Gelenks (am liegenden Hund) findet sich eine weitere Übersicht der möglichen Differenzialdiagnosen. Jeder Untersuchungsschritt wird als Farbfoto und Graphik der anatomisch relevanten Strukturen detailliert dargestellt. Ein besonderes Highlight ist die Darstellung der einzelnen Untersuchungsschritte in Form von Videos, die via URL-Adresse oder QR-Code abrufbar sind und zum „Nachuntersuchen" einladen.

In Teil 3 werden wichtige Erkrankungen des Skelettsystems des Hundes kurz und übersichtlich beschrieben. Jede Erkrankung wird anhand eines typischen Röntgenbefundes veranschaulicht. An dieser Stelle werden auch die weiterführende Diagnostik sowie mögliche Therapieoptionen angesprochen.

Es handelt sich um ein optisch sehr ansprechendes und übersichtlich gestaltetes Buch. Der orthopädische Untersuchungsgang wird systematisch und leicht verständlich beschrieben und in Form von Videos und Farbfotos lebendig. Detaillierte Graphiken verdeutlichen die anatomischen Grundlagen und führen zu einem tieferen Verständnis.

Fazit: Das Buch ist zum einen für Studierende der Veterinärmedizin und angehende Tierärzte mit Interesse für die Kleintierorthopädie sehr zu empfehlen, aber auch erfahrenere Kollegen finden Anregungen für ihren Untersuchungsgang, insbesondere, weil aufgrund der anschaulichen Graphiken die anatomischen Grundlagen der Untersuchungen hervorragend rekapituliert werden können.

Susanne Kaiser, Gießen

D. Koch, M. Fischer, 1. Aufl., 200 S., Stuttgart: Enke 2015, ISBN-13: 9783830413011, € 99,99.

Low-Carb für den Hund

Auf rund 60 Seiten vermittelt die Biochemikerin Ursula Bien kurz und knapp die wichtigsten Grundbegriffe zum Thema kohlenhydratarme Ernährung des Hundes. Angelehnt an die sogenannte LOGI-Methode beim Menschen wird eine eiweißreiche und fettoptimierte Low-Carb-Ernährung des Hundes empfohlen. Nach einleitenden Kapiteln zur artgerechten Ernährung und zum Verdauungstrakt des Hundes folgen kurze Erläuterungen zu den einzelnen Nahrungsbestandteilen, die nach Meinung der Autorin zu einer artgerechten Hundefütterung gehören: verschiedene Fette und Öle, diverse Fleisch- und Fischsorten, Eier und Milchprodukte, Gemüse- und Obstsorten. Auch Algen, Nüsse, Samen (Sesam, Sonnenblumenkerne, Floh- und Chiasamen) werden kurz gestreift.

Zur schnellen Orientierung findet der Leser neben einer Ernährungspyramide für den Hund zwei übersichtliche Tabellen mit geeigneten und ungeeigneten Nahrungsmitteln für den Hund. Im Kapitel „Wie viel Fressen braucht mein Hund?" gibt die Autorin neben der Faustformel „20–30 g Nahrung pro kg KG" auch Tipps für selbstgemachte, kalorienarme Leckerlis.

Überhaupt sieht Ursula Bien im kohlenhydratreichen Industrie-Hundefutter die Wurzel vieler moderner Hundekrankheiten wie Übergewicht, Diabetes, Allergien bis hin zu Gelenkbeschwerden. Bis hierhin mag man ihr noch folgen, wenn aber Borretsch- und Nachtkerzenöl zum Einreiben auf entzündete Hautareale und natives Kokosöl (explizit statt Spot-on-Präparate) als Zeckenschutz empfohlen werden, ist doch eine gewisse Skepsis angebracht.

Auf den letzten 20 Seiten folgen schön bebilderte Rezeptvorschläge für das selbst gekochte Hundemenü. Diese Seiten wären jedoch für eine etwas tiefergehende Darstellung der art- und vor allem bedarfsgerechten Hundeernährung besser angelegt gewesen.

Dr. Andrea Schürg, Stuttgart

U. Bien, 1. Aufl., 64 S., 4-farbig, zahlreiche Fotos, Lünen: Systemed 2015, ISBN 978–3–95814–011–0, € 7,99.