LAPAROSCOPY IN CATTLE AND ABOMASOPEXY
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Several authors have used laparoscopy in bovine in order to describe their normal anatomy, to evaluate the different structures of the reproductive system, to use as a guide for renal biopsy, and for umbilical structure resection in the calf. The real breakthrough in cattle laparoscopy occurred in 1998 when Janowitz described a laparoscopic technique for the correction and fixation of left displaced abomasum. [1]

General technique for laparoscopy

Equipment:
A rigid, 0° laparoscope measuring between 30 (Richard Wolf, Knittlingen, Germany) and 42 cm (Dr Fritz, Tuttlingen, Germany) in length, and having a diameter between 8 (Dr Fritz, Tuttlingen, Germany) and 10 mm (Richard Wolf, Knittlingen, Germany) is frequently used. If a videocamera unit is used, 10 mm scope should be favored. The light source consists of a 150-watt halogen bulb. Depending on the company, abdominal insufflators use either CO2 (Richard Wolf, Knittlingen, Germany) or filtered ambient air (Dr Fritz, Tuttlingen, Germany), and may possess a pressure control system (Richard Wolf, Knittlingen, Germany).

In order to obtain a pneumoperitoneum, it is recommended to use of a 15 cm Veress needle (Richard Wolf, Knittlingen, Germany). In certain animals such as overly conditioned or muscular beef cattle the use of a longer Veress needle (24 cm, Richard Wolf, Knittlingen, Germany) is preferable, so that penetration of the peritoneal space is ensured. Nowadays, Veress needle are seldom used in cattle because it is not necessary for most current laparoscopic procedures frequently used. Also, peritoneal tenting is frequent when using the Veress needle in cattle.

The trocar/cannula units frequently used are 5 mm, 8mm and 10mm of diameter. The 8 mm (internal diameter) trocar measures 12 cm in length (Dr Fritz, Tuttlingen, Germany). It allows the entry of an 8 mm (external diameter) laparoscope (Dr Fritz, Tuttlingen, Germany). The 10 mm (internal diameter) trocar measures 10 cm, 12.5 cm or 15 cm (Richard Wolf, Knittlingen, Germany). It allows for the passage of a 10 mm (external diameter) (Richard Wolf, Knittlingen, Germany) laparoscope or instruments measuring 10 mm in diameter (e.g. grasping forceps). In the case of obese animals the 15 cm may be used. The 5.5 mm (internal diameter) trocar measures 10 (Richard Wolf, Knittlingen, Germany) to 12 cm (Dr Fritz, Tuttlingen, Germany) in length and allows for the passage of instruments that are 5 mm in diameter (needle holders, long trocar/needle, scissors).

Preparation and anesthesia:
Whenever possible, the animals should be off feed for 24 hours to 48 hours. For interventions requiring dorsal recumbency, this preventative method may help to diminish risks related to this positioning, as well as the chances of rumen perforation during the insertion of the scope trocar.

The flank or ventral abdomen is surgically prepared: shaved, washed and scrubbed. If the intervention is performed on the left or right flank, local anesthesia at the site of the trocar’s insertion is performed. For ventral interventions, the animal is sedated with xylazine (0.1 mg/Kg I.V.) prior to laying the animal down), and placed and maintained in dorsal recumbency with ropes.
**Surgical technique**

**Pneumoperitoneum**

Pneumoperitoneum is obtained following the introduction of the Veress needle into the abdominal cavity, or after the direct insertion of the trocar into the abdominal cavity without prior pneumoperitoneum. A cutaneous incision approximately 2 cm in length is executed about 5 cm behind the caudal aspect of the last rib and 5 cm ventral to the extremity of the transverse processes. The site of entry can vary. The Veress needle or the primary trocar is introduced via an incision in the abdominal cavity and is oriented cranially at a 45-degree angle in relation to the sagittal plane of the cow. As soon as the needle or trocar goes through the peritoneum, air should be heard entering the abdomen. To ensure that the rumen has not been perforated, the air escaping the abdomen must be odorless. Insufflation may then be started at this point if needed and a pneumoperitoneum induced. At this time, a possible complication besides the accidental penetration of the rumen would be the detachment of the peritoneum due to an insufficiently long or incorrectly positioned needle. If during insufflation the intra-abdominal pressure rises too quickly, or if the abdomen does not distend uniformly, it is preferable to stop insufflation and check for retroperitoneal distention by transrectal examination.

By removing the top portion of the cannula, the air will go a lot faster into the abdomen. This technique precludes the use of an insufflator in some situations. Insufflation is stopped when all organs are sufficiently separated, without exceeding a pressure of 20 mm Hg as is suggested by Anderson.[2] Exploration of the abdominal cavity may then begin by orienting the laparoscope cranially.

**Laparoscopic abomasopexy**

There are at least 3 different surgical techniques reported to correct displaced abomasum by laparoscopy. The two steps technique, first described by Janowitz is a toggle pinning laparoscopic assisted abomasopexy.[1] This technique was modified by Newman as a one step procedure. [4] The second was first described by Barisani and allow standing laparoscopic fixation of a left displaced abomasum.[5, 6] The third is a ventral laparoscopic abomasopexy where the abomasum is sutured to the ventral abdominal wall without penetrating its lumen. (Babkine Can Vet J 2006, Mulon Vet Surg 2006).

**Two steps technique**

This technique is a laparoscopy guided toggle pin fixation. The first step of the procedure is performed through the left flank of the standing animal. The surgical site on the animal is prepared following standard procedure, and the points of entry for the trocar/cannula units are infiltrated with lidocaine. The entry site for the 8 mm trocar (portal site 1) gives access to the laparoscope through the left paralumbar fossa behind the ribs and beneath the transverse processes. The point of entry of the 5 mm trocar (portal site 2) that gives access to the long trocar used for the placement of the toggle and for emptying the air from the abomasum is situated in the dorsal third of the 11th intercostal space.

A Veress needle is introduced through a cutaneous incision 1 cm in length at portal site 1, and a pneumoperitoneum is induced. The 8 mm trocar/cannula unit is then inserted into the abdominal cavity. The 8 mm trocar/cannula unit can be inserted directly without using a Veress needle. Next, the 8 mm laparoscope (Dr Fritz,) is introduced by the cannula into the abdominal cavity. The abdominal cavity is then explored in order to ensure that there are no abnormalities that could prevent the continuation of the procedure. Next a 5 mm trocar-cannula unit is inserted in the 11th intercostal space under laparoscopic guidance.
The long 5 mm trocar is passed through this cannula and into the abdominal cavity where it is inserted into the greater curvature of the abomasum. The modified toggle (toggle with 2 strings: Dr Fritz, Tuttlingen, Germany) is introduced into this cannula (of the long trocar/cannula unit) and is pushed into the LDA with a blunt ended trocar. The two strings are left in place in the abdomen, and the air is emptied from the abomasum through the trocar. All instruments are then removed and the incisions are closed in a routine manner.

The second half of the surgery is performed once the animal has been sedated with xylazine (40mg IV) and is placed in dorsal recumbency. The right paramedian region of the abdomen is prepared for surgery in a standard fashion along a 20 cm by 20 cm square cranial to the umbilicus. The points of entry for the trocar/cannula units are infiltrated with lidocaine. The first trocar (8 mm) is placed to the right and cranial to the umbilicus. For the second portal, a trocar (5 mm) is placed 10 cm cranial to the first trocar. Both trocars are inserted into the abdomen. The laparoscope is passed through the first cannula. The 2 sutures are retrieved with grasping forceps and are pulled through the second portal (Maryland-dissector). The sutures pierce a roll of gauze bandage and are knotted together with the animal on right lateral recumbency to avoid excessive tension. They will be left in place for 3 to 4 weeks.
Sutures retrieval from ventral approach

Sutures are grasp with forceps

Sutures are pulled through the 5 mm cannula

Sutures are secured with a roll of gauze with the animal on lateral recumbency

Janowitz and others report that this technique is extremely effective, quick and relatively safe with a success rate of 98% based on lack of LDA recurrences.[1] No major complications were reported with this technique. Newman described a one step approach where the toggles are placed with the cow already on dorsal recumbency saving time to the procedure.[4]

**One step laparoscopy on standing animal**

This technique allows standing laparoscopic fixation of a left displaced abomasum. First steps are identical as the 2 steps technique. But instead of introducing the threads in the abdomen after deflating the abomasum, a spieker with a long needle inside is used to reach the right side of the abdomen’s floor.
With the help of a long speiker the threads are push down in the abdominal cavity

A long needle is then pass through the ventral right abdominal wall and the threads are pull

The two threads are secured with a roll of gauze

The two threads are then tighten together

**Ventral laparoscopic abomasopexy**

Recently, we described a different approach where the lumen of the abomasum is not penetrated by a trocar, therefore limiting spillage of gastric juice. This technique is performed on the animal placed in dorsal recumbency and allows the preventative or curative fixation of the abomasum. The cow is sedated with 0.1 mg/kg of xylazine intravenously, positioned in dorsal recumbency with her 4 legs tied with cables and the right hind limb slightly extended caudally. The abdomen is surgically prepared from the xyphoid process to 10 cm caudal of the umbilicus and with a width of 20 cm each side of the ventral midline. Local anesthetic solution of 2% lidocaine is infiltrated subcutaneously at the three portal sites, and at the fixation zone.
For the laparoscope portal, a stab incision is made through the body wall, 3 cm craniolateral to the left side of the umbilicus. An 8 mm trocar-cannula unit is inserted through the incision and directed cranially at a 45° into the abdomen. An 8 mm 0° laparoscope with videoendoscopic camera is inserted and observation of the peritoneum and spleen ensured correct intra-abdominal location. Abdominal insufflation is performed through the laparoscopic portal cannula with filtrated ambient air using an automatic insufflator until abdominal distension is sufficient for observation and identification of internal structures.

The ventral abdomen is explored with special attention to the cranial abdomen. The abomasum is decompressed if its greater curvature is against the ventral abdominal wall preventing further manipulation of the abomasum. A 30 cm long, 16 g needle is passed through the right ventral body wall into the abomasum under laparoscopic guidance. A flexible tube is attached to the needle and a suction device to avoid any spillage of abomasal contents and the abomasum is decompressed as much as possible. The rumen is decompressed similarly if it impeded observation or surgical manipulation.

Two instruments portal are made to perform the abomasopexy. The 1st instrument portal site is for a 10 mm grasping forceps (Richard Wolf GmbH) and is located 10 cm caudal to the xyphoid process and 7 cm to the right of the linea alba. The 2nd instrument portal is for a 5mm needle driver (Richard Wolf GmbH) and is located 5 cm lateral and 3 cm cranial to the right side of the umbilicus. Each trocar-cannula unit is inserted through abdominal stab incisions under laparoscopic guidance. All the cannulae and instuments are in place. Head of the animal is on the left.

The serosal surface of the greater curvature of the abomasum is identified. Using forceps, the abomasum is grasped approximately between its cranial and middle third, 2 - 3 cm from the greater omentum attachment on the greater curvature. The abomasum is manipulated carefully to evaluate its anatomic position. Three anatomical landmarks have to be observed before proceeding: the reticulo-abomasal groove, the attachment of the greater omentum to the left of the greater curvature (previously identified for adequate positioning of the grasping forceps) and the abomasal antrum. Four 1 cm long skin incisions, 2.5 cm apart and perpendicular to the ventral midline, are performed along the abdominal pexy site. The pexy site is 10 cm long and located between the umbilicus and the xyphoid process, 3 - 5 cm to right of ventral midline.

Polyglycolic acid (swaged, taper point ½ circle needle, 65mm) or polydioxanone suture material (swaged, cutting point ½ circle needle, 40mm) are used for abomasopexy. The needle is straightened to facilitate its intra- and extra-abdominal manipulation. From the most cranial skin incision, the needle is passed through the abdominal wall and grasped by the laparoscopic needle driver. The needle is passed through the abomasal wall without mucosal penetration to achieve a bite of ~ 2cm, perpendicular to the great curvature of the abomasum. The needle is then passed through the abdominal wall. An 5cm, 18g needle inserted through the abdominal wall near the suture entry point is used as a guide to exteriorize the needle.
and the suture material. The needle is then pulled out of the abdominal cavity. The 2 ends of the suture material are secured by forceps without applying any tension on the stay suture. Three additional sutures are placed caudally in similar fashion; each suture is located ~3 cm from the attachment of the greater omentum along the greater curvature of the abomasum.

Correct positioning of the abomasum is verified by pulling gently on the sutures without approximating the abomasum to the body wall yet verifying any inadvertent suture crossing. If suture position is acceptable, air is evacuated from the abdominal cavity by opening the cannula and the abomasum is approximated to the body wall by suture traction. The pexy sutures are tied and buried under the skin which is closed with a cruciate suture pattern (2 polydioxanone). Sutures are not removed after healing.

In a later study performed on 18[8] cows that had had a previous abomasopexy using this technique in order to correct a LDA, Mulon noted that these cows continued to have normal lactations without any complications.

References: