LAPAROSCOPIC HERNIORRHAPHY IN THE HORSE
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Laparoscopic herniorrhaphy/hernioplasty techniques can preserve testicular function and are recommended in stallions with a history of inguinal hernia. Various laparoscopic inguinal herniorraphy techniques are described including application of a mesh close to or within the inguinal canal, laparoscopic inguinal peritoneal flap hernioplasty (PFH) techniques on the recumbent or on the standing horse, and vaginal closure using cyanoacrylate with or without sutures.

PFH technique on the recumbent horse (Fig 1)
A 12 mm median stab incision is created 1 cm caudal to the umbilicus for introduction of the laparoscope and the horse is positioned in 30° Trendelenburg position. The abdomen is insufflated with CO₂ until the vaginal rings are visible. Portals 2 and 3 are created about 12 cm cranilaterally to each external inguinal ring under laparoscopic guidance (Fig 2). Peritoneum ventrolateral to the internal inguinal ring is elevated and cut on 3 sides, then separated from the underlying muscle using laparoscopic scissors to form a flap of 8 cm × 5 cm (Fig 3). The flap is inverted, moved dorsomedially to cover the vaginal ring and attached medially and laterally to the parietal wall, 2 cm dorsal to the ring. Two simple intracorporeal sutures using 3 metric braided lactomer 901 or laparoscopic helicoidal staples (Protack-Tyco/Vétoquinol) may be used (Fig 4). Incisions are closed in 1 layer using 1 to 2 simple interrupted skin sutures. Fourteen horses were operated at the authors practices using the PFH technique under general anesthesia from 2003 to 2009 with no recurrence and no side effects.

PFH technique on the standing horse
More recently, Wilderjans et al. have described an adaptation of this PFH technique on the standing horse. The risks related to the general anesthesia and recovery are avoided and this technique can be proposed quickly after a laparotomy. The flap is dissected dorsolaterally to the cord and brought dorso-medially. Wilderjans uses a rectangular-shaped flap and we use a triangular-shaped flap (Fig 5). The standing position allowed an immediate post-operative view of the flap position that can be applied by gravity (Fig 6). The authors described a very low rate of recurrence. It may be sometimes challenging to close efficiently the caudo-medial part of the vaginal ring using this technique, especially in very big horses where laparoscopic stapling device may be too short to fix the flap in a correct position. In that case, making a more ventral portal and/or removing the cannula may be usefull.

Other techniques
Fischer et al. reported an adaptation of human surgical technique called transabdominal preperitoneal mesh repair (TAPP) for herniorrhaphy in two stallions in Trendelenburg position, under general anesthesia. Polypropylene mesh is positioned under a peritoneal flap, collapsing the neck of the vaginal tunic and decreasing the size of the vaginal ring. It is secured in position with laparoscopic staples. Tissue ingrowth into the mesh leads to scarring and prevents re-herniation. The mesh has to be positioned very close to the spermatic cord to be effective.

A simpler technique that involves insertion of polypropylene mesh (rolled into a cylinder and stabilized with 2 sutures) into the vaginal canal during standing laparoscopy has been reported by Mariën. After insertion of the mesh into the inguinal canal, the proximal or both proximal and distal sutures are cut using laparoscopic scissors allowing the mesh to
unfurl and fill the canal. The proximal part of the mesh is then secured to the parietal peritoneum using endoscopic staples. Subsequent granulation tissue is supposed to obliterate the inguinal canal.

The author have developed a technique of standing hernioplasty by simply glueing the inguinal canal with cyanoacrylate. A flank approach is used. The vaginal ring is identified and the mesorchium and the deferent duct are pulled caudo-medially using a Babcock forceps introduced through the most ventral portal and the sheath of a laparoscopic needle is introduced through the second portal. A flexible polyethylene extension tube is introduced through the sheath and the tip is positioned at the opening of the cranio-lateral part of the vaginal ring. Then 2 ml of methyl-cyanoacrylate or n-butyl-2-cyano-acrylate are injected into the inguinal canal including its margins taking care to spare the viscera. The lateral part of the vaginal ring is compressed 30 seconds using the Babcock forceps (Fig 7). The abdomen is desuflated and the skin portals are sutured in a routine manner. At re laparoscopy 3 weeks post operatively, a nice closure of the inguinal ring is observed (Fig 8).

Figure 1: Principle of the PFH technique on dorsal recumbency, left vaginal ring : Dissection of a peritoneal flap and fixation over the vaginal ring

Figure 2: position of the laparoscopic portals
**Figure 3.** Left vaginal ring. Laparoscopic view in dorsal recumbency showing dissection of the peritoneal flap. Sci, scissors; Pfl, peritoneal flap; Cor, testicular cord; Iom, internal oblique muscle after peritoneal flap removal.

**Figure 4.** Left vaginal ring. Fixation of the peritoneal flap using helicoidal staples. Co, testicular cord; Dd, Deferent duct; Note the position of the flap (large white arrow) and the helicoidal staples (black arrows).

**Figure 5.** Principle of the PFH technique on the standing horse, left vaginal ring: Dissection of a peritoneal flap and fixation over the vaginal ring.

**Figure 6.** Left vaginal ring. Position of the flap over the vaginal ring before fixation.
Figure 7: Right vaginal ring: injection of cyanoacrylate. Ba: Babcock forceps pulling the cord caudo-medially; Ns: Sheath of the laparoscopic needle; Ca: Catheter; Co: spermatic cord. The visceral part of the vaginal ring is pressed onto its parietal part using Babcock forceps.

Figure 6: Right vaginal ring 3 weeks post op after cyanoacrylate application alone. Note the full closure of the ring.

References

