CONSIDERATIONS FOR LAPAROSCOPY IN MEGAVERTEBRATES

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Abstract

Laparoscopy in the megavertebrates presents several challenges for veterinary surgeons, largely secondary to anatomic size and limitations in available instrumentation.[1] Equipment constraints and problems with surgical technique have prevented routine use of laparoscopy in the diagnosis and treatment of disease in these large mammals. A 35-yr-old captive, female, southern white rhinoceros *(Ceratotherium simum simum),* with an estimated body weight of 2,250 kg, had a chronic history of a mucohemorrhagic vulvar discharge. Transrectal ultrasonography revealed a right transmural uterine horn enlargement. After multiple attempts to obtain a diagnostic sample of the uterine mass through conventional techniques including endoscopy, laparoscopic surgery was used successfully for visualization and biopsy of the mass. A standing restraint anesthetic technique,[2] incorporating a neuroleptanalgesic combination of butorphanol and azaperone together with local anesthetic infiltration, facilitated abdominal laparoscopy. Previous laparoscopic attempts in rhinoceroses and elephants have failed primarily due to limitations in the anatomy relating to recumbency; however, even in the absence of recumbency, laparoscopy in this case remained a challenge due to equipment limitations and unique anatomic constraints. A leiomyoma was suspected based on history, physical examination, the ultrasonographic appearance, and histopathology. Our experience indicates laparoscopic techniques remain extremely difficult in southern white rhinoceroses due to inadequacies in instrumentation. This report will help identify current limitations and stimulate improved laparoscopic methodologies in the megavertebrates.

Several challenges have been encountered during laparoscopy in megavertebrates (those weighing greater than 1000 kg) and should be considered during the planning and implementation of these procedures. First, standing sedation for laparoscopy in this rhinoceros allowed for easier trochar placement while avoiding the risks of general anesthesia. Trochar/cannula placement in the standing rhinoceros was more dorsal than the location used in horses in order to avoid traumatic perforation of the cecum. Second, the body wall of the white rhinoceros measured approximately 23 cm thick (as estimated by trochar length) and the peritoneum was extremely fibroelastic, necessitating forceful attempts to perforate it with the trocar. The paralumbar fossa of the rhinoceros was small due to extension of the ribs caudal toward the stifle compared to horses. The small fossa together with the thick body wall limited mobility of the laparoscope. Third, specialized laparoscopic instrumentation will be required to improve the success of laparoscopy in megavertebrates. Stronger

instruments (especially development of cannulae incorporating increased tubular thickness or a "double-walled" design) will be needed for laparoscopic procedures in rhinoceroses and elephants. Also, increased control may be gained for penetrating the peritoneum of rhinoceroses and elephants with the development of new trochar/cannula designs. For example, a screw-type trochar/cannula system may be safe for penetration into the abdomen of megavertebrates. Finally, specialized insufflation equipment may also improve trochar placement by allowing for abdominal insufflation prior to trochar/cannula placement.

The following recommendations for instrumentation will be important considerations for laparoscopy in the megavertebrates. The 300-watt xenon light source, currently used in horses for laparoscopy, was essential to see within the large abdominal cavity of the rhinoceros. The equine laparoscope (54 cm length, 10 mm diameter, 30^{o} viewing angle; Karl Storz Veterinary Endoscopy America, Inc., 175 Cremona Drive, Goleta, CA 93117 USA) was considered useful during the standing procedure in the white rhinoceros, while the remaining equine instrumentation was too short, including the equine trochars and cannulae (20 cm length; Storz) and the Ethicon guarded trochars (15 cm length, 12 mm dilating tip; Endopath, Ethicon Endo-Surgery, 4545 Creek Road, Cincinnati, OH 45242-2839 USA). The megavertebrate laparoscope (123 cm length), designed by the San Diego Wild Animal Park (SDWAP) and Karl Storz Veterinary Endoscopy of America, was too long for the uterine biopsy procedure in this white rhinoceros, but may be useful for other diagnostic procedures in rhinoceroses, elephants, or other large mammals such as killer whales. However, the megavertebrate trochar and cannula (51 cm length; Storz) were considered essential for successful penetration into the abdomen of the white rhinoceros.

The following are the authors' recommendations for instrumentation required for successful application of laparoscopy in rhinoceroses and elephants: the equine and megavertebrate laparoscopes (Storz); three trochars and cannulae, 50 cm length; a blunt trochar obturator, 70 cm length; an acute claw grasper, 70 cm length; a laparoscopic scissors, 70 cm length; a biopsy instrument, 70 cm length; laparoscopic Babcock forceps, 70 cm length; and a laparoscopic stapler, 70 cm length. Specialized instrumentation developed for elephants may need to be 100 cm or longer in length depending on the clinical application.

NOTE: The SDWAP together with Karl Storz Veterinary Endoscopy, Inc. have initiated development of the instrumentation necessary to perform laparoscopy in megavertebrates. The authors encourage anyone interested in using this equipment or needing assistance in the diagnosis or treatment of medical problems in these animals to contact the SDWAP. It is the authors' hope that these experiences will stimulate further research toward improved laparoscopic methodologies in the megavertebrates.

LITERATURE CITED

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