Ovariectomy of a brown bear (*Ursus arctos*): a case report

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ABSTRACT: Reproductive control is regularly implemented in bear facilities to prevent crowding of enclosures and surplus animals. Ovariectomy may represent an efficient method of sterilizing bears yet has not been reported in the literature. A 73 kg female brown bear, age two years and three months, was anesthetized for ovariectomy with tiletamin and zolazepam (Zoletil®, Virbac S.A., Carros Cedex, France) and medetomidin hydrochloride (Domitor®, Pfizer Animal Health, New York, USA). A 25 cm midline incision that extended from the umbilicus to the pubic brim was made. The suspensory ligament was stretched and blunt dissected so that ovaries in bursa were exposed on the surgical field. A "Figure 8" ligature was placed between two forcepses and a circumferential ligature was placed around proximal forceps at the ovarian pedicle. Another "Figure 8" ligature was placed between two forcepses and a circumferential ligature was placed around distal forceps at the cranial tip of the uterine horn. No surgical complications occurred, and no complications have transpired during the 12 month post-operative period.

Keywords: brown bear; ovariectomy; reproductive control; sterilization; *Ursus arctos*

List of abbrevations:

OVH = ovariohysterectomy; OVE = ovariectomy; IM = intramuscularly

Space for large, long-living carnivores (such as brown bears) in zoos and other captive facilities is restricted and the reintroduction of offspring into the wild is difficult, so consequently reproductive control to avoid surplus breeding is recommended (Huber et al., 1994; Linke, 1998). Orchiectomy has been described as the optimal method for reproductive control of male bears (Radisic et al., 2007). Temporary contraception in female bears may be achieved with hormonal contraception, but long-term use of hormonal contraceptives, such as synthetic progestins, increases the risk of endometric hyperplasia, pyometra and mammary gland and uterine cancer (Greenwood, 1992; Munson et al., 1995; Kazensky et al., 1998). Minimal information exists on the surgical sterilization of female brown bears and ovariectomy of brown bears has not yet been described (Linke, 1998; Radisic et al., 2007). Laparoscopic ovariohysterectomy has been described in curing brown bear pyometra (Friedrich et al., 2008), but most brown bear facilities in need of reproductive control do not have suitable facilities to perform laparoscopic operations or intubate animals.

Bears are seasonal breeders whose reproduction is characterized by delayed implantation – after having developed to the blastocyst stage the fertilized egg does not immediately implant but floats quiescent in the oviducts or uterus for varying periods before implantation (Hensel et al., 1969). Brown bears have bicornual uterus, anatomically most similar to the dog (Pearson, 1975).

Many surgical sterilization techniques have been described for female dogs, including traditional midline ovariohysterectomy (OVH), lateral flank ovariohysterectomy, early age gonadectomy, ovariectomy (OVE), laparoscopic ovariohysterectomy and ovariectomy (Janssens and Janssens, 1991; Van

Sluijs, 1992; Fingland, 1998; Fossum Welch, 2002; Hedlund, 2002; Austin et al., 2003; Stone, 2003; Toombs and Clarke, 2003a; McGrath et al., 2004; Howe, 2006; Van Goethem et al., 2006; Kirpensteijn, 2008). Bilateral OVE was proposed as being preferable over OVH because of less surgical trauma (smaller incisions and decreased abdominal trauma, the broad ligaments are not disrupted, and the uterine stump is left intact) and decreased surgery and anaesthesia times are reported. The primary rationale for selection of OVE or OVH is related to the expected frequency of short-term and long-term complications. Most evidence extracted from the literature leads to the conclusion that there is no benefit and thus no indication for removing the uterus during routine neutering in healthy bitches (Okkens et al., 1997; Van Goethem et al., 2006; Whitehead, 2006; Kirpensteijn, 2008).

As OVH and OVE have not yet been described in a brown bear, we were unfamiliar with species specific advantages and disadvantages of both techniques. In spite of the increased risk of surgery-related complications in OVH, such as intra-abdominal and vaginal bleeding, ureteral ligation, ovarian remnants, uterine stump complications and sinus tracts, prior to the surgery it was decided to perform OVH in a female brown bear (Van Goethem et al., 2006; Kirpensteijn, 2008). It was thought that OVH will prevent long – term complications and uterine pathology.

Case description

The surgery took place in a facility for orphan brown bears, without facilities for releasing them back into the wild. A captive female brown bear, age two years and three months, mass 73 kg, was anesthetized with 2.5 mg/kg tiletamin-zolazepam (Zoletil®, Virbac S.A., Carros Cedex, France) and 0.05 mg/kg medetomidin hydrochloride (Domitor®, Pfizer Animal Health, New York, USA) for surgical sterilization (Kreeger and Anremo, 2007; Carpenter and Brunson, 2007). Anaesthetics were administered intramuscularly (IM) to the gluteal region by Dan-Inject injection gun (10 ml Dan-Inject plastic dart syringes) (Dan-Inject ApS, Borkop, Denmark) and after 2 min and 15 s the animal lay down. During the surgery a supplementary dose of anaesthetic was administered IM because the animal started to show signs of decreasing anaesthetic effect (increased lip and eye lid movements, slight head movements); 75 min after the first dose 2.0 mg/kg tiletamin and zolazepam and 0.01 mg/kg medetomidin hydrochloride were administered. Tiletamine-zolazepam has low-potent analgetic intraabdominal effect, so medetomidine, an α_2-adrenergic agonist, was added to the anaesthetic protocol because of its analgetic intraabdominal effects (Nielsen, 1996). Prior to the surgery the animal was weighed and body measurements and blood samples were taken.

A 25 cm midline surgical incision from the umbilicus to the pubic brim was made. The incision proceeded through the skin, subcutaneous fat tissue, linea alba and peritoneum. Subcutaneous fat tissue was 2.5 to 3 cm thick.

After celiotomy, the ovaries and the non-enlarged uterus in the juvenile nulliparous female bear were palpated caudally to the kidneys and attached to the last two ribs with short suspensory ligaments. Suspensory ligaments, ovarian pedicles and broad ligaments were incorporated into abdominal fat tissue. The uterine bifurcation and cervix were located in the pelvic cavity and were difficult to exteriorize (Figure 1). An inability to expose the genital tract to the surgical field without damaging the ovarian artery and veins incorporated in fat was the reason for performing OVE instead of OVH. These problems could prolong the duration of surgery and general anaesthesia and cause postoperative complications such as infection, prolonged and delayed wound healing, incision swelling, ventral body wall dehiscence, self-inflicted trauma and pain (Van Goethem et al., 2006).

The suspensory ligament was stretched and manually blunt dissected inside the abdomen so that the ovary in bursa was exposed into the surgical field. A hole was made in the broad ligament in order to put two tissue forcepses on the ovarian pedicle. The arteriovenous complex within the pedicle was ligated with "Figure-8" (transfixing) ligature that was placed between two tissue forcepses. Proximal to the first ligature, a circumferential ligature was placed at the crushing groove that remained after the removal of the proximal clamp. The ovarian pedicle was then transected between the "Figure-8" ligature and distal forceps that was used as a hemostat. The uterine artery and vein were ligated at the cranial tip of the uterine horn, a few millimeters caudal to the proper ligament after two tissue forceps were placed. The "Figure-8" ligature was placed proximally between the forcepses, whereas the circumferential ligature was placed in

Figure 1. The uterine bifurcation and cervix were located within the pelvic cavity and difficult to exteriorize, prompting a decision to perform a ovariectomy instead of a ovariohysterectomy

the crushing groove that remained after the distal forceps were removed (Figure 2). The ovary was removed by transection between remaining tissue forceps as a hemostat and the "Figure-8" ligature. All ligatures were made with one absorbable polyglycolic acid suture material (PGA) (Serapid®, Serag-Wiessner KG, Naila, Germany). Before the abdominal closure, inspection of ovarian pedicles and the cranial tip of the uterine horn were performed and haemoserous fluid was removed. The abdomen was closed with a simple continuous suture pattern, secured in the middle with an Aberdeen knot using the two absorbable suture material PGA (Serapid®, Serag-Wiessner KG, Naila, Germany). Subcutaneous tissue was closed with a simple continuous suture using 2-0 absorbable suture material PGA (Serapid®, Serag-Wiessner KG, Naila, Germany). In order to avoid subsequent removal of the skin stitches, which would require further anaesthesia and cause more stress, the skin incision was closed using two absorbable suture material PGA (Serapid®, Serag-Wiessner KG, Naila, Germany) with a simple interrupted suture. There was no doubt that a subcuticular suture could be

Figure 2. Ligatures on the uterine artery and vein were placed at the cranial tip of the uterine horn. A "Figure-8" ligature was placed proximally between the forcepses, whereas the circumferential ligature was placed at the crushing groove that remains after distal forceps removal. The remaining forceps was placed by low strength pressure to keep the uterine horn in position during the whole ovary in bursa excision

placed in order to close the skin wound, as has been described in dogs (Fossum Welch, 2002; Toombs and Clarke, 2003b). A simple interrupted suture was placed because of the thinness of the skin and thus the inconvenience of placing subcuticular sutures and because of the possibility of the bear licking the wound and consequent suture dehiscence.

Passive immunization against *Clostridium tetani* toxin was achieved by application of a prophylactic dose of tetanus antitoxin (Tetanus antitoksin 300®, Veterina d.o.o., Zagreb, Croatia) subcutaneously (SC) in plica geni 3600 IU. Antimicrobial prophylaxis was achieved by IM administration of 12 ml procaine-benzyl penicillin (Benzapen®, Veterina d.o.o., Zagreb, Croatia) and 12 ml sulphapyridasine (Sulfapyridazin 25%®, Veterina d.o.o., Zagreb, Croatia). The operation lasted for 45 min, while the animal was completely awake after six hours. The first dose of anaesthetic was calculated based on estimated body weight, but the duration of anaesthesia was insufficient for ovariectomy (Ledecky et al., 2003; Radisic et al., 2007). Thus, an additional dose of anaesthetics based on measured body weight was administered, which maintained sufficient anaesthesia depth but prolonged recovery time. Although the usage of NSAID was described in postoperative analgesia for male bears, in this case, according to our observations, the analgetic effect of medetomidine was sufficient (Ledecky et al., 2003). Potential side-effects of NSAID (coagulation disorders, intraabdominal bleeding) were also a reason for avoid their use in this case. After surgery, the treated animal was returned to its enclosure. Daily monitoring showed no post-operative complications, such as inapetence, bleeding, prolaps of abdominal organs, swelling in the inguinal region or inability to stand up or walk because of the pain. The surgical wound healed "per primam". One year after the operation no uterine pathology was observed in the treated animal.

DISCUSSION AND CONCLUSIONS

There is no advantage in performing OVH over the simpler, less expensive, less invasive and less time-consuming OVE which (in the absence of specific indications for removing the uterus) should therefore be considered the ideal, and most ethical, approach to gonadectomy in bitches and queens (Van Goethem et al., 2006; Kirpensteijn, 2008). OVE also appears to be an appropriate method of birth control for captive brown bears and may be performed more efficiently than OVH, as the uterus is difficult to exteriorize in this species. The only bear uterine pathology described in the literature is a case of pyometra (Friedrich et al., 2008). Uterine pathology following OVE occurs infrequently in dogs and may be unlikely to occur in ovariectomized bears; however, it warrants further study in Ursid species.

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