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Surgical Gonadectomy in the Bitch & Queen: Should it be Done and at What Age?

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INTRODUCTION

Surgical gonadectomy refers to the surgical removal of both gonads under general anesthesia. In the female, gonadectomy (or spaying) is generally performed by removal of both ovaries (ovariectomy = OVX) or of ovaries and uterus (ovariohysterectomy = OVH) via an abdominal approach. Whether or not bitches and queens should be spayed, what is the best surgical procedure and what is the best age to perform it are issues which recently have been arising discussion because of the many welfare implications of such procedure. Current legislation in some countries of the world (such as the US) requires that stray animals are euthanized within a short period of time following their arrival at the shelter in case the animal fails on one or more key behavioral tests, which is causing the destruction of several million animals each year in North America. On the other hand, the public opinion in many European countries is becoming more and more sensitive to welfare issues for companion animals, and as a consequence the concept “spay/neuter as soon as possible” is being questioned more and more. A factor which is contributing to this discussion is the availability of new drugs for reversible chemical sterilization of companion animals. This paper will review advantages and disadvantages of surgical gonadectomy in the bitch and queen, what is the best age to perform it and whether or not only the ovaries or also the uterus should be removed.

SHOULD WE CASTRATE BITCHES AND QUEENS?

Advantages of gonadectomy – The removal of the ovaries is associated in both bitches and queens with a reduced risk of mammary and uterine diseases (mammary neoplasia and pyometra, respectively), as well as absence of ovarian diseases (ovarian tumors, ovarian cysts), progesterone-related diseases (false pregnancy, feline mammary hypertrophy), estrogen-related diseases (vaginal hyperplasia/prolapse, persistent estrus, bone marrow aplasia) pregnancy-related diseases (unwanted pregnancy, pregnancy complications, abortion, dystocia, uterine prolapse, sub-involution of placental sites) or parturition-related diseases (dystocia, uterine prolapse, subinvolution of placental sites). Bitches gonadectomized prior to puberty have a 95% reduction of the risk of developing mammary tumors as opposed to bitches spayed after 1st heat (8% risk), after 2nd heat (26% risk) or bitches spayed after 2.5 years of age or left intact (100% or full risk). From a behavioural point of view it is commonly believed that spayed bitches and queen, apart from not showing estrus-related behavior, have a more relaxed, somewhat lazy attitude. Gonadectomy may contribute to reducing pet overpopulation.

Disadvantages of gonadectomy – Surgical gonadectomy is an irreversible technique, which may be a problem for some owners who would like to have progeny from their pets at a later time. Disadvantages of gonadectomy in bitches and queen include generic surgical risk, a few behavioral abnormalities, obesity, and, in bitches only, urinary incontinence and osteoporosis (Table n° 1).
Table n° 1 – Side effects of ovariectomy/ovariohisterectomy in the bitch and queen, and their risk based on personal experience and data from literature. Incidence is calculated on total number or spayed animals. Osteoporosis is reported in the bitch under experimental conditions but has never been observed to occur spontaneously.

Generic surgical risk includes haemorrhage/granuloma of the ovarian or (more commonly) uterine pedicle, suture dehiscence/infection/abscess/edema, peritonitis, evisceration, formation of suture fistulas, retention of a cotton gauze, ureteral ligation with secondary hydronephrosis, formation of vesicovaginal fistula with secondary hydroureter, ovarian remnant syndrome with or without secondary uterine stump inflammation (Table n° 2). Incidence of these conditions vary depending on OVX or OVH from 7% to 27% in the bitch and 33% in the queen.

<table>
<thead>
<tr>
<th>Side effects</th>
<th>Bitch</th>
<th>Queen</th>
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<tbody>
<tr>
<td>Generic surgical risk</td>
<td>7-27%</td>
<td>33%</td>
</tr>
<tr>
<td>Obesity</td>
<td>25-50%</td>
<td>50-75%</td>
</tr>
<tr>
<td>Urinary incontinence</td>
<td>5-12%</td>
<td>-</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>reported</td>
<td>-</td>
</tr>
<tr>
<td>Behavioural changes</td>
<td>reported</td>
<td>Reported</td>
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<table>
<thead>
<tr>
<th>Surgical complications</th>
<th>Occurs after</th>
<th>Incidence (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemorrhage of ovarian/uterine pedicle (bitch, especially if spayed during heat) (b)</td>
<td>OVH, OVX (*)</td>
<td>80%</td>
</tr>
<tr>
<td>Vaginal haemorrhage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>False pregnancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suture dehiscence, infection, ascenso, edema</td>
<td>OVH, OVX</td>
<td>15%</td>
</tr>
<tr>
<td>Peritonitis; evisceration</td>
<td>OVH, OVX</td>
<td>15%</td>
</tr>
<tr>
<td>Ovarian remnant syndrome</td>
<td>OVH, OVX</td>
<td>17-43%</td>
</tr>
<tr>
<td>Ligature of ureter/s, ureterovaginal fistula</td>
<td>OVH</td>
<td>11-17%</td>
</tr>
<tr>
<td>Granuloma of the utero/ovarian pedicle</td>
<td>OVH, OVX</td>
<td>6-28%</td>
</tr>
<tr>
<td>Fistula due to use of non-absorbable suture material</td>
<td>OVH, OVX</td>
<td>3-20%</td>
</tr>
<tr>
<td>Cotton gauze in abdomen</td>
<td>OVH, OVX</td>
<td>3-20%</td>
</tr>
<tr>
<td>Infection of the uterine stump</td>
<td>OVH</td>
<td>3-20%</td>
</tr>
</tbody>
</table>
Table n° 2 – Short- or long-term complications due to ovariectomy (OVX) or ovariohysterectomy (OVH). Based on personal experience and data from literature (a): total number of short- and long-term complications; (b): haemorrhage of the uterine or ovarian pedicle because of incomplete ligature or rupture of blood vessels. (*) the risk of complications is higher following OVH than OVX.

There is no correlation between incidence of complications and age of the animal, ability of the veterinarian or presence of reproductive diseases. There is no breed predisposition. The complication observed most frequently seems to be (vaginal or intra-abdominal) haemorrhage, which is much more common in large (80% incidence) as opposed to small (2% incidence) size bitches. Vulvar blood loss may occur following ovariohysterectomy (blood coming from the uterine pedicle, the suspensory ligament or the broad ligament) as well as following OVX (blood coming from the ovarian pedicle following OVX).

Some complications may be due to the stage of the reproductive cycle in which spaying is performed: intraoperative bleeding is more common during proestrus and estrus (due to high estrogen concentrations) while false pregnancy may follow when spaying is performed during diestrus (due to rising prolactin concentrations following an sudden progesterone fall).

Heat after gonadectomy in bitches and queens is a well know surgical complication of both OVX/OVH. Ovarian remnants are more commonly found on the right side, and may (but this is not proven) occur more frequently following OVH than OVX because of the fact that the abdominal incision tends to be more caudal in OVH therefore making it more difficult to reach the ovaries.

Ureteral obstruction, due to the inclusion of the ureter into the ligature, or the development of a uretero-vaginal fistula are reported only following OVH. Granulomas of the ovarian (less common) or uterine (more common) pedicle may be due to the use of non-absorbable suture material, while inflammation of the uterine pedicle may occur if the most caudal part of the uterus is accidentally caught in the suture during OVH performed because of pyometra. Pyometra may develop following OVX if an ovarian remnant is left in place and the bitch/queen resumes regular cycling following surgery, or if progestins are administered for medical reasons later in life.

Obesity – An increase in body weight following gonadectomy is observed in bitches and particularly common in queens. Gonadectomized bitches have twice the risk of obesity as opposed to intact bitches. Food intake increases significantly in bitches during the first 90 days following OVX/OVH with respect to bitches receiving a sham-laparotomy. Appetite increases significantly in gonadectomized bitches 6 months, and in gonadectomized cats 3 days after surgery. In a recent study in castrated cats, increases in serum concentrations of Insulin Growth Factor I, prolactin and leptin were observed 1, 7 and 11 weeks following surgery, respectively (Martin et al., 2006).

Urinary Incontinence– A decreased capacity of the external urethral sphincter is observed following gonadectomy in bitches but not in queens. Average urethral closure pressure in intact bitches is 18.6+10.5 cm H20, 12 months following gonadectomy is 10.3+6.7 cm H20 in continent bitches, and may fall to 4.6+2.3 cm H20 in incontinent animals. Signs of urinary incontinence (urine loss during sleep or recumbency) may appear from 2 weeks to 9 years after surgery, and may typically be corrected by the administration of estrogen-based drugs.

Osteoporosis – Osteoporosis (loss of trabecular bone) is the most important complication of menopause in women and is thought to be due to a lack of estrogen stimulation causing reduced secretion of calcitonin. Loss of trabecular bone has been observed in Beagle bitches 11 months following OVH (Snow et al., 1984), although at present it is unclear whether this bears any clinical significance presumably because of the short life-span of most of the dogs used as companion animals.

Behavioural changes - Castration may exacerbate dominance in the bitches regardless of their attitude prior to surgery. A significant increase in the degree of reactivity has been observed in German sheperd bitches 5 months following OVX (Kim et al., 2006). Owners should realize the importance of
WHICH IS THE BEST AGE TO CASTRATE BITCHES AND QUEENS

Prepuberal gonadectomy – Good or Bad?
Apart from ensuring that the animal will never be able to reproduce after puberty, gonadectomy is also a less invasive, less traumatic surgery when performed prior to puberty than in adult animals. The incidence of short-term post-surgical complications is lower in young (10%) than in adult animals and most of the complications are minor problems such as swelling of the abdominal suture. Complications seem to be less common the younger the age at which OVX is performed.

Long-term complications of prepuberal gonadectomy include immaturity of external genitalia, urinary incontinence and cystitis, abnormal growth and behavioural changes. Presence of infantile vulva is reported in bitches, with infolding vulvar lips increasing the risk for vulvar dermatitis (Spain et al, 2004a). The risk for obesity does not change in animals gonadectomized prepuberally. It is unknown whether there is a predisposition to obesity, but if this is the case gonadectomy seems to have the same stimulus regardless of the age, although castration as an adult might be less of a stimulus for obesity when compared to castration early in life. The risk of urinary incontinence increases in bitches gonadectomized prior to 5 months of age, and even more so if prior to 3 months of age. Also the risk for cystitis increases in bitches castrated prior to 5 months of age (Spain et al., 2004a).

An increase in length of long bones occurs in all dogs and cats undergoing prepuberal gonadectomy. A 6.7% increased risk of developing hip dysplasia and therefore arthritis was observed in dogs, while a decrease in the diameter of the pre-pelvic uretra and a 30% decrease in basal metabolic rate was observed in queens castrated a 7 weeks vs 7 months.

Effects of prepuberal gonadectomy on behaviour vary depending on species and sex. In dogs there is an increased aggressiveness and barking towards family members and strangers, increased fear of noise, increased sexual behaviour but decreased separation anxiety and decreased urination at home. In cats castrated prior to 5 months of age there is a decrease in activity and an increase of shyness towards strangers (Spain et al., 2004b).

In which stage of the reproductive cycle? – The ideal stage of the reproductive cycle in which to perform gonadectomy is anestrus. This is particularly true for bitches, as when such surgery is performed in proestrus or estrus there is an increased risk of short-term post-surgical complications (see above), while when it is performed in diestrus there is an increased risk of false pregnancy (due to the sudden decrease in serum progesterone causing a peak in serum prolactin concentration which sets in mammary function). In bitches gonadectomy should best be performed during anestrus (2.5-5.5 months following onset of proestrus); serum progesterone assay may be of help in ruling out diestrus when history is not available. Although no specific study has ever looked at what is the best stage for performing gonadectomy in felines, the queen is not known to experience any such problems depending on when in her reproductive stage she is castrated.

SHOULD WE REMOVE ONLY OVARIES OR OVARIES + UTERUS?

Whether to remove only the ovaries or also the uterus is for many veterinarians a true dilemma. The "Anglo-Saxon" or "British" school of thought has always had the approach of removing everthing based on the concept that what is removed cannot cause a disease, while the "Latin" approach has always been that of removing only the ovaries since the uterus quickly undergoes atrophy following OVX, and perhaps the risk of developing urinary incontinence could be lower because of anatomical reasons. In a study done in Utrecht in which 138 OVH’ed bitches and 126 OVX’ed bitches were followed up for 8-11 years, the following observations were reported (Okkens et al., 1997) :

a) there was no difference in short-term as well as long-term side effects among the 2 groups of dogs
b) there was no case of cystic endometrial hyperplasia, pyometra or any other uterine disease in OVX’ed bitches, 

c) 6 OVX’ed and 9 OVH’ed bitches developed urinary incontinence (no statistical difference).

In reality, there are some differences in terms of degree of invasiveness and length of the surgery, and therefore length of anesthesia all of which are higher in the case of OVH. This causes a higher risk of surgical complications and a higher stress for the animal as well as a higher cost for the owner. The following conclusion of Okkens et al. (1997) “There is no indications to remove also the uterus in elective castration procedures of healthy bitches, and therefore ovarietomy is to be considered the procedure of choice” is currently shared by the majority of US as well as European authors (Whitehead, 2006). Therefore, it is currently considered unethical to perform ovariohysterectomy instead of ovarietomy, unless there are specific health reasons. Although such data are available only for dogs. It is likely that the same situation is true also for queens.

In case of specific indications for OVH, it is advisable not to remove the cervix because of its important role in isolating the abdominal cavity from outside even in the castrated female. Hysterectomy should not be performed as bilateral development of ovarian cysts has been anecdotally reported with bitches having to undergo laparotomy again to remove the cystic ovaries. Also, if a previously hysterectomized small litter size bitch is mated by a large size dog her vagino-cervical suture may rupture with a consequent coital peritonitis.

CONCLUSIONS

Surgical gonadectomy is one of the most common surgical procedures performed by private practitioners. Although it is considered a routine procedure to be performed sooner or later in the life of a pet not intended for breeding purposes, more and more frequently owners question their veterinarian as to whether or not gonadectomy is an appropriate procedure for the welfare of their pet, and at what age it should be done. Prepuberal gonadectomy offers many advantages especially for veterinarians working in shelters as a neutered pet has more chances of finding a home and less chances of being abandoned again. However, spaying bitches before 3 months of age may increase risk of developing urinary incontinence later in life. Therefore, prepuberal gonadectomy is not necessarily indicated for client-owned female puppies. There is no advantage in performing ovariohysterectomy over the simpler, less expensive and less invasive ovarietomy which (in absence of specific indications for removing the uterus) should therefore be considered the ideal, and most ethical, approach to gonadectomy in the bitch and queen.

REFERENCES

Borthwick R – Unilateral hydronephrosis in a spayed bitch. Vet Rec 90: 244, 1972
Dorn AS e Swist RA – Complications of canine ovariohysterectomy. JAAHA 13:720-724, 1977
Faggella AM, Aronsohn AM – Surgical techniques for neutering 6- to 14-week old kittens. JAVMA 202:53, 1993
Faggella AM, Aronsohn AM – Evaluation of anesthetich protocols for neutering 6- to 14-week old pups.
Misdorp W – Canine mammary tumors: protective effect of late ovariectomy and stimulating effects of progestins. Vet Quart 10:26-33, 1988
Overall KL – Sex and aggression. Canine Practice 20:16-18, 1995